10 Chapter

Time, Speed and Distance

INTRODUCTION

The concepts underlying the chapter of Time, Speed and Distance (TSD) are amongst the most important for the purpose of the Maths section in aptitude exams. The basic concepts of TSD are used in solving questions based on motion in a straight line, relative motion, circular motion, problems based on trains, problem based on boats, clocks, races, etc. Besides, these concepts can also be used for the creation of new types of problems. Your ability to solve these problems will depend only on the depth of your understanding.

Due to this diversity in the possibilities for question setting, this chapter is very important for CAT aspirants. Besides, all other exams based on Aptitude (CMAT, XLRI, FMS, IIFT, Bank PO) also require the use of TSD.

This chapter is one of the most important chapters in the entire portion of quantitative aptitude.The students are therefore advised to closely understand the concepts contained in this chapter to be comfortable with the problems related to this topic in the examination.

THEORY OF TSD

Concept of Motion and Mathematical Representation of Motion

Motion/movement occurs when a body of any shape or size changes its position with respect to any external stationary point. Thus, when a person travels from city *A* to city *B*, we say that he has moved from city *A* to city *B*. In general, whenever a body moves with respect to a stationary point, we say that the body has undergone a displacement/motion with respect to the starting point. Thus, for motion to have occurred, there must have been some displacement with respect to a stationary point on the ground.

The mathematical model that describes motion has three variables, namely: Speed, Time and Distance. The interrelationship between these three is also the most important formula for this chapter, namely:

Speed × Time = Distance (Equation for the description of one motion of one body)

The above equation is the mathematical description of the movement of a body. In complex problems, students tend to get confused regarding the usage of this equation and often end up mixing up the speed, time and distance of different motions of different bodies.

It must be mentioned here that this formula is the cornerstone of the chapter Time, Speed and Distance.

Besides, this formula is also the source of the various formulae applied to the problems on the applications of time, speed and distance—to trains, boats and streams, clocks and races, circular motion and straight line motion.

In the equation above, *speed* can be defined as the rate at which distance is covered during the motion. It is measured in terms of *distance* per unit time and may have any combination of units of distance and time in the numerator and the denominator respectively. (m/s, km/hour, m/min, km/min, km/day, etc.)

When we say that the speed of a body is S kmph, we mean to say that the body moves with S kmph towards or away from a stationary point (as the case may be).

Time (t) is the time duration over which the movement/motion occurs/has occurred. The unit used for measuring time is synchronous with the denominator of the unit used for measuring speed. Thus, if the speed is measured in terms of km/h then time is measured in hours.

Distance (d) is the displacement of the body during the motion.

The above equation, as is self-evident, is such that the interrelationship between the three parameters defines the value of the third parameter if two of the three are known. Hence we can safely say that if we know two of the three variables describing the motion, then the motion is fully described and every aspect of it is known.

The Proportionalities Implicit in the Equation $S \times T = D$

The above equation has three implicit proportionality dimensions each of which has its own critical bearing on the solving of time, speed and distance problems.

1. Direct proportionality between time and distance (when the speed is constant) time µ distance

Illustration

A car moves for 2 hours at a speed of 25 kmph and another car moves for 3 hours at the same speed. Find the ratio of distances covered by the two cars.

Solution: Since, the speed is constant, we can directly conclude that time µ distance.

Hence $\dfrac{t_A}{t_B} = \dfrac{d_A}{d_B}$

Since, the times of travel are 2 and 3 hours respectively, the ratio of distances covered is also 2/3.

Note: This can be verified by looking at the actual distances travelled—being 50 km and 75 km in this case.

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2. **Direct Proportionality between speed and distance (when the time is constant) speed µ distance**

(a) *A body travels at S_1 kmph for the first 2 hours and then travels at S_2 kmph for the next two hours.* Here two motions of one body are being described and between these two motions the time is constant hence speed will be proportional to the distance ravelled.

(b) *Two cars start simultaneously from A and B respectively towards each other with speeds of S_1 kmph and S_2 kmph. They meet at a point C....* Here again, the speed is directly

proportional to the distance since two motions are described where the time of both the motions is the same, that is, it is evident here that the first and the second car travel for the same time.

In such a case the following ratios will be valid:

$S_1/S_2 = d_1/d_2$

Illustrations

(i) A car travels at 30 km/h for the first 2 hours of a journey and then travels at 40 km/h for the next 2 hours of the journey. Find the ratio of the distances travelled at the two speeds.

Solution: Since time is constant between the two motions described, we can use the proportionality between speed and distance.

Hence, $d_1/d_2 = s_1/s_2 = 3/4$

Alternatively, you can also think in terms of percentage as d_2 will be 33.33% higher than d_1 since S_2 is 33.33% higher than S_1 and time is constant.

(ii) Two cars leave simultaneously from points A and B on a straight line towards each other. The distance between A and B is 100 km. They meet at a point 40 km from A. Find the ratio of their speeds.

Solution: Since time is the same for both the motions described, we have ratio of speed = ratio of distance.

$S_A/S_B = 40/60 = 2/3$

(iii) Two cars move simultaneously from points A and B owards each other. The speeds of the two cars are 20 m/s and 25 m/s respectively. Find the meeting point if $d(AB) = 900$ km.

Solution: For the bodies to meet, the time of travel is constant (since the two cars have moved simultaneously).

Hence, speed ratio = distance ratio

Æ 4/5 = distance ratio

Hence, the meeting point will be 400 km from A and 500 km from B.

3. Inverse proportionality between speed and time (when the distance is constant) Speed µ 1/time

(a) *A body travels at S_1 kmph for the first half of he journey and then travels at S_2 kmph for the second half of the journey.* Here two motions of one body are being described and between these two motions the distance travelled is constant. Hence he speed will be inversely proportional to the time travelled for.

(b) Two cars start simultaneously from A and B respectively towards each other. They meet at a point C and reach their respective destinations B and A in t_1 and t_2 hours respectively... Here again, the speed is inversely proportional to the time since two motions are described where the distance of both the motions is the same, that is, it is evident here that the first and the second car travel for the distance, viz., AB.

In such a case, the following ratio will be valid:

$S_1/S_2 = t_2/t_1$ i.e. $S_1 t_1 = S_2 t_2 = S_3 t_3 = K$

Illustrations

(i) A train meets with an accident and moves at 3/4 its original speed. Due to this, it is 20 minutes late. Find the original time for the journey beyond the point of accident.

Solution: Speed becomes 3/4 (Time becomes 4/3)

Extra time = 1/3 of normal time = 20 minutes

Normal time = 60 minutes

Alternatively, from the table on product constancy in the chapter of percentages, we get that a 25% reduction in speed leads to a 33.33% increase in time.

But, 33.33% increase in time is equal to 20 minutes increase in time.

Hence, total time (original) = 60 minutes.

(ii) A body travels half the journey at 20 kmph and the other half at 30 kmph. Find the average speed.

Solution: The short-cut process is elucidated in the chapter on 'averages'. Answer = 24 kmph.

(iii) A man travels from his house to his office at 5 km/h and reaches his office 20 minutes late. If his speed had been 7.5 km/h, he would have reached his office 12 minutes early. Find the distance from his house to his office.

Solution: Notice that here the distance is constant. Hence, speed is inversely proportional to time.

Solving mathematically

$S_1/S_2 = t_2/(t_2 + 32)$

$5/7.5 = t_2/(t_2 + 32)$

$5t_2 + 160 = 7.5\ t_2$

$t_2 = 160/2.5 = 64$ minutes

Hence, the distance is given by $7.5 \times 64/60 = 8$ km.

Alternatively, using the Product Constancy Table from the chapter of percentages. If speed increases by 50%, then time will decrease by 33.33%.

But the decrease is equal to 32 minutes.

Hence, original time = 96 minutes and new time is 64 minutes.

Hence, the required distance = $5 \times 96/60$ km = 8 km.

or distance = $7.5 \times 64/60$ km = 8 km

[*Note:* The entire process can be worked out mentally while reading the problem.]

CONVERSION BETWEEN kmph to m/s

1 km/h = 1000 m/h = 1000/3600 m/s = 5/18 m/s.

Hence, to convert y km/h into m/s multiply by 5/18.

Thus, y km/h = $\dfrac{5y}{18}$ m/s.

And vice versa : y m/s = 18 y/5 km/h. To convert from m/s to kmph, multiply by 18/5.

Relative Speed : Same Direction and Opposite Direction

Normally, when we talk about the movement of a body, we mean the movement of the body with respect to

a stationary point. However, there are times when we need to determine the movement and its relationships with respect to a moving point/body. In such instances, we have to take into account the movement of the body/point with respect to which we are trying to determine relative motion.

Relative movement, therefore, can be viewed as the movement of one body relative to another moving body.

The following formulae apply for the relative speed of two **independent** bodies with respect to each other:

Case I: Two bodies are moving in *opposite* directions at speeds S_1 and S_2 respectively.

The relative speed is defined as $S_1 + S_2$

Case II: Two bodies are moving in the *same direction*.

The relative speed is defined as

   (a) $S_1 - S_2$ when S_1 is greater than S_2.

   (b) $S_2 - S_1$ when S_1 is lesser than S_2.

In other words, the relative speed can also be defined as the positive value of the difference between the two speeds, that is, $|S_1 - S_2|$.

Motion in a Straight Line

Problems on situations of motion in a straight line are one of the most commonly asked questions in the CAT and other aptitude exams. Hence a proper understanding of the following concepts and their application to problem solving will be extremely important for the student.

Motion in a straight line is governed by the rules of relative speed enumerated above.

A. Two or more bodies starting from the same point and moving in the same direction: Their relative speed is $S_1 - S_2$.

(a) *In the case of the bodies moving to and fro between two points A and B:* The faster body will reach the end first and will meet the second body on its way back. The relative speed $S_1 - S_2$ will apply till the point of reversal of the faster body and after that the two bodies will start to move in the opposite directions at a relative speed of $S_1 + S_2$. The relative speed governing the movement of the two bodies will alternate between $S_1 - S_2$ and $S_1 + S_2$ everytime any one of the bodies reverses directions. However, if both the bodies reverse their direction at the same instant, there will be no change in the relative speed equation.

In this case, the description of the motion of the two bodies between two consecutive meetings will also be governed by the proportionality between speed and distance (since the time of movement between any two meetings will be constant).

Distances covered in this case: For every meeting, he total distance covered by the two bodies will be $2D$ (where D is the distance between the extreme points). However, notice that the value of $2D$ would be applicable only if both the bodies reverse the direction between two meetings. In case only one body has reversed direction, the total distance would need to be calculated on a case-by-case basis. The respective coverage of the distance is in the ratio of the individual speeds.

Thus, for the 9th meeting (if both bodies have reversed direction between every 2 meetings) the total distance covered will be $9 \times 2D = 18D$.

This will be useful for solving problems that require the calculation of a meeting point.

(b) *In the case of the bodies continuing to move in the same direction without coming to an end point and reversing directions*: The faster body will take a lead and will keep increasing the lead and the movement of the two bodies will be governed by the relative speed equation: $S_1 - S_2$.

Here again, if the two bodies start simultaneously, their movement will be governed by the direct proportionality between speed and distance.

B. *Moving in the opposite direction*: Their relative speed will be initially given by $S_1 + S_2$.

(a) *In the case of the bodies moving to and fro between two points A and B starting from opposite ends of the path*: The two bodies will move towards each other, meet at a point in between A and B, then move apart away from each other. The faster body will reach its extreme point first followed by the slower body reaching its extreme point next. Relative speed will change every time; one of the bodies reverses direction.

The position of the meeting point will be determined by the ratio of the speeds of the bodies (since the 2 movements can be described as having the time constant between them).

Distances covered in the above case: For the first meeting, the total distance covered by the two bodies will be D (the distance between the extreme points). The coverage of the distance is in the ratio of the individual speeds.

Thereafter, as the bodies separate and start coming together, the combined distance to be covered is $2D$. Note that if only one body is reversing direction between two meetings, this would not be the case and you will have to work it out.

Thus, for the 10th meeting (if both bodies have reverse direction between every 2 meetings) the total distance covered will be $D + 9 \times 2D = 19D$.

This will be useful for solving of problems that require the calculation of a meeting point.

Illustrations

(i) Two bodies A and B start from opposite ends P and Q of a straight road. They meet at a point $0.6D$ from P. Find the point of their fourth meeting.

Solution: Since time is constant, we have ratio of speeds as $3 : 2$.

Also, total distance to be covered by the two together for the fourth meeting is $7D$. This distance is divided in a ratio of $3 : 2$ and thus we have that A will cover $4.2D$ and B will cover $2.8D$.

The fourth meeting point can then be found out by tracking either A or B's movement. A, having moved a distance of $4.2D$, will be at a point $0.2D$ from P. This is the required answer.

(ii) A starts walking from a place at a uniform speed of 2 km/h in a particular direction. After half an hour, B starts from the same place and walks in the same direction as A at a uniform speed and overtakes A after 1 hour 48 minutes. Calculate the speed of B.

Solution: Start solving as you read the question. From the first two sentences you see that A is 1 km ahead of B when B starts moving.

This distance of 1 km is covered by B in 9/5 hours [1 hour 48 minutes = $1(4/5) = 9/5$ hours].

The equation operational here $(S_B - S_A) \times T =$ initial distance

$(S_B - 2) \times 9/5 = 1$

Solving, we get $S_B = 23/9$ km/h.

(b) *In the case of the bodies continuing to move in the same direction without coming to an end point and reversing directions:* The bodies will meet and following their meeting they will start separating and going away from each other. The relative speed will be given by $S_1 + S_2$ initially while approaching each other and, thereafter, it will be $S_1 + S_2$ while moving away from each other.

Important: The student is advised to take a closer look and get a closer understanding of these concepts by taking a few examples with absolute values of speed, time and distance. Try to visualise how two bodies separate and then come together. Also, clearly understand the three proportionalities in the equation $s \times t = d$, since these are very important tools for problem solving.

Concept of Acceleration

Acceleration is defined as the rate of change of speed.

Acceleration can be positive (speed increases) or negative (speed decreases Æ also known as deceleration)

The unit of acceleration is speed per unit time (e.g. m/s^2)

For instance, if a body has an initial speed of 5 m/s and a deceleration of 0.1 m/s^2 it will take 50 seconds to come to rest.

Final speed = Initial speed + Acceleration × Time

Some more examples:

(i) Water flows into a cylindrical beaker at a constant rate. The base area of the beaker is 24 cm^2. The water level rises by 10 cm every second. How quickly will the water level rise in a beaker with a base area of 30 cm^2.

Solution: The flow of water in the beaker is 24 cm^2 × 10 cm/s = 240 cm^3/s.

If the base area is 30 cm^2 then the rate of water level rise will be 240/30 = 8 cm/s.

Note: In case of confusion in such questions the student is advised to use dimensional analysis to understand what to multiply and what to divide.

(ii) A 2 kilowatt heater can boil a given amount of water in 10 minutes. How long will it take for

   (a) a less powerful heater of 1.2 kilowatts to boil the same amount of water?

   (b) a less powerful heater of 1.2 kilowatts to boil double the amount of water?

Solution:

(a) The heating required to boil the amount of water is 2 × 10 = 20 kilowatt minutes. At the rate of 1.2 kilowatt, this heat will be generated in 20/1.2 minutes = 16.66 minutes.

(b) When the water is doubled, the heating required is also doubled. Hence, heating required = 40 kilowatt minutes. At the rate of 1.2 kilowatt, this heat will be generated in 40/1.2 = 33.33 minutes.

AN APPLICATION OF ALLIGATION IN TIME, SPEED AND DISTANCE

Consider the following situation:

Suppose a car goes from A to B at an average speed of S_1 and then comes back from B to A at an average

speed of S_2. If you had to find out the average speed of the whole journey, what would you do?

The normal short cut given for this situation gives the average speed as:

$$\frac{2S_1 S_2}{S_1 + S_2}$$

However, this situation can be solved very conveniently using the process of alligation as explained below:

Since, the two speeds are known to us, we will also know their ratio. The ratio of times for the two parts of the journey will then be the inverse ratio of the ratio of speeds. (Since the distance for the two journeys are equal). The answer will be the weighted average of the two speeds (weighted on the basis of the time travelled at each speed)

The process will become clear through an example:

A car travels at 60 km/h from Mumbai to Poona and at 120 km/h from Poona to Mumbai. What is the average speed of the car for the entire journey.

Solution
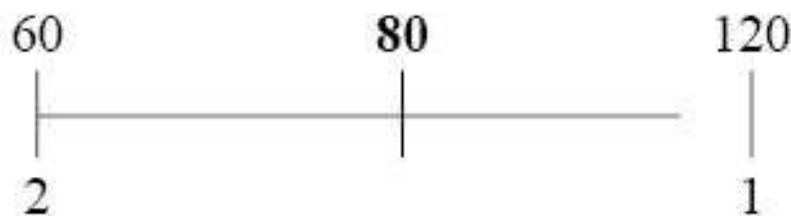
The process of alligation, will be used here to give the answer as 80. (*Note:* For the process of alligation, refer to the chapter of Alligations.)

Note here, that since the speed ratio is 1:2, the value of the time ratio used for calculating the weighted average will be 2:1.

What will happen in case the distances are not constant?

For instance, if the car goes 100 km at a speed of 66kmph and 200 km at a speed of 110 kmph, what will be the average speed?

In this case the speed ratio being 6:10 i.e. 3:5 the inverse of the speed ratio will be 5:3. This would have been the ratio to be used for the time ratio in case the distances were the same (for both the speeds). But since the distances are different, we cannot use this ratio in this form. The problem is overcome by multiplying this ratio (5:3) by the distance ratio (in this case it is 1:2) to get a value of 5:6. This is the ratio which has to be applied for the respective weights. Hence, the alligation will look like:

Solution
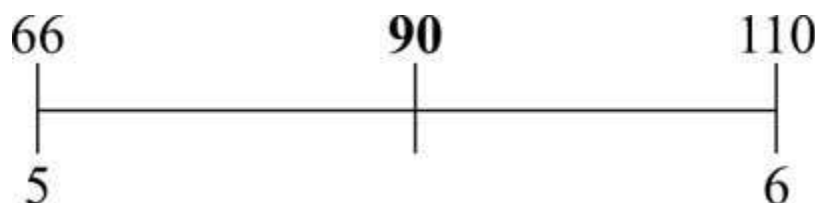
Thus the required answer is 90 kmph. (The student is advised to check this value through normal mathematical processes.)

📶 APPLICATIONS OF TIME, SPEED AND DISTANCE

Trains

Trains are a special case in questions related to time, speed and distance because they have their own theory and distinct situations.

The basic relation for trains problems is the same: Speed × Time = Distance.

The following things need to be kept in mind before solving questions on trains:

(a) When the train is crossing a moving object, the speed has to be taken as the **relative speed** of the train with respect to the object. All the rules for relative speed will apply for calculating the relative speed.

(b) The distance to be covered when crossing an object whenever a train crosses an object will be equal to: **Length of train + Length of object**

Thus, the following cases will yield separate equations, which will govern the crossing of the object by the train:

For each of the following situations the following notations have been used:

S_T = Speed of train S_O = Speed of object t = time

L_T = Length of train L_O = Length of object

Case I: Train crossing a stationary object without length:

$S_T \times t = L_T$

Case II: Train crossing a stationary object with length:

$S_T \times t = (L_T + L_O)$

Case III: Train crossing a moving object without length:

- In opposite direction: $(S_T + S_O) \times t = L_T$

- In same direction: $(S_T - S_O) \times t = L_T$

Case IV: Train crossing a moving object with length:

- In opposite direction: $(S_T + S_O) \times t = (L_T + L_O)$

- In same direction: $(S_T - S_O) \times t = (L_T + L_O)$

[*Note:* In order for a train to completely cross a stationary point on the ground, the train has to traverse a distance that is equal to its entire length.

This can be visualised by remembering yourself stationary on a railway platform and being crossed by a train. You would say that the train starts crossing you when the engine of the train comes in line with you. Also, you would say that you have been crossed by the train when the end of the guard's compartment comes in line with you. Thus, the train would have travelled its own length in crossing you].

Illustrations

(i) A train crosses a pole in 8 seconds. If the length of the train is 200 metres, find the speed of the train.

Solution: In this case, it is evident that the situation is one of the train crossing a stationary object without length. Hence, Case I is applicable here.

Thus, $S_T = 200/8 = 25$ m/s $\to 25 \times \dfrac{18}{5} = 90$ kmph.

(ii) A train crosses a man travelling in another train in he opposite direction in 8 seconds. However, the train requires 25 seconds to cross the same man if the trains are travelling in the same direction. If the length of the first train is 200 metres and that of the train in which the man is sitting is 160 metres, find the speed of the first train.

Solution: Here, the student should understand that the situation is one of the train crossing a moving object without length. Thus the length of the man's train is useless or redundant data.

Then applying the relevant formulae after considering the directions of the movements we get the equations:

$S_T + S_M = 25$

$S_T - S_M = 8$

$S_T = \dfrac{33}{2} = \dfrac{33 \times 18}{2 \times 5} = 59.4$ kmph

Boats and Streams

The problems of boats and streams are also dependent on the basic equation of time, speed and distance : Speed × Time = Distance.

However, as in the case of trains the adjustments to be made for solving questions on boats and streams are:

The boat has a speed of its own, which is also called the *speed of the boat in still water* (S_B).

Another variable that is used in boats and streams problems is the *speed of the stream* (S_S).

The speed of the movement of the boat is dependent on whether the boat is moving:

(a) In still water the speed of movement is given by $\to S_B$.

(b) While *moving upstream* (or against the flow of the water), the speed of movement is given by $\to$ $S_U = S_B - S_S$

(c) While *moving downstream* (or with the flow of the water), the speed of movement is given by $\to$ $S_D = S_B + S_S$

The time of movement and the distance to be covered are to be judged by the content of the problem.

Circular motion: A special case of movement is when two or more bodies are moving around a circular track.

The relative speed of two bodies moving around a circle in the same direction is taken as $S_1 - S_2$.

Also, *when two bodies are moving around a circle in the opposite direction, the speed of the two bodies is taken to be $S_1 + S_2$.*

The peculiarity inherent in moving around a circle in the same direction is that when the faster body overtakes the slower body it goes ahead of it. And for every unit time that elapses, the faster body keeps increasing the distance by which the slower body is behind the faster body. However, when the distance by which the faster body is in front of the slower body becomes equal to the circumference of the circle around which the two bodies are moving, the faster body again comes in line with the slower body. This

event is called as overlapping or lapping of the slower body by the faster body. We say that the slower body has been lapped or overlapped by the faster body.

First meeting: Three or more bodies start moving simultaneously from the same point on the circumference of the circle, in the same direction around the circle. They will first meet again in the LCM of the times that the fastest runner takes in totally overlapping each of the slower runners.

For instance, if A, B, C and D start clockwise from a point X on the circle such that A is the fastest runner hen we can define T_{AB} as the time in which A completely overlaps B, T_{AC} as the time in which A completely overlaps C and T_{AD} as the time in which A completely overlaps D. Then the LCM of T_{AB}, T_{AC} and T_{AD} will be the time in which A, B, C and D will be together again for the first time.

First meeting at starting point: Three or more bodies start moving simultaneously from the same point on the circumference of a circle, in the same direction around the circle. Their first meeting at the starting point will occur after a time that is got by the LCM of the times that each of the bodies takes to complete one full round.

For instance, if A, B and C start from a point X on the circle such that T_A, T_B and T_C are the times in which A, B and C respectively cover one complete round around the circle, then they will all meet together at the starting point in the LCM of T_A, T_B and T_C.

Clocks

Problems on clocks are based on the movement of the minute hand and that of the hour hand as well as on the relative movement between the two. In my opinion, it is best to solve problems on clocks by considering a clock to be a circular track having a circumference of 60 km and each kilometre being represented by one minute on the dial of the clock. Then, we can look at the minute hand as a runner running at the speed of 60 kmph while we can also look at the hour hand as a runner running at an average speed of 5 kmph.

Since, the minute hand and the hour hand are both moving in the same direction, the relative speed of the minute hand with respect to the hour hand is 55 kmph, that is, for every hour elapsed, the minute hand goes 55 km (minute) more than the hour hand.

(Beyond this slight adjustment, the problems of clocks require a good understanding of unitary method. This will be well illustrated through the solved example below.)

Important Information

Number of right angles formed by a clock: A clock makes 2 right angles between any 2 hours. Thus, for instance, there are 2 right angles formed between 12 to 1 or between 1 and 2 or between 2 and 3 or between 3 and 4 and so on.

However, contrary to expectations, the clock does not make 48 right angles in a day. This happens because whenever the clock passes between the time period 2–4 or between the time period 8–10 there are not 4 but only 3 right angles.

This happens because the second right angle between 2–3 (or 8–9) and the first right angle between 3–4 (or 9–10) are one and the same, occurring at 3 or 9.

Right angles are formed when the distance between the minute hand and the hour hand is equal to 15 minutes.

Exactly the same situation holds true for the formation of straight lines. There are 2 straight lines in every hour. However, the second straight line between 5–6 (or 11–12) and the first straight line between 6–7 (or 12–1) coincide with each other and are represented by the straight line formed at 6 (or 12).

Straight lines are formed when the distance between he minute hand and the hour hand is equal to either 0 minutes or 30 minutes.

Illustration

At what time between 2–3 p.m. is the first right angle in that time formed by the hands of the clock?

Solution: At 2 p.m. the minute hand can be visualised as being 10 kilometres behind the hour hand. (considering the clock dial to be a race track of circumference 60 km such that each minute represents a kilometre).

Also, the first right angle between 2–3 is formed when the minute hand is 15 kilometres ahead of the hour hand.

Thus, the minute hand has to cover 25 kilometres over the hour hand.

This can be written using the unitary method:

Distance covered by the minute hand over the hour hand.

55 kilometres ——————————— in 1 hour

25 kilometres ——————————— in what time?

Æ 5/11 of an hour.

Thus, the first right angle between 2–3 is formed at 5/11 hours past 2 o'clock.

This can be converted into minutes and seconds using unitary method again as:

1 hour ——————————— 60 minutes

5/11 hours ——————————— ? minutes

Æ 300/11 minutes = 27 (3/11) minutes

1 minute ——————————— 60 seconds

3/11 minutes ——————————— ? seconds Æ 180/11 seconds = 16.3636 seconds.

Hence, the required answer is: **2 : 27 : 16.36 seconds**.

1. The Sinhagad Express left Pune at noon sharp. Two hours later, the Deccan Queen started from Pune in the same direction. The Deccan Queen overtook the Sinhagad Express at 8 p.m. Find the average speed of the two trains over this journey if the sum of their average speeds is 70 km/h.

   (a) 34.28 km/h
   (b) 35 km/h
   (c) 50 km/h
   (d) 12 km/h

2. Walking at 3/4 of his normal speed, Abhishek is 16 minutes late in reaching his office. The usual time taken by him to cover the distance between his home and his office is

   (a) 48 minutes
   (b) 60 minutes
   (c) 42 minutes
   (d) 62 minutes

3. Ram and Bharat travel the same distance at the rate of 6 km per hour and 10 km per hour respectively. If Ram takes 30 minutes longer than Bharat, the distance travelled by each is

   (a) 6 km
   (b) 10 km
   (c) 7.5 km
   (d) 20 km

4. Two trains for Mumbai leave Delhi at 6 : 00 a.m. and 6 : 45 am and travel at 100 kmph and 136 kmph respectively. How many kilometres from Delhi will the two trains be together?

   (a) 262.4 km
   (b) 260 km
   (c) 283.33 km
   (d) 275 km

5. Two trains, Calcutta Mail and Bombay Mail, start at the same time from stations Kolkata and Mumbai respectively towards each other. After passing each other, they take 12 hours and 3 hours to reach Mumbai and Kolkata respectively. If the Calcutta Mail is moving at the speed of 48 km/h, the speed of the Bombay Mail is

   (a) 24 km/h
   (b) 22 km/h
   (c) 21 km/h
   (d) 96 km/h

6. Shyam's house, his office and his gym are all equidistant from each other. The distance between any 2 of them is 4 km. Shyam starts walking from his gym in a direction parallel to the road connecting his office and his house and stops when he reaches a point directly east of his office. He then reverses direction and walks till he reaches a point directly south of his office. The total distance walked by Shyam is

   (a) 6 km
   (b) 9 km
   (c) 16 km
   (d) 12 km

7. Lonavala and Khandala are two stations 600 km apart. A train starts from Lonavala and moves towards Khandala at the rate of 25 km/h. After two hours, another train starts from Khandala at the rate of 35 km/h. How far from Lonavala will they will cross each other?

   (a) 250 km
   (b) 300 km
   (c) 279.166 km
   (d) 475 km

8. Walking at 3/4 of his normal speed, a man takes 2(1/2) hours more than the normal time. Find the normal time.

(a) 7.5 h

(b) 6 h

(c) 8 h

(d) 12 h

9. Alok walks to a viewpoint and returns to the starting point by his car and thus takes a total time of 6 hours 45 minutes. He would have gained 2 hours by driving both ways. How long would it have taken for him to walk both ways?

(a) 8 h 45 min

(b) 7 h 45 min

(c) 5 h 30 min

(d) 6 h 45 min

10. Sambhu beats Kalu by 30 metres or 10 seconds. How much time was taken by Sambhu to complete a race 1200 meters.

(a) 6 min 30 s

(b) 3 min 15 s

(c) 12 min 10 s

(d) 2 min 5 s

11. What is the time taken by Chandu to cover a dis- ance of 360 km by a motorcycle moving at a speed of 10 m/s?

(a) 10 h

(b) 5 h

(c) 8 h

(d) 6 h

12. Without stoppage, a train travels a certain distance with an average speed of 60 km/h, and with stoppage, it covers the same distance with an average speed of 40 km/h. On an average, how many minutes per hour does the train stop during the journey?

(a) 20 min/h

(b) 15 min/h

(c) 10 min/h

(d) 10 min/h

13. Rajdhani Express travels 650 km in 5 h and another 940 km in 10 h. What is the average speed of train?

(a) 1590 km/h

(b) 168 km/h

(c) 106 km/h

(d) 126 km/h

14. Rishikant, during his journey, travels for 20 minutes at a speed of 30 km/h, another 30 minutes at a speed of 50 km/h, and 1 hour at a speed of 50 km/h and 1 hour at a speed of 60 km/h. What is the average velocity?

(a) 51.18 km/h

(b) 63 km/h

(c) 39 km/h

(d) 48 km/h

15. A car travels from A to B at V_1 km/h, travels back from B to A at V_2 km/h and again goes back from A to B at V_2 km/h. The average speed of the car is:

(a) $\dfrac{2V_1 V_2}{V_1 + 2V_2}$

(b) $\dfrac{2V_1 V_2}{V_2 + 2V_1}$

(c) $\dfrac{3V_1 V_2}{V_2 + 2V_1}$ (d) $\dfrac{3V_1 V_2}{V_1 + 2V_2}$

16. Narayan Murthy walking at a speed of 20 km/h reaches his college 10 minutes late. Next time he increases his speed by 5 km/h, but finds that he is still late by 4 minutes. What is the distance of his college from his house?

    (a) 20 km   (b) 6 km

    (c) 12 km   (d) None of these

17. Jayshree goes to office at a speed of 6 km/h and returns to her home at a speed of 4 km/h. If she takes 10 hours in all, what is the distance between her office and her home?

    (a) 24 km   (b) 12 km

    (c) 10 km   (d) 30 km

18. A motor car does a journey in 17.5 hours, covering the first half at 30 km/h and the second half at 40 km/h. Find the distance of the journey.

    (a) 684 km   (b) 600 km

    (c) 120 km   (d) 540 km

19. Sujit covers a distance in 40 minutes if he drives at a speed of 60 kilometer per hour on an average. Find the speed at which he must drive at to reduce the time of the journey by 25%?

    (a) 60 km/h   (b) 70 km/h

    (c) 75 km/h   (d) 80 km/h

20. Manish travels a certain distance by car at the rate of 12 km/h and walks back at the rate of 3 km/h. The whole journey took 5 hours. What is the distance he covered on the car?

    (a) 12 km   (b) 30 km

    (c) 15 km   (d) 6 km

21. A railway passenger counts the telegraph poles on the rail road as he passes them. The telegraph poles are at a distance of 50 metres. What will be his count in 4 hours, if the speed of the train is 45 km per hour?

    (a) 600   (b) 2500

    (c) 3600   (d) 5000

22. Two trains A and B start simultaneously in the opposite direction from two points A and B and arrive at their destinations 9 and 4 hours respectively after their meeting each other. At what rate does the second train B travel if the first train travels at 80 km per hour.

    (a) 60 km/h   (b) 100 km/h

    (c) 120 km/h   (d) 80 km/h

23. Vinay fires two bullets from the same place at an interval of 12 minutes but Raju sitting in a train approaching the place hears the second report 11 minutes 30 seconds after the first. What is the approximate speed of train (if sound travels at the speed of 330 metre per second)?

    (a) 660/23 m/s   (b) 220/7 m/s

(c) 330/23 m/s   (d) 110/23 m/s

24. A car driver, driving in a fog, passes a pedestrian who was walking at the rate of 2 km/h in the same direction. The pedestrian could see the car for 6 minutes and it was visible to him up to a distance of 0.6 km. What was the speed of the car?

(a) 30 km/h   (b) 15 km/h

(c) 20 km/h   (d) 8 km/h

25. Harsh and Vijay move towards Hosur starting from IIM, Bangalore, at a speed of 40 km/h and 60 km/h respectively. If Vijay reaches Hosur 200 minutes earlier then Harsh, what is the distance between IIM, Bangalore, and Hosur?

(a) 600 km   (b) 400 km

(c) 900 km   (d) 200 km

26. A journey of 192 km takes 2 hours less by a fast train than by a slow train. If the average speed of the slow train be 16 kmph less than that of fast train, what is the average speed of the faster train?

(a) 32 kmph   (b) 16 kmph

(c) 12 kmph   (d) 48 kmph

27. A passenger train takes 2 h less for a journey of 300 kilometres if its speed is increased by 5 kmph over its usual speed. Find the usual speed.

(a) 10 kmph   (b) 12 kmph

(c) 20 kmph   (d) 25 kmph

28. If Arun had walked 1 km/h faster, he would have taken 10 minutes less to walk 2 kilometre. What is Arun's speed of walking?

(a) 1 kmph   (b) 2 kmph

(c) 3 kmph   (d) 6 kmph

29. A plane left half an hour later than the scheduled time and in order to reach its destination 1500 kilometre away in time, it had to increase its speed by 33.33 per cent over its usual speed. Find its increased speed.

(a) 250 kmph   (b) 500 kmph

(c) 750 kmph   (d) 1000 kmph

30. A train moves at a constant speed of 120 km/h for one kilometre and at 40 kmph for the next one kilometre. What is the average speed of the train?

(a) 48 kmph   (b) 50 kmph

(c) 80 kmph   (d) 60 kmph

31. A cyclist moving on a circular track of radius 100 metres completes one revolution in 2 minutes. What is the average speed of cyclist (approximately)?

(a) 314 m/minute   (b) 200 m/minute

(c) 300 m/minute   (d) 900 m/minute

32. A person travelled a distance of 200 kilometre between two cities by a car covering the first quarter of the journey at a constant speed of 40 km/h and he remaining three quarters at a constant speed of x km/h. If the average speed of the person for the entire journey was 53.33 km/h what is the value of x?

(a) 55 km/h   (b) 60 km/h

(c) 70 km/h   (d) 80 km/h

33. A car travels 1/3 of the distance on a straight road with a velocity of 10 km/h, the next 1/3 with a velocity of 20 km/h and the last 1/3 with a velocity of 60 km/h. What is the average velocity of the car for the whole journey?

(a) 18 km/h   (b) 10 km/h

(c) 20 km/h   (d) 15 km/h

34. Two cars started simultaneously toward each other from town A and B, that are 480 km apart. It took the first car travelling from A to B 8 hours to cover the distance and the second car travelling from B to A 12 hours. Determine at what distance from A the two cars meet.

(a) 288 km   (b) 200 km

(c) 300 km   (d) 196 km

35. Walking at 3/4 of his usual speed, a man is 16 minutes late for his office. The usual time taken by him to cover that distance is

(a) 48 minutes   (b) 60 minutes

(c) 42 minutes   (d) 62 minutes

36. A and B travel the same distance at the rate of 8 kilometre and 10 kilometre an hour respectively. If A takes 30 minutes longer than B, the distance travelled by B is

(a) 6 km   (b) 10 km

(c) 16 km   (d) 20 km

37. Two trains for Patna leave Delhi at 6 a.m. and 6:45 a.m. and travel at 98 kmph and 136 kmph respectively. How many kilometres from Delhi will the two trains meet?

(a) 262.4 km   (b) 260 km

(c) 200 km   (d) None of these

38. Two trains A and B start from station X to Y, Y to X respectively. After passing each other, they take 12 hours and 3 hours to reach Y and X respectively. If train A is moving at the speed of 48 km/h, the speed of train B is

(a) 24 km/h   (b) 96 km/h

(c) 21 km/h   (d) 20 km/h

39. X and Y are two stations 600 km apart. A train starts from X and moves towards Y at the rate of 25 km/h. Another train starts from Y at the rate of 35 km/h. How far from X they will cross each other?

(a) 250 km   (b) 300 km

(c) 450 km   (d) 475 km

40. *A* starts from a point that is on the circumference of a circle, moves 600 metre in the North direction and then again moves 800 metre East and reaches a point diametrically opposite the starting point. Find the diameter of the circle?

(a) 1000 m   (b) 500 m

(c) 800 m   (d) 900 m

41. Ram and Shyam run a race of 2000 m. First, Ram gives Shyam a start of 200 m and beats him by 30 s. Next, Ram gives Shyam a start of 3 min and is beaten by 1000 metres. Find the time in minutes in which Ram and Shyam can run the race separately.

(a) 8, 10   (b) 4, 5

(c) 5, 9   (d) 6, 9

42. A motorboat went downstream for 28 km and immediately returned. It took the boat twice as long to make the return trip. If the speed of the river flow were twice as high, the trip downstream and back would take 672 minutes. Find the speed of the boat in still water and the speed of the river flow.

(a) 9 km/h, 3 km/h   (b) 9 km/h, 6 km/h

(c) 8 km/h, 2 km/h   (d) 12 km/h, 3 km/h

43. A train requires 7 seconds to pass a pole while it requires 25 seconds to cross a stationary train which is 378 metres long. Find the speed of the train.

(a) 75.6 km/h   (b) 75.4 km/h

(c) 76.2 km/h   (d) 21 km/h

44. A boat sails downstream from point *A* to point *B*, which is 10 km away from *A*, and then returns to *A*. If the actual speed of the boat (in still water) is 3 km/h, the trip from *A* to *B* takes 8 hours less han that from B to *A*. What must the actual speed of the boat for the trip from *A* to *B* to take exactly 100 minutes?

(a) 1 km/h   (b) 2 km/h

(c) 3 km/h   (d) 4 km/h

45. A boat sails down the river for 10 km and then up the river for 6 km. The speed of the river flow is 1 km/h. What should be the minimum speed of the boat for the trip to take a maximum of 4 hours?

(a) 2 kmph   (b) 3 kmph

(c) 4 kmph   (d) 5 kmph

46. A man rows 6 km/h in still water. If the river is running at 3 km per hour, it takes him 45 minutes to row to a place and back. How far is the place?

(a) 1.12 km   (b) 1.25 km

(c) 1.6875 km   (d) 2.5 km

47. A boat goes 40 km upstream in 8 h and a distance of 49 km downstream in 7 h. The speed of the boat in still water is

(a) 5 km/h
(b) 5.5 km/h
(c) 6 km/h
(d) 6.5 km/h

48. Two trains are running on parallel lines in the same direction at speeds of 40 kmph and 20 kmph respectively. The faster train crosses a man in the second train in 36 seconds. The length of the faster train is

(a) 200 metres
(b) 185 metres
(c) 225 metres
(d) 210 metres

49. The speed of the boat in still water is 12 km/h and the speed of the stream is 2 km/h. A distance of 8 km, going upstream, is covered in

(a) 1 h
(b) 1 h 15 min
(c) 1 h 12 min
(d) None of these

50. A boat goes 15 km upstream in 80 minutes. The speed of the stream is 5 km/h. The speed of the boat in still water is

(a) 16.25 km/h
(b) 16 km/h
(c) 15 km/h
(d) 17 km/h

51. In a stream, B lies in between A and C such that it is equidistant from both A and C. A boat can go from A to B and back in 6 h 30 minutes while it goes from A to C in 9 h. How long would it take to go from C to A?

(a) 3.75 h
(b) 4 h
(c) 4.25 h
(d) 4.5 h

52. Two trains pass each other on parallel lines. Each train is 100 metres long. When they are going in the same direction, the faster one takes 60 seconds to pass the other completely. If they are going in opposite directions they pass each other completely in 10 seconds. Find the speed of the slower train in km/h.

(a) 30 km/h
(b) 42 km/h
(c) 48 km/h
(d) 60 km/h

53. Vinay runs 100 metres in 20 seconds and Ajay runs the same distance in 25 seconds. By what distance will Vinay beat Ajay in a hundred metre race?

(a) 10 m
(b) 20 m
(c) 25 m
(d) 12 m

54. In a 100 m race, Shyam runs at 1.66 m/s. If Shyam gives Sujit a start of 4 m and still beats him by 12 seconds, what is Sujit's speed?

(a) 1.11 m/s
(b) 0.75 m/s
(c) 1.33 m/s
(d) 1 km/h

55. At a game of billiards, A can give B 15 points in 60 and A can give C 20 in 60. How many points can B give C in a game of 90?

(a) 11   (b) 13

(c) 10   (d) 14

56. In a 500 m race, the ratio of speed of two runners Vinay and Shyam is 3 : 4. If Vinay has a start of 140 m then Vinay wins by

(a) 15 m   (b) 20 m

(c) 25 m   (d) 30 m

57. How many seconds will a caravan 120 metres long running at the rate 10 m/s take to pass a standing boy.

(a) 10 s   (b) 12 s

(c) 11 s   (d) 14 s

58. Two trains are travelling in the same direction at 50 km/h and 30 km/h respectively. The faster train crosses a man in the slower train in 18 seconds. Find the length of the faster train.

(a) 0.1 km   (b) 1 km

(c) 1.5 km   (d) 1.4 km

59. Two trains for Howrah leave Muzaffarpur at 8:30 a.m. and 9:00 a.m. respectively and travel at 60 km/h and 70 km/h respectively. How many kilometres from Muzaffarpur will the two trains meet?

(a) 210 km   (b) 180 km

(c) 150 km   (d) 120 km

60. Without stoppage, a train travels at an average speed of 75 km/h and with stoppages it covers the same distance at an average speed of 60 km/h. How many minutes per hour does the train stop?

(a) 10 minutes   (b) 12 minutes

(c) 14 minutes   (d) 18 minutes

61. A boat rows 16 km up the stream and 30 km downstream taking 5 h each time. The velocity of the current

(a) 1.1 km/h   (b) 1.2 km/h

(c) 1.4 km/h   (d) 1.5 km/h

62. Vijay can row a certain distance downstream in 6 h and return the same distance in 9 h. If the stream flows at the rate of 3 km/h, find the speed of Vijay in still water.

(a) 12 km/h   (b) 13 km/h

(c) 14 km/h   (d) 15 km/h

63. Subbu can row 6 km/h in still water. When the river is running at 1.2 km/h, it takes him 1 hour to row to a place and back. How far in the place?

(a) 2.88 km   (b) 2.00 km

(c) 3.12 km   (d) 2.76 km

64. A dog is passed by a train in 8 seconds. Find the length of the train if its speed is 36 kmph.

(a) 70 m   (b) 80 m

(c) 85 m   (d) 90 m

65. A lazy man can row upstream at 16 km/h and downstream at 22 km/h. Find the man's rate in still water (in kmph).

(a) 19   (b) 14

(c) 17   (d) 18

66. A man can row 30 km upstream and 44 km downstream in 10 hours. It is also known that he can row 40 km upstream and 55 km downstream in 13 hours. Find the speed of the man in still water.

(a) 4 km/h   (b) 6 km/h

(c) 8 km/h   (d) 12 km/h

67. In a stream that is running at 2 km/h, a man goes 10 km upstream and comes back to the starting point in 55 minutes. Find the speed of the man in still water.

(a) 20 km/h   (b) 22 km/h

(c) 24 km/h   (d) 28 km/h

68. A man goes down stream at x km/h and upstream at y km/h. The speed of the boat in still water is

(a) $0.5 (x + y)$ (b) $0.5 (x - y)$

(c) $x + y$ (d) $x - y$

69. The length of the minutes hand of a clock is 8 cm. Find the distance travelled by its outer end in 15 minutes.

(a) $4p$ cm   (b) $8p$ cm

(c) $12p$ cm   (d) $16p$ cm

70. Between 5 a.m. and 5 p.m. of a particular day for how many times are the minute and the hour hands together?

(a) 11   (b) 22

(c) 33   (d) 44

71. At what time are the hands of clock together between 2 and 3 p.m.?

(a) 2/11 hours past 2 p.m.

(b) 2/9 hours past 2 p.m.

(c) 2:10 p.m.

(d) None of these

72. A motorboat went down the river for 14 km and then up the river for 9 km. It took a total of 5 hours for the entire journey. Find the speed of the river flow if the speed of the boat in still water

is 5 km/h.

(a) 1 kmph   (b) 1.5 kmph

(c) 2 kmph   (d) 3 kmph

73. A motorboat whose speed in still water is 10 km/h went 91 km downstream and then returned to its starting point. Calculate the speed of the river flow if the round trip took a total of 20 hours.

(a) 3 km/h   (b) 4 km/h

(c) 6 km/h   (d) 8 km/h

74. In a race of 600 meters, Ajay beats Vijay by 60 metres and in a race of 500 meters Vijay beats Anjay by 25 meters. By how many meters will Ajay beat Anjay in a 400 meter race?

(a) 48 m   (b) 52 m

(c) 56 m   (d) 58 m

75. A motorboat whose speed in still water is 15 kmph goes 30 km downstream and comes back in a total 4 hours 30 min. Determine the speed of the stream.

(a) 2 kmph   (b) 3 kmph

(c) 4 kmph   (d) 5 kmph

1. The J&K Express from Delhi to Srinagar was delayed by snowfall for 16 minutes and made up for the delay on a section of 80 km travelling with a speed 10 km per hour higher than its normal speed. Find the original speed of the J&K Express (according to the schedule)

   (a) 60 km/h

   (b) 66.66 km/h

   (c) 50 km/h

   (d) 40 km/h

2. Ayrton Senna had to cover a distance of 60 km. However, he started 6 minutes later than his scheduled time and raced at a speed 1 km/h higher than his originally planned speed and reached the finish at the time he would reach it if he began to race strictly at the appointed time and raced with the assumed speed. Find the speed at which he travelled during the journey described.

   (a) 25 km/h

   (b) 15 km/h

   (c) 10 km/h

   (d) 6 km/h

3. Amitabh covered a distance of 96 km two hours faster than he had planned to. This he achieved by travelling 1 km more every hour than he intended to cover every 1 hour 15 minutes. What was the speed at which Amitabh travelled during the journey?

   (a) 16 km/h

   (b) 26 km/h

   (c) 36 km/h

   (d) 30 km/h

4. An urgent message had to be delivered from the house of the Peshwas in Pune to Shivaji who was camping in Bangalore. A horse rider travels on horse back from Pune to Bangalore at a constant speed. If the horse increased its speed by 6 km/h, it would take the rider 4 hours less to cover that distance. And travelling with a speed 6 km/h lower than the initial speed, it would ake him 10 hours more than the time he would have taken had he travelled at a speed 6 kmph higher than the initial speed. Find the distance between Pune and Bangalore.

   (a) 120 km

   (b) 600 km

   (c) 720 km

   (d) 750 km

5. A pedestrian and a cyclist start simultaneously towards each other from Aurangabad and Paithan which are 40 km apart and meet 2 hours after the start. Then they resumed their trips and the cyclist arrives at Aurangabad 7 hours 30 minutes earlier than the pedestrian arrives at Paithan. Which of these could be the speed of the pedestrian?

   (a) 4 km/h

   (b) 5 km/h

   (c) 3 km/h

   (d) 6 km/h

6. Two motorists met at 10 a.m. at the Dadar railway station. After their meeting, one of them proceeded in the East direction while the other proceeded in the North direction. Exactly at noon, they were 60 km apart. Find the speed of the slower motorist if the difference of their speeds is 6 km/h.

   (a) 28 km/h

   (b) 18 km/h

   (c) 9 km/h

   (d) 19 km/h

7. Two cyclists start simultaneously towards each other from Aurangabad and Ellora, which are 28 km apart. An hour later they meet and keep pedalling with the same speed without stopping. The second cyclist arrives at Ellora 35 minutes later than the first arrives at Aurangabad. Find the speed of the cyclist who started from Ellora.

   (a) 12 km/h   (b) 16 km/h

   (c) 15 km/h   (d) 10 km/h

8. Two ants start simultaneously from two ant holes towards each other. The first ant covered 8% of the distance between the two ant holes in 3 hours, the second ant covered $\frac{7}{120}$ of the distance in 2 hours 30 minutes. Find the speed (feet/h) of the second ant if the first ant travelled 800 feet to the meeting point.

   (a) 15 feet/h   (b) 25 feet/h

   (c) 45 feet/h   (d) 35 feet/h

9. A bus left point X for point Y. Two hours later a car left point X for Y and arrived at Y at the same time as the bus. If the car and the bus left simultaneously from the opposite ends X and Y towards each other, they would meet 1.33 hours after the start. How much time did it take the bus to travel from X to Y?

   (a) 2 h   (b) 4 h

   (c) 6 h   (d) 8 h

10. A racetrack is in the form of a right triangle. The longer of the legs of the track is 2 km more than the shorter of the legs (both these legs being on a highway). The start and end points are also connected o each other through a side road. The escort vehicle for the race took the side road and rode with a speed of 30 km/h and then covered the two intervals along the highway during the same time with a speed of 42 km/h. Find the length of the racetrack.

   (a) 14 km   (b) 10 km

   (c) 24 km   (d) 36 km

11. Two planes move along a circle of circumference 1.2 km with constant speeds. When they move in different directions, they meet every 15 seconds and when they move in the same direction, one plane overtakes the other every 60 seconds. Find the speed of the slower plane.

   (a) 0.04 km/s   (b) 0.03 km/s

   (c) 0.05 km/s   (d) 0.02 km/s

12. Karim, a tourist leaves Ellora on a bicycle. Having travelled for 1.5 h at 16 km/h, he makes a stop for 1.5 h and then pedals on with the same speed. Four hours after Karim started, his friend and local guide Rahim leaves Ellora on a motorcycle and rides with a speed of 28 km/h in the same direction as Karim had gone. What distance will they cover before Rahim overtakes Karim?

   (a) 88 km   (b) 90.33 km

   (c) 93.33 km   (d) 96.66 km

13. A tourist covered a journey partly by foot and partly by tonga. He walked for 90 km and rode the

tonga for 10 km. He spent 4 h less on the tonga than on walking. If the tourist had reversed the times he travelled by foot and on tonga, the distances travelled on each part of the journey would be equal. How long did he ride the tonga?

(a) He rode for 6 hours

(b) He rode for 4 hours

(c) He rode for 2 hours

(d) He rode for 5 hours

14. Two Indian tourists in the US cycled towards each other, one from point A and the other from point B. The first tourist left point A 6 hrs later than the second left point B, and it turned out on their meeting that he had travelled 12 km less than the second tourist. After their meeting, they kept cycling with the same speed, and the first tourist arrived at B 8 hours later and the second arrived at A 9 hours later. Find the speed of the faster tourist.

(a) 4 km/h

(b) 6 km/h

(c) 9 km/h

(d) 2 km/h

15. Two joggers left Delhi for Noida simultaneously. The first jogger stopped 42 min later when he was 1 km short of Noida and the other one stopped 52 min later when he was 2 km short of Noida. If the first jogger jogged as many kilometres as the second and the second as many kilometres as the first, the first one would need 17 min less than the second. Find the distance between Delhi and Noida.

(a) 5 km

(b) 15 km

(c) 25 km

(d) 35 km

16. A tank of 4800 m^3 capacity is full of water. The discharging capacity of the pump is 10 m^3/min higher than its filling capacity. As a result the pump needs 16 min less to discharge the fuel than to fill up the tank. Find the filling capacity of the pump.

(a) 50 m^3/min

(b) 25 m^3/min

(c) 55 m^3/min

(d) 24 m^3/min

17. An ant climbing up a vertical pole ascends 12 meters and slips down 5 meters in every alternate hour. If the pole is 63 meters high how long will it take it to reach the top?

(a) 18 hours

(b) 17 hours

(c) 16 hours 35 minutes

(d) 16 hours 40 minutes

18. Two ports A and B are 300 km apart. Two ships leave A for B such that the second leaves 8 hours after the first. The ships arrive at B simultaneously. Find the time the slower ship spent on the trip if the speed of one of them is 10 km/h higher than that of the other.

(a) 25 hours

(b) 15 hours

(c) 10 hours

(d) 20 hours

19. An ant moved for several seconds and covered 3 mm in the first second and 4 mm more in each successive second than in its predecessor. If the ant had covered 1 mm in the first second and 8 mm more in each successive second, then the difference between the path it would cover during

the same time and the actual path would be more than 6 mm but less than 30 mm. Find the time for which the ant moved (in seconds).

(a) 5 s
(b) 4 s

(c) 6 s
(d) 2 s

20. The Sabarmati Express left Ahmedabad for Mumbai. Having travelled 300 km, which constitutes 66.666 per cent of the distance between Ahmedabad and Mumbai, the train was stopped by a red signal. Half an hour later, the track was cleared and the engine-driver, having increased the speed by 15 km per hour, arrived at Mumbai on time. Find the initial speed of the Sabarmati Express.

(a) 50 kmph
(b) 60 kmph

(c) 75 kmph
(d) 40 kmph

21. Two swimmers started simultaneously from the beach, one to the south and the other to the east. Two hours later, the distance between them turned out to be 100 km. Find the speed of the faster swimmer, knowing that the speed of one of them was 75% of the speed of the other.

(a) 30 kmph
(b) 40 kmph

(c) 45 kmph
(d) 60 kmph

22. A motorcyclist left point A for point B. Two hours later, another motorcyclist left A for B and arrived at B at the same time as the first motorcyclist. Had both the motorcyclists started simultaneously from A and B travelling towards each other, they would have met in 80 minutes. How much time did it take the faster motorcyclist to travel from A to B?

(a) 6 hours
(b) 3 hours

(c) 2 hours
(d) 4 hours

23. Two horses started simultaneously towards each other and meet each other 3 h 20 min later. How much time will it take the slower horse to cover the whole distance if the first arrived at the place of departure of the second 5 hours later than the second arrived at the point of departure of the first?

(a) 10 hours
(b) 5 hours

(c) 15 hours
(d) 6 hours

24. The difference between the times taken by two buses to travel a distance of 350 km is 2 hours 20 minutes. If the difference between their speeds is 5 kmph, find the slower speed.

(a) 35 kmph
(b) 30 kmph

(c) 25 kmph
(d) 20 kmph

25. One bad day, at 7 a.m. I started on my bike at the speed of 36 kmph to meet one of my relatives. After I had travelled some distance, my bike went out of order and I had to stop. After resting for 35 minutes, I returned home on foot at a speed of 14 kmph and reached home at 1 p.m. Find the distance from my house at which my bike broke down.

(a) 54 km
(b) 63 km

(c) 72 km
(d) None of these

Direction for Questions 26 to 30: Read the following data and answer the questions that follow.

Three brothers, Ram, Shyam and Mohan, travelled by road. They all left the college at the same time—12 noon. The description of the motions of the three are detailed below:

Name	Ram	Shyam	Mohan
Phase I	Bus for 2 hours @ 10 mph	Bike for @ 1 hours 30 mph	Foot for 3 hours @ 3.33 mph
Phase II	Bike for 1.5 hours @ 40 mph	Foot for 3 hours @ 3.33 mph	Bus for 3 hours @ 10 mph
Phase III	Foot for 3 hours @ 3.33 mph	Bus for 4 hours @ 10 mph	Bike for 2 hours @ 30 mph

26. When did Ram overtake Shyam?

   (a) 3:15 p.m.
   (b) 2:22 p.m.
   (c) 2:30 p.m.
   (d) 2:20 p.m.

27. At what distance from the start does Mohan overtake Shyam?

   (a) 40 miles
   (b) 57 miles
   (c) 70 miles
   (d) 80 miles

28. If Ram travelled by bike instead of foot in the last leg of his journey (for the same distance as he had covered by foot), what is the difference in the times of Ram and Mohan to cover 90 miles?

   (a) 6 h 50 minutes
   (b) 10 h 40 minutes
   (c) 3 hrs 55 minutes
   (d) 4 hrs 10 minutes

29. If all of them travelled a distance of 100 miles, who reached first and at what time (assume the last leg time increases to cover 100 miles)?

   (a) Mohan at 6 p.m.
   (b) Ram at 8 p.m.
   (c) Shyam at 6 p.m.
   (d) Mohan at 8 p.m.

30. In the above question, who reached last and at what time?

   (a) Ram at 9:30 p.m.
   (b) Ram at 10 p.m.
   (c) Shyam at 9:30 p.m.
   (d) Shyam at 10 p.m.

31. A motorcyclist rode the first half of his way at a constant speed. Then he was delayed for 5 minutes and, therefore, to make up for the lost time he increased his speed by 10 km/h. Find the initial speed of the motorcyclist if the total path covered by him is equal to 50 km.

   (a) 36 km/h
   (b) 48 km/h
   (c) 50 km/h
   (d) 62 km/h

32. Ram Singh and Priyadarshan start together from the same point on a circular path and walk around, each at his own pace, until both arrive together at the starting point. If Ram Singh performs the circuit in 3 minutes 44 seconds and Priyadarshan in 6 minutes 4 seconds, how many times does Ram Singh go around the path?

   (a) 8
   (b) 13
   (c) 15
   (d) Cannot be determined

33. Ravi, who lives in the countryside, caught a train for home earlier than usual yesterday. His wife normally drives to the station to meet him. But yesterday he set out on foot from the station to meet his wife on the way. He reached home 12 minutes earlier than he would have done had he waited at the station for his wife. The car travels at a uniform speed, which is 5 times Ravi's speed on foot. Ravi reached home at exactly 6 O'clock. At what time would he have reached home if his wife, forewarned of his plan, had met him at the station?

(a) 5 : 48
(b) 5 : 24
(c) 5 : 00
(d) 5 : 36

34. Hemant and Ajay start a two-length swimming race at the same moment but from opposite ends of the pool. They swim in lane and at uniform speeds, but Hemant is faster than Ajay. They first pass at a point 18.5 m from the deep end and having completed one length, each one is allowed to rest on the edge for exactly 45 seconds. After setting off on the return length, the swimmers pass for the second time just 10.5 m from the shallow end. How long is the pool?

(a) 55.5 m
(b) 45 m
(c) 66 m
(d) 49 m

35. Rahim sets out to cross a forest. On the first day, he completes 1/10th of the journey. On the second day, he covers 2/3rd of the distance travelled the first day. He continues in this manner, alternating the days in which he travels 1/10th of the distance still to be covered, with days on which he travels 2/3 of the total distance already covered. At the end of seventh day, he finds that $22\frac{1}{2}$ km more will see the end of his journey. How wide is the forest?

(a) $66\frac{2}{3}$ km
(b) 100 km
(c) 120 km
(d) 150 km

36. The metro service has a train going from Mumbai to Pune and Pune to Mumbai every hour, the first one at 6 a.m. The trip from one city to other takes $4\frac{1}{2}$ hours, and all trains travel at the same speed. How many trains will you pass while going from Mumbai to Pune if you start at 12 noon?

(a) 8
(b) 10
(c) 9
(d) 13

37. The distance between two towns is x km. A car travelling between the towns covers the first k km at an average speed of y km/h and the remaining distance at z km/h. The time taken for the journey is

(a) $\dfrac{k}{y} + \dfrac{(x-k)}{z}$
(b) $ky + \dfrac{(k-x)}{z}$
(c) $\dfrac{k}{y} + \dfrac{(k-x)}{z}$
(d) $ky + z(x-k)$

38. Two rifles are fired from the same place at a difference of 11 minutes 45 seconds. But a man who is coming towards the place in a train hears the second sound after 11 minutes. Find the speed of train.

(a) 72 km/h
(b) 36 km/h

(c) 81 km/h   (d) 108 km/h

Directions for Questions 39 and 40: Read the following and answer the questions that follow.

The Kalinga Express started from Patna to Tata at 7 p.m. at a speed of 60 km/h. Another train, Rajdhani Express, started from Tata to Patna at 4 a.m. next morning at a speed of 90 km/h. The distance between Patna to Tata is 800 km.

39. How far from Tata will the two trains meet?

(a) 164 km   (b) 156 km

(c) 132 km   (d) 128 km

40. At what time will the two trains meet?

(a) 5 : 32 a.m.   (b) 5 : 28 a.m.

(c) 5 : 36 a.m.   (d) 5 : 44 a.m.

Directions for Questions 41 to 43: Read the following and answer the question that follow.

A naughty bird is sitting on top of a car. It sees another car approaching it at a distance of 12 km. The speed of the two cars is 60 kmph each. The bird starts flying from the first car and moves towards the second car, reaches the second car and comes back to the first car and so on. If the speed at which the bird flies is 120 kmph then answer the following questions. Assume that the two cars have a crash.

41. The total distance travelled by the bird before the crash is

(a) 6 km   (b) 12 km

(c) 18 km   (d) None of these

42. The total distance travelled by the bird before it reaches the second car for the second time is

(a) 10.55 km   (b) 11.55 km

(c) 12.33 km   (d) None of these

43. The total number of times that the bird reaches the bonnet of the second car is (theoretically):

(a) 12 times   (b) 18 times

(c) Infinite times   (d) Cannot be determined

44. A dog sees a cat. It estimates that the cat is 25 leaps away. The cat sees the dog and starts running with the dog in hot pursuit. If in every minute, the dog makes 5 leaps and the cat makes 6 leaps and one leap of the dog is equal to 2 leaps of the cat. Find the time in which the cat is caught by the dog (assume an open field with no trees)

(a) 12 minutes   (b) 15 minutes

(c) 12.5 minutes   (d) None of these

45. Two people A and B start from P and Q (distance = D) at the same time towards each other. They meet at a point R, which is at a distance $0.4D$ from P. They continue to move to and fro between the two points. Find the distance from point P at which the fourth meeting takes place.

(a) $0.8D$ (b) $0.6D$

(c) $0.3D$ (d) $0.4D$

46. A wall clock gains 2 minutes in 12 hours, while a table clock loses 2 minutes in 36 hours; both are set right at noon on Tuesday. The correct time when they both show the same time next would be

(a) 12:30 night   (b) 12 noon

(c) 1:30 night   (d) 12 night

47. Two points *A* and *B* are located 48 km apart on the riverfront. *A* motorboat must go from *A* to *B* and return to *A* as soon as possible. The river flows at 6 km/h. What must be the least speed of the motorboat in still water for the trip from *A* to *B* and back again to be completed in not more than six hours (assume that the motorboat does not stop at *B*)?

(a) 18 km/h   (b) 16 km/h

(c) 25 km/h   (d) 46 km/h

48. Two *ghats* are located on a riverbank and are 21 km apart. Leaving one of the ghats for the other, a motorboat returns to the first *ghat* in 270 minutes, spending 40 min of that time in taking the passengers at the second *ghat*. Find the speed of the boat in still water if the speed of the river flow is 2.5 km/h?

(a) 10.4 km/h   (b) 12.5 km/h

(c) 22.5 km/h   (d) 11.5 km/h

49. A train leaves Muzaffarpur for Hazipur at 2:15 p.m. and travels at the rate of 50 kmph. Another train leaves Hazipur for Muzaffarpur at 1:35 p.m. and travels at the rate of 60 kmph. If the distance between Hazipur and Muzaffarpur is 590 km at what distance from Muzaffarpur will the two trains meet?

(a) 200 km   (b) 300 km

(c) 250 km   (d) 225 km

50. A dog after travelling 50 km meets a *swami* who counsels him to go slower. He then proceeds at 3/4 of his former speed and arrives at his destination 35 minutes late. Had the meeting occurred 24 km further the dog would have reached its destination 25 minutes late. The speed of the dog is

(a) 48 km/h   (b) 36 km/h

(c) 54 km/h   (d) 58 km/h

1. Two people started simultaneously towards each other from Siliguri and Darjeeling, which are 60 km apart. They met 5 hours later. After their meeting, the first person, who travelled from Siliguri to Darjeeling, decreased his speed by 1.5 km/h and the other person, who travelled from Darjeeling to Siliguri, increased his speed by 1.5 km/h. The first person is known to arrive at Darjeeling 2.5 hours earlier than the second person arrived at Siliguri. Find the initial speed of the first person.

   (a) 4.5 km/h   (b) 6 km/h

   (c) 7.5 km/h   (d) 9 km/h

2. Two friends Arun and Nishit, on their last day in college, decided to meet after 20 years on a river. Arun had to sail 42 km to the meeting place and Nishit had to sail $35\frac{5}{7}$ per cent less. To arrive at the meeting place at the same time as his friend Nishit, Arun started at the same time as Nishit and sailed with the speed exceeding by 5 km/h the speed of Nishit. Find the speed of Arun.

   (a) 10 kmph   (b) 14 km/h

   (c) 9 kmph   (d) Both b and c

3. Three cars leave Patna for Ranchi after equal time intervals. They reach Ranchi simultaneously and then leave for Vizag, which is 120 km from Ranchi. The first car arrives there an hour after the second car, and the third car, having reached Vizag, immediately reverses the direction and 40 km from Vizag meets the first car. Find the speed of the first car.

   (a) 30 km/h   (b) 19 km/h

   (c) 32 km/h   (d) 22 km/h

4. Two sea trawlers left a sea port simultaneously in two mutually perpendicular directions. Half an hour later, the shortest distance between them was 17 km, and another 15 min later, one sea trawler was 10.5 km farther from the origin than the other. Find the speed of each sea trawler.

   (a) 16 km/h, 30 km/h   (b) 18 km/h, 24 km/h

   (c) 20 km/h, 22 km/h   (d) 18 km/h, 36 km/h

5. Shaurya and Arjit take a straight route to the same terminal point and travel with constant speeds. At the initial moment, the positions of the two and the terminal point form an equilateral triangle. When Arjit covered a distance of 80 km, the triangle becomes right- angled. When Arjit was at a distance of 120 km from the terminal point, the Shaurya arrived at the point. Find the distance between them at the initial moment assuming that there are integral distances throughout the movements described.

   (a) 300 km   (b) 240 km

   (c) 200 km   (d) 225 km

6. Mrinalini and Neha travel to Connaught Place along two straight roads with constant speeds. At the initial moment, the positions of Mrinalini, Neha, and Connaught Place form a right triangle. After Mrinalini travelled 30 km, the triangle between the points became equilateral. Find the distance between Mrinalini and Neha at the initial moment if at the time Mrinalini arrived at

Connaught Place, Neha had to cover 6.66 km to reach Connaught Place.

(a) $10\sqrt{3}$ km

(b) $12\sqrt{3}$ km

(c) $30\sqrt{5}$ km

(d) None of these

7. Three cars started simultaneously from Ajmer to Benaras along the same highway. The second car travelled with a speed that was 10 km/h higher than the first car's speed and arrived at Benaras 1 hour earlier than the first car. The third car arrived at Benaras 33.33 minutes earlier than the first car, travelling half the time at the speed of the first car and the other half at the speed of the second car. Find the total distance covered by these three cars during their journey between Ajmer and Benaras.

(a) 360 km

(b) 600 km

(c) 540 km

(d) 840 km

8. Three sprinters A, B, and C had to sprint from points P to Q and back again (starting in that order). The time interval between the starting times of the three sprinters A, B and C was 5 seconds each. Thus C started 10 seconds after A, while B started 5 seconds after A. The three sprinters passed a certain point R, which is somewhere between P and Q, simultaneously (none of them having reached point Q yet). Having reached Q and reversed the direction, the third sprinter met the second one 9 m short of Q and met the first sprinter 15 m short of Q. Find the speed of the first sprinter if the distance between PQ is equal to 55 m.

(a) 4 m/s

(b) 3 m/s

(c) 2 m/s

(d) 1 m/s

9. Two trains start from the same point simultaneously and in the same direction. The first train travels at 40 km/h, and the speed of the second train is 25 per cent more than the speed of the first train. Thirty minutes later, a third train starts from the same point and in the same direction. It overtakes the second train 90 minutes later than it overtook the first train. What is the speed of the third train?

(a) 20 km/h

(b) 40 km/h

(c) 60 km/h

(d) 80 km/h

10. A passenger train left town Alpha for town Beta. At the same time, a goods train left Beta for Alpha. The speed of each train is constant throughout the whole trip. Two hours after the trains met, they were 450 km apart. The passenger train arrived at the place of destination 16 hours after their meeting and the goods train, 25 hours after the meeting. How long did it take the passenger train to make the whole trip?

(a) 21 hours

(b) 28 hours

(c) 14 hours

(d) None of these

11. Two ducks move along the circumference of a circular pond in the same direction and come alongside each other every 54 minutes. If they moved with the same speeds in the opposite directions, they would meet every 9 minutes. It is known that when the ducks moved along the cicumference in opposite directions, the distance between them decreased from 54 to 14 feet every 48 seconds. What is the speed of the slower duck?

(a) 20 feet/min
(b) 15 feet/min

(c) 30 feet/min
(d) 20.83 feet/min

12. Dev and Nishit started simultaneously from opposite points X and Y on a straight road, at constant speeds. When Dev had covered 40% of the distance from X to Y, Nishit was 4 km away from Dev after having crossed Dev. When Nishit had covered half the way, Dev was 10 km short of the mid point. Find a possible of the time it took Dev to cover the distance from X to Y to the time it took Nishit to cover the same distance.

(a) $\left[\dfrac{1+\sqrt{3}}{2}\right]$
(b) $\dfrac{3\sqrt{2}+4}{2\sqrt{2}+1}$

(c) Either a or b
(d) None of these

13. For Question 12 which of these is a possible value of the distance between the points X and Y:

(a) $20(2 + \sqrt{3})$
(b) $20(1 + \sqrt{2})$

(c) 60 km
(d) Both (a) and (b)

14. Two ships sail in a fog towards each other with the same speed. When they are 4 km apart, the captains decelerate the engines for 4 minutes with a deceleration rate of 0.1 m/s^2, and then the ships continue sailing with the speeds attained. For what range of values of the initial speed V_0 will the ships avoid collision?

(a) $0 < V_0 < 10$ m/s
(b) $0 < V_0 < 20$ m/s

(c) $0 < V_0 < 30$ m/s
(d) None of these

15. Three points A, B and C are located at the vertices of an equilateral triangle with sides equal to 168 metres. A donkey called Dinky starts from A to B at 60 metres/hour and at the same time a cow called Moo starts from B to C at 30 metres/hour. In what time after their departure will the distance between the donkey and the cow be the least?

(a) 2 h
(b) 3 h

(c) 0.5 h
(d) 8 h

16. A train has to travel the distance between Aurangabad and Daulatabad, equal to 20 km, at a constant speed. It travelled half the way with the specified speed and stopped for three minutes, to arrive at Daulatabad on time, it had to increase its speed by 10 km/h for the rest of the way. Next time the train stopped half-way for five minutes. By what speed must it increase its speed for the remaining half of the distance to arrive at Daulatabad as per the schedule?

(a) 10 kmph
(b) 20 kmph

(c) 15 kmph
(d) 16 kmph

17. Nishit travels from Patna to Kolkata, a distance of 200 km at the speed of 40 km/h. At the same time, Ravi starts from Kolkata at a speed of 20 kmph along a road, which is perpendicular to the road on which Nishit is travelling. When will Nishit and Ravi be closest to each other?

(a) In 1.5 hours
(b) In 4 hours

(c) In 3.33 hours
(d) In 5 hours

18. Two towns are at a distance of 240 km from each other. A motorist takes 8 hours to cover the distance if he travels at a speed of V_0 km/h from town A to an intermediate town C, and then continues on his way with an acceleration of x km/hr². He needs the same time to cover the whole distance if he travels from A to C at V_0 km/h and from C to B at V_1 km/h or from A to C at V_1 km/h and from C to B at V_0 km/h. Find V_0 if the acceleration 'x' is double V_0 in magnitude and $V_0 \pi V_1$.

(a) 15 km/h   (b) 10 km/h

(c) 20 km/h   (d) 8 km/h

19. Jaideep travels from Alaska, which is on a highway, to Burgen, which is 16 km from the highway. The distance between Alaska and Burgen along a straight line is 34 km. At what point should Jaideep turn from the highway to reach Burgen in the shortest possible time, if his speed along the highway is 10 km/h and 6 km/h otherwise.

(a) 30 km away from A

(b) 20 km away from A

(c) 18 km away from A

(d) 15 km away from A

20. An object begins moving at time moment $t = 0$ and 4 s after the beginning of the motion, attains the acceleration of 3 m/s². Find the speed of the object 6 s after the beginning of motion if it is known that the speed of the body varies accordingly to the law $v(t) = (t^2 + 2b.t + 4)$ m/s and the object moves along a straight line.

(a) 22 m/s   (b) 10 m/s

(c) 30 m/s   (d) 15 m/s

21. For problem 20, find the distance covered by the object in the first 7 seconds if we assume that the speed of the object in a particular second is the speed it attains at the start of the second.

(a) 15 metres   (b) 14 metres

(c) 10 metres   (d) 5 metres

22. Three *ghats X, Y* and *Z* on the Yamuna in Delhi are located on the river bank. The speed of the river flow is 8 km/h in the direction of its flow, *Ghat Y* being located midway between *X* and *Z*. A raft and a launch leave *Y* at the same time, the raft travelling down the river to *Z* and the launch travelling to *X*. The speed of the launch in still water is 5 km/h. Having reached *X*, the launch reverses its direction and starts to *Z*. Find the range of values of *V* for which the launch arrives at *Z* later than the raft.

(a) $8 < V < 24$ km/h   (b) $8 < V < 16$ km/h

(c) $8 < V < 20$ km/h   (d) $12 < V < 24$ km/h

23. A pedestrian left point A for a walk, going with the speed of 5 km/h. When the pedestrian was at a distance of 6 km from A, a cyclist followed him, starting from A and cycling at a speed 9 km/h higher than that of the pedestrian. When the cyclist overtook the pedestrian, they turned back and returned to A together, at the speed of 4 km/h. At what v will the time spent by the pedestrian on his total journey from A to A be the least?

(a) 5 km/h

(b) 6 km/h

(c) 6.1 kmph

(d) 5.5 km/h

24. A cyclist left point A for point B and travelled at the constant speed of 25 km/h. When he covered the distance of 8.33 km, he was overtaken by a car that left point A twelve minutes after the cyclist and travelled at a constant speed too. When the cyclist travelled another 30 km, he encountered the car returning from B. Assume that the car did not stop at point B. Find the distance between A and B.

(a) 39.5833 km

(b) 41.0833 km

(c) 60.833 km

(d) 43.33 km

25. A robot began moving from point A in a straight line at 6 p.m. with an initial speed of 3 m/s. One second later, the speed of the robot became equal o 4 m/s. Find the acceleration of the robot at the end of the 2nd second if its speed changes by the law $s(t) = (at^2 + 2t + (b))$

(a) 1 m/s^2

(b) –2 m/s^2

(c) 0 m/s^2

(d) 2 m/s^2

26. For Question 25, the distance of the robot from point A after 6 seconds will be (assuming that for every second the robot travels at a constant speed equal to its starting speed for that second and any acceleration occurs at the start of the next second)

(a) 45 m

(b) 36 m

(c) 10 m

(d) 17 m

27. Two friends Amit and Akshay began moving simultaneously from point A along a straight line in the same direction: Amit started moving at the speed of 5 m/s and moved with an uniform acceleration of 4 m/s^2, while his friend Akshay moved at a uniform speed. The limits for Akshay's speed (S) so that he should first leave Amit behind and then get overtaken by Amit at a distance of 18 m from A are

(a) $5 < S < 9$

(b) $3 < S < 5$

(c) $4 < S < 8$

(d) None of these

28. On the banks of the river Ganges there are two bathing points in Varanasi and Patna. A *diya* left in the river at Varanasi reaches Patna in 24 hours. However, a motorboat covers the whole way to and fro in exactly 10 hours. If the speed of the motorboat in still water is increased by 40%, then it takes the motorboat 7 hours to cover the same way (from Varanasi to Patna and back again). Find the time necessary for the motorboat to sail from Varanasi to Patna when its speed in still water is not increased.

(a) 3 hours

(b) 4 hours

(c) 4.8 hours

(d) None of these

29. Two friends started walking simultaneously from points A and B towards each other. 144 minutes later the distance between them was 20% of the original distance. How many hours does it take the faster walker to cover the distance AB if he needs eight hours less to travel the distance than his friend (assume all times to be in whole numbers and in hours)?

(a) 3 hours   (b) 6 hours

(c) 12 hours   (d) 4 hours

30. Two cars left points *A* and *B* simultaneously, travelling towards each other. 9 hours after their meeting, the car travelling from *A* arrived at *B*, and 16 hours after their meeting, the car travelling from *B* arrived at *A*. How many hours did it take the slower car to cover the whole distance?

(a) 36 hours   (b) 21 hours

(c) 25 hours   (d) 28 hours

31. A pedestrian and a cyclist left Nagpur for Buti Bori at the same time. Having reached Buti Bori, the cyclist turned back and met the pedestrian an hour after the start. After their meeting, the pedestrian continued his trip to Buti Bori and the cyclist turned back and also headed for Buti Bori. Having reached Buti Bori, the cyclist turned back again and met the pedestrian 30 mins after their first meeting. Determine what time it takes the pedestrian to cover the distance between Nagpur and Buti Bori.

(a) 1 hour   (b) 2 hours

(c) 2.5 hours   (d) 3 hours

32. Points *A*, *B* and *C* are at the distances of 120, 104.66 and 112 km from point *M* respectively. Three people left these points for point *M* simultaneously: the first person started from point *A*, the second from *B* and the third from *C*. The first person covered the whole way at a constant speed and arrived at *M* an hour before the second and the third persons (who arrived simultaneously). The third person covered the whole way at a constant speed. The second person, having travelled 72 km at the same speed as the first, stopped for 2 hours. The rest of the way he travelled at a speed that is less than the speed of the third person by the same amount as the speed of the third is less than that of the first. Determine the speed of the first person.

(a) 6 kmph   (b) 5 kmph

(c) 4 kmph   (d) 3 kmph

33. Two people started simultaneously from points *A* and *B* towards each other. At the moment the person who started from *A* had covered two-thirds of the way, the other person had covered 2 km less than half the total distance. If it is known that when the person who started from *B* had covered 1/4 of the way, the other person was 3 km short of the mid point. Find the distance between *A* and *B*. The speeds of the two people were constant.

(a) $(15 - 3\sqrt{17})$ km   (b) $(15 + 3\sqrt{17})$ km

(c) Both a and b   (d) $3\sqrt{17} - 5$ km

34. Sohan and Lallan left their house simultaneously. Thirty six minutes later, Sohan met his uncle travelling to their house, while Lallan met the uncle twelve minutes after Sohan. Twenty four minutes after his meeting with Lallan, the uncle rang the door bell at Sohan and Lallan's house. Assume each person travels at a constant speed. Find the ratio of the speeds of Sohan to Lallan to the uncle.

(a) 1 : 2 : 2   (b) 1 : 3 : 2

(c) 3 : 1 : 3   (d) 2 : 1 : 2

35. The distance between two towns—Aurangabad and Jalna is 80 km. A bus left Aurangabad and travelled at a constant speed towards Jalna. Thirty minutes later, Deepak Jhunjhunwala left Aurangabad in his car towards Jalna. He overtook the bus in thirty minutes and continued on his way to Jalna. Without stopping at Jalna, he turned back and again encountered the bus 80 minutes after he had left Aurangabad. Determine the speed of the bus.

    (a) 40 kmph

    (b) 45 kmph

    (c) 50 kmph

    (d) None of these

36. Rohit left Mahabaleshwar for Nashik at 6 a.m. An hour and a half later Vimal, whose speed was 5 km/h higher than that of Rohit left Mahabaleshwar. At 10 : 30 p.m. of the same day the distance between the two friends was 21 km. Find the speed of Vimal.

    (a) 40 kmph

    (b) 41 kmph

    (c) 69 kmph

    (d) Either b or c

37. Aurangzeb and Babar with their troops left from Delhi and Daulatabad towards each other simultaneously. Each of them marched at a constant speed and, having arrived at their respective points of destination, went back at once. Their first meeting was 14 km from Daulatabad, and the second meeting, eight hours after the first meeting was at a distance of 2 km from Delhi. Find the distance between the Delhi and Daulatabad.

    (a) 30 km

    (b) 25 km

    (c) 35 km

    (d) None of these

38. Two tourists left simultaneously point A for point B, the first tourist covers each kilometre 2 minutes faster than the second. After travelling 30 per cent of the way, the first tourist returned to A, stopped there for 102 minutes and again started for B. The two tourists arrived at B simultaneously. What is the distance between A and B if the second tourist covered it in 2.5 hours?

    (a) 60 km

    (b) 70 km

    (c) 45 km

    (d) None of these

39. Amar and Akbar left Bhubaneshwar simultaneously and travelled towards Cuttack. Amar's speed was 15 km/h and that of Akbar was 12 km/h. Half an hour later, Anthony left Bhubaneshwar and travelled in the same direction. Some time later, he overtook Akbar and 90 minutes further on he overtook Amar. Find Anthony's speed.

    (a) 18 kmph

    (b) 24 kmph

    (c) 20 kmph

    (d) 16 kmph

40. Two bodies, moving along a circle in the same direction, meet every 49 minutes. Had they moved at the same speeds in the opposite directions, they would meet every 7 minutes. If, moving in the opposite directions, the bodies are at the distance of 40 m from each other along the arc at time $t = 0$, then at $t = 24$ seconds, their distance will be 26 metres (the bodies do not meet during those 24 seconds). Find the speed of the faster body in metres per minute.

    (a) 15

    (b) 20

    (c) 25

    (d) None of these

41. The distance between Varanasi and Lucknow is 220 km. Two buses start from these towns towards each other. They can meet halfway if the first bus leaves 2 hours earlier than the second. If they start simultaneously, they will meet in 4 hours. Find the speeds of the buses.

(a) $17.5(3 + \sqrt{5})$ km/h, $17.5(1 + \sqrt{5})$ km/h

(b) $27.5(3 + \sqrt{5})$ km/h, $27.5(1 + \sqrt{5})$ km/h

(c) $27.5(3 - \sqrt{5})$ km/h, $27.5(\sqrt{5} - 1)$ km/h

(d) None of these

42. A road passes through the towns Sangamner and Yeotmal. A cyclist started from Sangamner in the direction of Yeotmal. At the same time, two pedestrians started from Yeotmal travelling at the same speed, the first of them towards Sangamner and the other in the opposite direction. The cyclist covered the distance between the towns in half an hour and, continued ahead in the same direction. He overtook the second pedestrian, 1.2 hours after he met the first pedestrian. Determine the time the cyclist spent travelling from Sangamner to the point of the meeting with the first pedestrian (assuming the speeds of the cyclist and the pedestrians to be constant).

(a) 24 min   (b) 18 min

(c) 30 min   (d) Cannot be determined

43. Two people A and B start moving from P and Q that are 200 km apart, towards each other A is on a moped and B on foot. They meet at a point R when A gives B a lift to P and returns to his original path to reach Q. On reaching Q he finds that he has taken 2.6 times his normal time. B on the other hand realises that he has saved 40 minutes over his normal travel time. Find the ratio of their speeds.

(a) 3 : 2   (b) 4 : 3

(c) 3 : 1   (d) None of these

44. For Question 43, find the speed of the moped.

(a) 160 kmph   (b) 180 kmph

(c) 200 kmph   (d) None of these

45. Three friends A, B and C start from P to Q that are 100 km apart. A is on a moped while B is riding pillion and C walks on. A takes B to a point R and returns to pick up C on the way and takes him to point Q. B, on the other hand, walks to Q from point R (R is the mid-point between P and Q).

If the ratio of speeds of the three people is 5 : 2 : 2, find where will the last person be when the first person reaches Q.

(a) 12.85 km from Q   (b) 12.75 km from Q

(c) 16.66 km from Q   (d) 83.33 km from P

46. A motorboat moves from point A to point B and back again, both points being located on the river-bank. If the speed of the boat in still water is doubled, then the trip from A to B and back again would take 20% of the time that the motorboat usually spends in the journey. How many times is

the actual speed of the launch higher than the speed of the river flow?

(a) $\sqrt{\dfrac{3}{2}}$

(b) $\dfrac{\sqrt{3}}{3}$

(c) $\dfrac{2}{3}$

(d) $\dfrac{3}{2}$

47. A watch loses 2/3% time during the 1st week and gains 1/3% time during the next week. If on a Sunday noon, it showed the right time, what time will it show at noon on the Sunday after the next.

(a) 11 : 26 : 24 a.m.

(b) 10 : 52 : 18 a.m.

(c) 10 : 52 : 48 a.m.

(d) 11 : 36 : 24 a.m.

48. Clocks *A*, *B* and *C* strikes every hour. *B* slows down and takes 2 min longer than *A* per hour while *C* become faster and takes 2 min less than *A* per hour. If they strike together at 12 midnight, when will they strike together again

(a) 10 a.m.

(b) 11 a.m.

(c) 9 p.m.

(d) 8 p.m.

49. A boat went down the river for a distance of 20 km. It then turned back and returned to its starting point, having travelled a total of 7 hours. On its return trip, at a distance of 12 km from the starting point, it encountered a log, which had passed the starting point at the moment at which the boat had started downstream. The downstream speed of the boat is

(a) 7 kmph

(b) 13 kmph

(c) 16 kmph

(d) 10 kmph

50. Two boats go downstream from point *X* to point *Y*. The faster boat covers the distance from *X* to *Y* 1.5 times as fast as the slower boat. It is known that for every hour the slower boat lags behind the faster boat by 8 km. However, if they go upstream, then the faster boat covers the distance from *Y* to *X* in half the time as the slower boat. Find the speed of the faster boat in still water.

(a) 12 kmph

(b) 20 kmph

(c) 24 kmph

(d) 25 kmph

ANSWER KEY

Level of Difficulty (I)

1. (a)	2. (a)	3. (c)	4. (c)
5. (d)	6. (d)	7. (c)	8. (a)
9. (a)	10. (a)	11. (a)	12. (a)
13. (c)	14. (a)	15. (c)	16. (d)
17. (a)	18. (b)	19. (d)	20. (a)
21. (c)	22. (c)	23. (c)	24. (d)
25. (b)	26. (d)	27. (d)	28. (c)
29. (d)	30. (d)	31. (a)	32. (b)

33. (a)	34. (a)	35. (a)	36. (d)
37. (d)	38. (b)	39. (a)	40. (a)
41. (b)	42. (a)	43. (a)	44. (d)
45. (c)	46. (c)	47. (c)	48. (a)
49. (d)	50. (a)	51. (b)	52. (a)
53. (b)	54. (c)	55. (c)	56. (b)
57. (b)	58. (a)	59. (a)	60. (b)
61. (c)	62. (d)	63. (a)	64. (b)
65. (a)	66. (c)	67. (b)	68. (a)
69. (a)	70. (a)	71. (a)	72. (c)
73. (a)	74. (d)	75. (d)	

Level of Difficulty (II)

1. (c)	2. (a)	3. (a)	4. (c)
5. (a)	6. (b)	7. (b)	8. (d)
9. (b)	10. (a)	11. (b)	12. (c)
13. (c)	14. (b)	15. (b)	16. (a)
17. (c)	18. (d)	19. (b)	20. (b)
21. (b)	22. (c)	23. (a)	24. (c)
25. (d)	26. (b)	27. (c)	28. (c)
29. (d)	30. (d)	31. (c)	32. (b)
33. (d)	34. (b)	35. (c)	36. (c)
37. (a)	38. (c)	39. (b)	40. (d)
41. (b)	42. (b)	43. (c)	44. (c)
45. (a)	46. (b)	47. (a)	48. (b)
49. (c)	50. (a)		

Level of Difficulty (III)

1. (c)	2. (b)	3. (a)	4. (a)
5. (b)	6. (d)	7. (b)	8. (d)
9. (c)	10. (d)	11. (d)	12. (b)
13. (b)	14. (b)	15. (a)	16. (d)
17. (b)	18. (c)	19. (c)	20. (b)
21. (b)	22. (a)	23. (b)	24. (c)
25. (b)	26. (d)	27. (a)	28. (b)
29. (d)	30. (d)	31. (b)	32. (a)
33. (c)	34. (d)	35. (a)	36. (d)
37. (d)	38. (a)	39. (a)	40. (b)
41. (d)	42. (b)	43. (d)	44. (d)
45. (a)	46. (a)	47. (c)	48. (b)
49. (d)	50. (b)		

Hints

Level of Difficulty (II)

1. The train saves 16 minutes by travelling faster over a section of 80 km.

    Thus, $\dfrac{80}{S} - \dfrac{80}{S+10} = \dfrac{16}{60} = 0.2666$

    Check the options.

2. $\dfrac{60}{S} - \dfrac{60}{S+1} = \dfrac{6}{60}$. Check the options to solve.

3. Solve through options.

4. Solve through options.

5. Relative speed (in opposite direction) = 20 km/hr.

    Use the options after this.

6. The question is based on Pythagoras' triplets.

8. Assume the distance between the two ant holes is 600 feet. Then, the first ant's speed is 16 feet/hr while the second ant's speed is 14 feet/hr.

    If the first ant covers 800 feet, the second will cover 700 feet (since, distance is proportional to speed). Hence total distance is 1500 feet and required speed is 14 × 2.5 = 35 feet/hr.

9. Solve through options.

13. Solve using options as follows.

    Check for option (a). (He rode for 6 hours)

    Then, walking time = 10 hrs

    Thus, speed of the tonga = 1.66 km/hr

    And speed of walking = 9 km/hr.

    As per the question, if the times are reversed, the distances travelled by each mode will be equal.

    Thus, 10 × 1.66 should be equal to 6 × 9.

    But, this is not so. Hence, move to the next option.

14. Solve using options.

15. Solve using options, the following equations.

    Speed of first = $\left(\dfrac{x-1}{42} \times 60 \right)$ km/hr = S_A

    Speed of second = $\dfrac{x-2}{52} \times 60$ km/hr = S_B.

    Then, $\dfrac{x-2}{S_B} - \dfrac{x-1}{S_A} = \dfrac{17}{60}$

19. The first pattern of movement is

    3 + 7 + 11 + 15 + 19 + 23

    The second pattern of movement is

    1 + 9 + 17 + 25 + 33 + 41

    It is evident that the difference in the net movements between the second pattern and the first

pattern is more than 6 mm and less than 30 mm for a movement of 4 seconds.

20. By increasing speed by 15 kmph, the time reduces by 30 minutes.

22. Given that they meet in 80 minutes, when moving towards each other, the sum of their speeds should be such that they cover 1.25% of the distance per minute (i.e. 75% of the distance per hour).

25. Ratio of time taken in going and coming back is 7 : 18.

    Also, total time of travel is 325 minutes.

26-30. Chart out the distances covered by the three of them in each leg of their journeys.

32. The answer would have been 13, if the question had stated the initial directions of their walking. Hence, we cannot determine the answer.

33. Solve on the basis of the would be wife's movement.

36. The train will meet all trains that start from Pune between 8 a.m. and 4 p.m.

38. Assume speed of sound = 330 m/s.

    Then, distance covered by sound in 45 seconds = distance covered by the trains in 11 minutes.

39-40. Use the concept of relative speed to solve.

41. The bird will fly for the time which the two cars take in approaching one another.

42. Chart the relative movements of the two cars and the bird.

46. The wall clock gains 6 minutes in 36 hours, while the table clock loses 2 minutes in 36 hours. Hence, time differential in 36 hours = 8 minutes. For them to show the same time again, we need a total time differential of 12 hours.

48. Solve through options.

Level of Difficulty (III)

1. The first person who travels from Siliguri to Darjeeling is obviously faster than the second. Hence, reject Options (a) and (b). Then, check all the conditions with Options (c) and (d) and select the one which satisfies the conditions.

2. Since distance to be travelled by Nishit is $35\frac{5}{7}$% less, his speed will also be $35\frac{5}{7}$% less than Arun's speed. Check the options with the conditions that Arun's speed is 5 kmph higher than that of Nishit.

3. Let S_1, S_2 and S_3 be the speeds of the three cars.

   Then: $\dfrac{120}{S_1} - \dfrac{120}{S_2} = 1$ hour   (1)

   It is also known that the speed of the third car is double the speed of the first car.

   With these realisations, check for factors of 120 which can satisfy the equation above.

   [Note that in equations like (1) above, normally the respective values of S_1 and S_2 will be factors of 120.]

5. If the side of the initial equilateral triangle is S, then when Arjit covers $(S - 120)$ kms, Shaurya covers S kilometres. Also, when Arjit covers a distance of 80 kilometres, Shaurya covers a distance such that the resultant triangle is right angled.

Check these conditions through options.

6. Solve through a process similar to the previous question.

7. If S_1 is the speed of the first car, then $(S_1 + 10)$ will be the second car's speed. If t_1 hours is the time required for the first car, then $(t_1 - 1)$ hours is the time required for the second car in covering the same distance, while that of the third car is $\left(t_1 - \dfrac{33.33}{60}\right)$ hours.

   Check these conditions through options.

10. The relative speed is 225 km/hr.

11. The sum of the speeds of the ducks is 50 feet/min

   Hence, circumference $= 9 \times 50 = 450$ feet and difference of speeds $= \dfrac{450}{54} = 8.33$.

15. Use options to solve.

16. Through trial and error try to find the initial speed of the train, so that the first condition is met.

17. Use options to solve.

18. Let the distance $AC = d$

   Then, $\dfrac{d}{V_0} + \dfrac{240 - d}{V_1} = \dfrac{d}{V_1} + \dfrac{240 - d}{V_0}$

   If $V_0 \, \pi \, V_1$, then the above condition will be satisfied only if $d = 120$ km.

19. The time required will be represented by

   $$\dfrac{\text{Distance travelled on highway}}{10}$$
   $$+ \dfrac{\text{Distance travelled on side roads}}{10}$$

   This has to be minimised, check the options.

20-21. Acceleration is $\dfrac{dv}{dt} = 2t + 2b$

   At $t = 4$, the acceleration is given to be 3.

   Hence, $b = \dfrac{-5}{2}$

   Hence, the velocity equation becomes
   $V_{(t)} = t_2 - 5t + 4$

29. Total time taken to cover the entire distance together $= 144 \times \dfrac{5}{4} = 180$ minutes $= 3$ hours.

   Hence, distance covered per hour $= 33.33\%$ of the total by both of them combined.
   Check this condition for all the options.

31. Suppose A and B are the points where the first and the second meetings took place.
   The total distance covered by the pedestrian and the cyclist before the first meeting = Twice the

distance between Nagpur and Buti Bori.

Total time taken is 1 hour.

Total distance covered by the pedestrian and the cyclist between the two meetings = Twice the distance between A and Buti Bori.

and time taken is half an hour.

Hence, A is the mid-point. This will result in a GP.

32. Solve through options by checking all the conditions given in the question.

33. If $2d$ is the distance between A and B, then

$$\frac{\frac{2}{3} \times 2d}{d-2} = \frac{d-3}{2d \times \frac{1}{4}}$$

34. In 24 minutes, the uncle covers the distance for which Lallan requires 48 minutes.

35. Check the options for all the conditions.

36. Vimal could either be 21 km behind Rohit or 21 km ahead of Rohit.

37. If d is the distance between Delhi and Daulatabad, then you will get the following equation.

$$\frac{d-14}{14} = \frac{28+(d-16)}{(d-14)+2}$$

38. Check the conditions through the options.

47. The net time loss is 1/3% of 168 hours.

49. In the time taken by the boat in traveling $d + (d - 12)$ kms, the log travels 12 km. Let, S_B be the speed of the boat is still water and, S_S be the speed of the stream.

Then

$$\frac{12}{S_S} = \frac{20}{(S_S + S_B)} + \frac{8}{(S_B - S_S)} \tag{1}$$

It is also known that,

$$\frac{20}{(S_S + S_B)} + \frac{20}{(S_B - S_S)} = 7 \text{ hours} \tag{2}$$

Solve through options.

## Solutions and Shortcuts

Level of Difficulty (I)

1. The ratio of time for the travel is 4:3 (Sinhagad to Deccan Queen). Hence, the ratio of speeds would be 3:4. Since, the sum of their average speeds is 70 kmph, their respective speeds would be 30 and 40 kmph respectively. Use alligation to get the answer as 34.28 kmph.

2. When speed goes down to three fourth (i.e. 75%) ime will go up to 4/3rd (or 133.33%) of the original time. Since, the extra time required is 16 minutes, it should be equated to 1/3rd of the normal time. Hence, the usual time required will be 48 minutes.

3. Since, the ratio of speeds is 3:5, the ratio of times would be 5:3. The difference in the times

would be 2 (if looked at in the 5:3 ratio context.) Further, since Ram takes 30 minutes longer, 2 corresponds to 30. Hence, using unitary method, 5 will correspond to 75 and 3 will correspond to 45 minutes. Hence at 10 kmph, Bharat would travel 7.5 km.

4. The train that leaves at 6 am would be 75 km ahead of the other train when it starts. Also, the relative speed being 36 kmph, the distance from Mumbai would be:

$(75/36) \times 136 = 283.33$ km

5. If you assume that the initial stretch of track is covered by the two trains in time t each, the following figure will give you a clearer picture.

Calcutta Mail t 12

       3   t Bombay Mail

Kolkata   Meeting Point   Mumbai
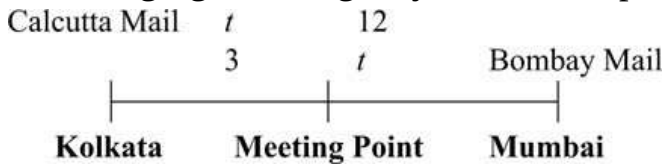
From the above figure, we can deduce that,

$t/3 = 12/t$.

Hence, $t^2 = 36$, gives us $t = 6$.

Hence, the distance between Kolkata to the starting point is covered by the Calcutta Mail in 6 hours, while the same distance is covered by the Bombay Mail in 3 hours.

Hence, the ratio of their speeds would be 1:2. Hence, the Bombay Mail would travel at 96 kmph.

6.
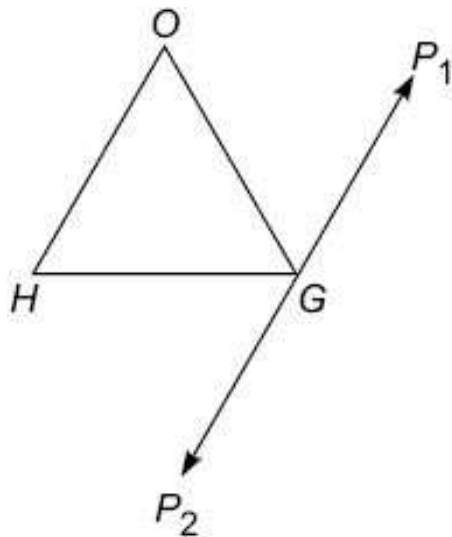
From the figure above we see that Shyam would have walked a distance of $4 + 4 + 4 = 12$ km. (G to P_1, P_1 to G and G to P_2).

7. When the train from Khandala starts off, the train from Lonavala will already have covered 50 kms. Hence, 550 km at a relative speed of 60 kmph will take 550/60 hrs. From this, you can get the answer as:

$50 + (550/60) * 25 = 279.166$ km.

8. When his speed becomes $3/4^{th}$, his time would increase by $1/3^{rd}$. Thus, the normal time = 7.5 hrs. (since increased time = 2.5 hrs).

9. Since he gains 2 hours by driving both ways (instead of walking one way) the time taken for driving would be 2 hours less than the time taken for walking. Hence, he stands to lose another two hours by walking both ways. Hence his total time should be 8 hrs 45 minutes.

10. Kalu's speed = 3 m/s.

For 1200 m, Kalu would take 400 seconds and Sambhu would take 10 seconds less. Hence, 390 seconds.

11. Since Chandu is moving at a speed of 10 m/s and he has to cover 360 km or 360000 meters, the time taken would be given by 360000/10 seconds = 36000 seconds = 36000/60 minutes = 600 minutes = 10 hours.

12. Since the train travels at 60 kmph, it's speed per minute is 1 km per minute. Hence, if it's speed with stoppages is 40 kmph, it will travel 40 minutes per hour.

13. Total distance/Total time = 1590/15 = 106 kmph.

14. The distance covered in the various phases of his travel would be:

10 km + 25 km + 50 km + 60 km. Thus the total distance covered = 145 km in 2 hours 50 minutes Æ

145 km in 2.8333 hours Æ 51.18 kmph

15. The average speed would be given by:

$$\frac{3d}{\frac{d}{v_1} + \frac{d}{v_2} + \frac{d}{v_2}} = \frac{3v_1v_2}{2v_1 + v_2}$$

16. By increasing his speed by 25%, he will reduce his time by 20%. (This corresponds to a 6 minute drop in his time for travel—since he goes from being 10 minutes late to only 4 minutes late.) Hence, his time originally must have been 30 minutes. Hence, the required distance is 20 kmph × 0.5 hours = 10 km.

17. $d/6 + d/4 = 10$ Æ $d = 24$ km.

18. If the car does half the journey @ 30 kmph and the other half at 40 kmph it's average speed can be estimated using weighted averages.

Since, the distance traveled in each part of the journey is equal, the ratio of time for which the car would travel would be inverse to the ratio of speeds. Since, the speed ratio is 3:4, the time ratio for the two halves of the journey would be 4:3. The average speed of the car would be:

(30 × 4 + 40 × 3)/7 = 240/7 kmph.

It is further known that the car traveled for 17.5 hours (which is also equal to 35/2 hours).

Thus, total distance = average speed × total time = (240 × 35)/(2 × 7) = 120 × 5 = 600 km

19. To reduce the time of the journey by 25%, he should increase his speed by 33.33% or 1/3rd. Thus, required speed = 80 kmph.

20. You can solve this question using the options. Option (a) fits the given situation best as if we take the distance as 12 km he would have taken 1 hour to go by car and 4 hours to come back walking —a total of 5 hours as given in the problem.

21. In four hours, the train will travel 180 km (180,000 metres). The number of poles would be 180,000/50 = 3600.

22. Is the same question as Question No. 5.

23.
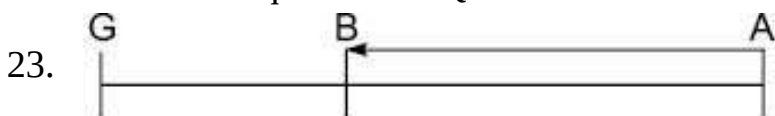
In the above figure, the train travels from A to B in 11:30 minutes.

Suppose, you denote the time at which the first gunshot is heard as $t = 0$. Also, if you consider the travel of the sound of the second the gunshot is heard at point B at $t = 11:30$ minutes. Also, the second gunshot should reach point B at $t = 12$ minutes. Hence, the sound of the 2nd gunshot would take 30 seconds to travel from B to A.

Thus, $\dfrac{S_{train}}{S_{sound}} = \dfrac{t_{sound}}{t_{train}}$

$S_{train} = 330 \times \dfrac{30}{690} = \dfrac{330}{23}$ m/s.

24. In 6 minutes, the car goes ahead by 0.6 km. Hence, the relative speed of the car with respect to the pedestrian is equal to 6 kmph, since, the pedestrian is walking at 2 kmph, hence, the net speed is 8 kmph.

25. At 40 kmph, Harsh would cover $(200/60) \times 40$ km.

= 400/3 km. = 133.33 km.

This represents the distance by which Vijay would be ahead of Harsh, when Vijay reaches the endpoint means in essence that Vijay must have travelled for 133.33/20 hours Æ 6.66 hours

Hence, the distance is $60 \times 6.66 = 400$ km.

26. Solve this question using the values given in the options. Option (d) can be seen to fit the situation given by the problem as it gives us the following chain of thought:

If the average speed of the faster train is 48 kmph, the average speed of the slower train would be 32 kmph. In this case, the time taken by the faster train (192/48 = 4 hours) is 2 hours lesser than the time taken by the slower train (192/32 = 6 hours). This satisfies the condition given in the problem and hence option (d) is correct.

27. The required speed s would be satisfying the equation:

$300/s - 300/(s + 2) = 5$

Solving for s from the options it is clear that $s = 25$.

28. Solve through options using trial and error. For usual speed 3 kmph we have:

Normal time Æ 2/3 hours = 40 minutes.

At 4 kmph the time would be 2/4 hrs, this gives us a distance of 10 minutes. Hence option (c) is correct.

29. By increasing the speed by 33.33%, it would be able to reduce the time taken for travel by 25%. But since this is just able to overcome a time delay of 30 minutes, 30 minutes must be equivalent to 25% of the time originally taken. Hence, the original time must have been 2 hours and the original speed would be 750 kmph. Hence, the new speed would be 1000 kmph.

30. The average speed would be given by:

$\dfrac{(120 \times 1 \times 40 \times 3)}{4} = 60$ kmph.

31. The length of the circular track would be equal to the circumference of the circle. In 2 minutes thus, the cyclist covers $3.14 \times 200 = 628$ meters (using the formula for the circumference of a circle).

Thus, the cyclist's speed would be 628/2 = 314 meters/minute.

32. The total time taken by the motorist would be $200/53.333 = 200 \times 3/160 = 3.75$ hours $= 3$ hours 45 minutes. In the first half of the journey the motorist covers $1/4^{th}$ the distance @ 40kmph. This means that he takes $50/40 = 1.25$ hours $= 1$ hour 15 minutes in covering the first 50 kms. This also means that he covers the remaining distance of 150 km in 2 hours 30 minutes Æ a speed of 60 kmph. Hence, option (b) is correct.

33. Assume a distance of 60 km in each stretch. Get the average speed by the formula. Total distance/ Total time $= 180/10 = 18$ kmph.

34. The speed of the first car would be 60 kmph while the speed of the second car would be 40 kmph. The relative speed of the two cars would be 100 kmph. To cover 480 km they would take $480/100 = 4.8$ hours Æ In 4.8 hours, the car traveling from A to B would have traveled $4.8 \times 60 = 288$ kms.

35. At $3/4^{th}$ speed, extra time $= 1/3^{rd}$ of time $= 16$ minutes.

    Normal time $= 48$ minutes.

36. Solve using options. The value in option (d) fits the situation as $20/8 - 20/10 = 2.5 - 2 = 0.5$ hours $= 30$ minutes.

37. $[73.5 \times 136]/38$. Same logic as for Question 4.

38. The time taken before their meeting would be given by $t^2 = 12 \times 3 = 36$ Æ $t = 6$ hours. This means that their ratio of speeds is 1:2. Since train A is traveling slower, the speed of train B would be double the speed of train A. Required answer $= 48 \times 2 = 96$. (Please take a look at the solution of question number 5).

39. The distance would get divided in the ratio of speeds (since time is constant). Thus, the distance ratio would be 5 : 7 and required distance $= 5/12 \times 600 = 250$ km.

40. The diameter of the circle would be given by the hypotenuse of the right triangle with legs 600 and 800 respectively. Hence, the required diameter $= 1000$ meters.

41. When Ram runs 2000 m, Shyam runs $(1800 - 30s)$

    When Ram runs 1000 m, Shyam runs $(2000 - 180s)$.

    Then:

    $$2000/1000 = \frac{1800 - 30s}{2000 - 180s}$$

    Solving, we get $s = 6.66$ m/s

    Thus, Shyam's speed $= 400$ m/minute and he would take 5 minutes to cover the distance. Option (b) fits.

42. From the situation described in the first condition itself we can see that the speed of coming back has to be double the speed of going downstream. Checking the options, only option (a) fits this condition i.e. Downstream speed $= 2 \times$ Upstream speed.

    Hence, option (a) is correct.

43. $7 \times S_t = L_t$ (1)

    $25 \times S_t = L_t + 378$ (2)

    Solving, $S_t = 21$ m/sec.

    $= 21 \times 18/5 = 75.6$ kmph.

44. In order to solve this, you first need to think of the speed of the river flow (if the speed of the boat

in still water is 3 kmph). If we take the speed of the river flow as s, we get downstream speed as $3 + s$ and upstream speed as $3 - s$.

$10/(3 - s) - 10/(3 + s) = 8$ hours Æ $s = 2$ kmph.

Note: It is obvious that since the difference between the downstream time and the upstream time is 8 hours, the upstream and downstream speeds would both be factors of 10. The only value of s such that both $3 + s$ and $3 - s$ are factors of 10 is $s = 2$.

If the boat needs to reach 10 km downstream in 100 minutes (1.66 hours) it means: $10/1.66 = 6$ kmph is the downstream speed.

Since, the speed of the stream is 2 kmph, the required speed of the boat = 4 kmph

45. Solve through options. For option (c) at 4 kmph, the boat would take exactly 4 hours to cover the distance.

46. $x/9 + x/3 = 3/4$ Æ $4x/9 = 3/4$ Æ $x = 27/16$ kms = 1.6875 kms.

47. Upstream speed = $40/8 = 5$ kmph.

Downstream speed = $49/7 = 7$ kmph.

Speed in still water = average of upstream and downstream speed = 6 kmph.

48. $(20 \times 5/18) \times 36 = L_t$ Æ $L_t = 200$ m.

49. $8/(12 - 2) = 8/10 = 0.8$ hours

50. 15 km upstream in 80 minutes Æ $15/1.33 = 11.25$ kmph. (upstream speed of the boat).

Thus, still water speed of the boat

$= 11.25 + 5 = 16.25$ kmph

51. Since A to C is double the distance of A to B, it is evident that the time taken for A to C and back would be double the time taken from A to B and back (i.e. double of 6.5 hours = 13 hours). Since going from A to C takes 9 hours, coming back from C to A would take 4 hours (Since $9 + 4 = 13$).

52. $(S_f - S_s) \times 60 = 200$

Where S_f and S_s are speeds of the faster and slower train respectively

Æ $S_f - S_s = 3.33$

Also, $(S_f + S_s) \times 10 = 200$.

Æ $S_f + S_s = 20$.

Solving we get $S_s = 8.33$ m/s

$= 8.33 \times 18/5 = 30$ kmph.

53. Speed of Vinay = 5 m/s, Speed of Ajay = 4m/s. In a hundred meter race, Vinay would take 20 seconds to complete and in this time Ajay would only cover 80 meters. Thus, Vinay beats Ajay by 20 meters in a hundred meter race.

54. Solve using options 1.33 m/s fits perfectly.

55. Solve using options 1.33 m/s fits perfectly. When A scores 60 points B scores 45, and C scores 40.

Thus, when B scores 90, C would score 80. So, B can give C 10 points in 90.

56. When Shyam does 500, Vinay does 375. Since Vinay has a start of 140 m, it means that Vinay only needs to cover 360 m to reach the destination.

When Vinay does 360, Shyam would cover 480 m and lose by 20 m. (Since the ratio of their speeds is 3 : 4)

57. Distance to be covered = 120 meters. Speed = 10m/s Æ Time required = 120/10 =12 seconds.

58. $20 \times (5/18) \times 18 = 100$ m = 0.1 km.

59. When the second train leaves Muzaffarpur, the first train would have already traveled 30 km. Now, after 9 AM, the relative speed of the two trains would be 10 kmph (i.e. the rate at which the faster train would catch the slower train).

    Since the faster train has to catch up a relative distance of 30 km in order for the trains to meet, it would take 30/10 = 3 hours to catch up.

    Distance from Muzaffarpur = $70 \times 3 = 210$ km

60. Speed of running of the train = 1.25 km/hr.

    With stoppage, an effective speed of 60 kmph means that the time of travel per hour would be 60/1.25 = 48 minutes.

    Thus, the train stops for 12 minutes per hour.

61. Upstream speed = 3.2 kmph

    Downstream speed = 6 kmph.

    Thus, speed of stream = 1.4 kmph.

62. Vijay takes 9 hours to return upstream after going for 6 hours downstream. Solve using options. Option (d) fits as we get Downstream speed = 18 kmph Æ distance = 18×6 =108 km

    Also, upstream speed = 12 kmph Æ distance = $12 \times 9 = 108$ km

63. Upstream speed = 4.8 kmph

    Downstream speed = 7.2 kmph.

    $d/4.8 + d/7.2 = 1$

    Solving we get $d = 2.88$ km.

64. The length of the train would be given by: $36 \times 5/18 \times 8 = 80$ meters.

65. Rate in still water = $(16 + 22)/2 = 19$ kmph

66. The given situations are satisfied with the speed of the boat as 8 kmph and the speed of the stream as 3 kmph. Option (c) is correct.

67. $10/(x - 2) + 10/(x + 2) = 55/60 = 11/12$ hours.

    $x = 22$ fits the expression.

68. The speed of the boat in still water is the average of the upstream and downstream speeds. $(x + y)/2$.

69. $(1/4) \times 2pr = 4p$ (Since $r = 8$ cm).

70. The hands would be together once in each hour. However, the 12 noon time would be counted in both 11 to 12 and 12 to 1. Hence, the no. of times = $12 - 1 = 11$.

71. If we consider the clock to be a circle with circumference 60 km, the speed of the Minute hand = 60 kmph, while the speed of the hour hand = 5 kmph. The relative speed = 55 kmph. At 2 PM, the distance between the two would be seen as 10 km. This would get covered in 10/55 = 2/11 hours. Option (a) is correct.

72. $14/(5 + x) + 9/(5 - x) = 5$

$x = 2$, fits this equation.

73. Look for the solution by thinking of the factors of 91. It can be seen that $91/13 + 91/7 = 7 + 13 = 20$ hours. This means that the speed of the boat in still water is 10 kmph and the speed of the water flow would be 3 kmph. Option (a) is correct.

74. When Ajay does 600 metres, Vijay does 540 m.

    When Vijay does 500 metres, Anjay does 475 m

    Thus, Ajay : Vijay : Anjay = 600 : 540 : 513.

    Thus, Ajay would beat Anjay by $(87 \times 2/3) = 58$ m in a 400 m race.

75. $30/(15 + x) + 30/(15 - x) = 4$ hrs 30 minutes.

    At $x = 5$, the equation is satisfied.

Level of Difficulty (II)

1. By travelling at 10 kmph higher than the original speed, the train is able to make up 16 minutes while traveling 80 km.

    This condition is only satisfied at an initial speed of 50 (and a new speed of 60 kmph).

2. Solve this question through options. For instance, if he traveled at 25 kmph, his original speed would have been 24 kmph.

    The time difference can be seen to be 6 minutes in this case:

    $60/24 - 60/25 = 0.1$ hrs $= 6$ mins. Thus, this is the correct answer.

3. In 1 hours 15 minutes an individual will be able to cover 25% more than his speed per hour. The relationship between the original speed and the new speed is best represented as below:

    Original speed $\xrightarrow{\text{25\% increase}}$ speed per 75 minutes $\xrightarrow{\text{+1 increase}}$ New speed.

    Thus, to go from the new speed to the original speed the process would be:

    New speed $\xrightarrow{-1}$ Speed per 75 minutes $\xrightarrow{20\%\downarrow}$ Original speed.

    We need to use this process to check the option. Only the first option satisfies this condition. (at 16 kmph it would take 6 hours while at 12 kmph it would take 8 hours).

4. The question's structure (and solving) have to be done on the basis of integers. The following equations emerge:

    $\dfrac{d}{s} - \dfrac{d}{(s+6)} = 4$ and $\dfrac{d}{(S-6)} - \dfrac{d}{(S+6)} = 10$

    Solving these expressions through normal solving methods is close to impossible (at the very least it would take a huge amount of time.) Instead this question has to be solved using the logic that integral difference in ratios in such a situation can only occur in all the three ratios (d/s), $d/(s + 6)$ and $d/(s - 6)$) are integers.

    Hence, d should have three divisors which are 6 units apart from each other.

5. The relative speed is 20 kmph. Also, the pedestrian should take 7:30 hours more than the cyclist. Using option (a) the speeds of the two people are 4km/hr and 16 km/hr respectively. At this speed, the respective times would be 10 hrs and 2:30 hours, giving the required answer.

6.
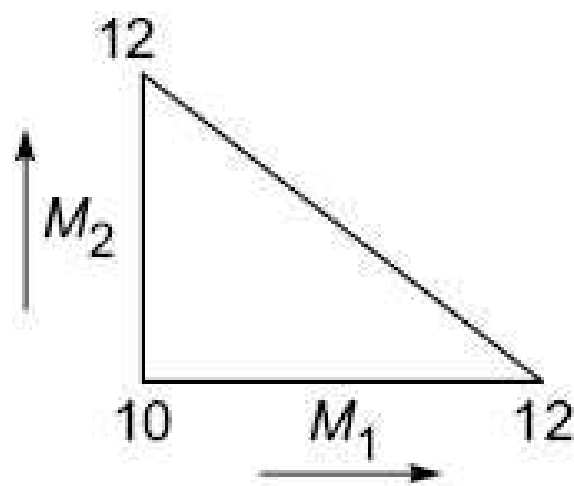
The distance between the motorists will be shown on the hypotenuse. Using the 3,4,5 Pythagoras triplet and the condition that the two speeds are 6 kmph different from each other, you will get the triplet as: 18,24,30. Hence, the slower motorist travelled at 18 kmph.

7. Since the two motorists meet after an hour, their relative speed is 28 kmph. Use options to check out the values. Since the speed of the faster cyclist is asked for it has to be greater than 14 kmph. Hence only check options > 14 kmph.

8. Since the second ant covers 7/120 of the distance in 2 hours 30 minutes, we can infer that is covers 8.4/120 = 7% of the distance in 3 hours. Thus, in 3 hours both ants together cover 15% of the distance Æ 5% per hour Æ they will meet in 20 hours.

   Also, ratio of speeds = 8 : 7.

   So, the second ant would cover 700 ft to the meeting profit in 20 hours and its speed would be 35 feet/hr.

9. In this question consider the total distance as 100%. Hence the sum of their speeds will be 75% per hour. Checking option (c)

   If the bus took 6 hours, it would cover 16.66% distance per hour and the car would cover 25% distance per hour. (as it takes 2 hours less than the bus.)

   This gives an addition of only 41.66%. Hence, the answer is not correct.

   Option (b) is the correct answer.

10. The requisite conditions are met on a Pythagoras triplet 6,8,10. Since the racetrack only consists of the legs of the right triangle the length must be 6 + 8 = 14 km.

11. The sum of speeds would be 0.08 m/s (relative speed in opposite direction). Also if we go by option (b), the speeds will be 0.03 and 0.05 m/s respectively.

    At this speed the overlapping would occur every 60 seconds.

12. When Rahim starts, Karim would have covered 40 km. Also, their relative speed is 12 kmph and the distance between the two would get to 0 in 40/12 = 3.33 hours.

    Distance covered = 28 × 3.33 = 93.33 km.

13. Solve this question through options.

    For option (c), the conditions match since: If he rode for 2 hours (speed = 5 kmph), he would have walked for 6 hours (4 hours more) and his walking speed would be 15 kmph.

    If we interchange the times, we get 15 × 2 = 5 × 6.

14. This is a complex trial and error based question and the way you would have to think in this is:
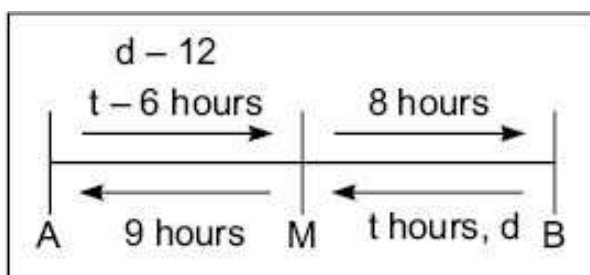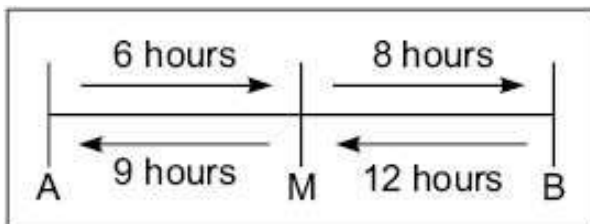
From the figure above, it is clear that A is faster as he takes only $t + 2$ hours while B has taken $t + 9$ hours to complete the journey.

Then, we get: $(t - 6)/9 = 8/t$

Solving for t, we get $t = -6$ (not possible)

Or $t = 12$. Putting this value of t in the figure it changes to:

We also get ratio of speeds $= 3 : 2$ (inverse of ratio of times)

The next part of the puzzle is to think of the 12 km less traveled by the first person till the meeting point.

If the speed of the faster person is 3s, that of the slower person $= 2s$.

Further

$12 \times 2s - 6 \times 3s = 12$ km

$s = 2$ kmph.

The speed of the faster tourist is $3 \times 2 = 6$ kmph

15. Solve using options. The first option you would check for (given the values in the questions) would be option (b). This would give that the first jogger would run at 3 min per km, while the second jogger would run at 4 min per km. In the new condition, the first jogger would jog for 13 km while the second jogger would jog fo 14 km and their respective times would be 39 mins and 56 minutes. This is consistent with the condition in the question which talks about a difference of 17 minutes in their respective times.

16. Solve this through options as: For option (a)

    $4800/60 - 4800/50 = 16$ minutes

17. The ant would cover $7 \times 8 = 56$ meters in 16 hours.

    Further, it would require 7/12 of the 17th hour to reach the top. Thus time required = 16 hours 35 minutes

18. If the slower ship took 20 hours (option d) the faster ship would take 12 hours and their respective speeds would be 15 and 25 kmph. This satisfies the basic condition in the question.

19. The movement of the ant in the two cases would be 3, 7, 11, 15, 19, 23 and 1, 9, 17, 25, 33, 41. It can be seen that after 3 seconds the difference is 6mm, after 4 seconds, the difference is 16mm and after 5 seconds the difference is 30 mm. Thus, it is clearly seen that the ant moved for 4 seconds.

20. When the signal happened distance left was 150 km.

$150/(s) - 150/(s + 15) = 1/2$ hours Æ $s = 60$.

21. The following figure gives us the movement of the two swimmers:
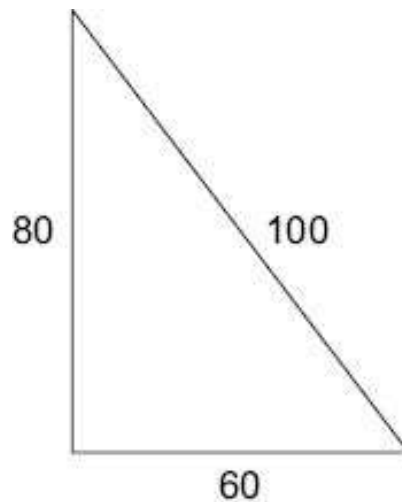
The faster swimmer must have traveled 80 km in 2 hours and hence his speed is 40 kmph.

22. Since they cover the distance in 80 minutes traveling in opposite directions we infer 100% distance is covered in 80 minutes Æ 1.25% per minute Æ 75% per hour.

    i.e. their combined distance coverage is 75% per hour.

    Since we are asked for the time the faster motorcyclist takes, we can pick up this time from the options.

Options	Time for faster motorcyclist	Faster's % coverage per hour	Slower's % coverage per hour
a	6 hours	16.66	58.33
b	3 hours	33.33	41.66
c	2 hours	50	25
d	4 hours	25	50
e	5 hours	20	55

It is clear that options a, b, d and e are not feasible as it is making the faster motorcyclist slower.

Thus option (c) has to be correct.

Note: You can use the values in option (c) to check the other condition in problem and see that it works.

23. Since the two horses meet after 200 minutes, they cover 0.5% of the distance per minute (combined) or 30% per hour. This condition is satisfied only if you the slower rider takes 10 hours (thereby covering 10% per hour) and the faster rider takes 5 hours (thereby covering 20% per hour).

24. Solve through options the equation: $350/s - 350/ (3 + 5) = 2.33$ hours.

    Æ $s = 25$.

25. Solve this question through options. The total travel time should be 5 hours 25 minutes.

    or 5(5/12) hours = 65/12 hours

    $d/36 + d/14 = 65/12$ Æ $d = 54.6$ km.

    Thus, option (d) none of these is correct.

26–28. You can make the following table to chart out the motions of the three.

Hour	Ram	Shyam	Mohan
1	10	30	3.33
2	20	33.33	6.66
3	60	36.66	10
4	81.66	40	20
5	85	50	30
6	88.33	60	40
	90(6.5)	70(7)	70(7)
		80(8)	100(8)

26. It is evident that Ram would overtake Shyam between 2 and 3. At x, Shyam is ahead by 13.33 km.

Relative speed between $2 - 3 = 36.66$ kmph.

Time required $= 13.33/36.66$ of the hour

$= 4/11$ of the hour

$= 2 : 22$. (approx)

27. Mohan would overtake Shyam after 70 miles.

28. Ram would cover 90 miles in 3 hours 45 minutes.

Mohan would cover 90 miles in 7 hours 40 minutes.

Time difference $= 3$ hours 55 minutes.

29. Mohan at 8 pm (each of the others would reach later).

30. Ram would reach at 9:30 p.m., while Shyam would reach at 10:00 p.m.

31. $25/s - 25/(s + 10) = 1/2$

$S = 50$ km/hr.

32. The respective times are 224 seconds and 364 seconds. They will meet at the starting point in the LCM of these times i.e. 224×13. Hence, Ram Singh will cover the circle 13 times.

33. The wife drives for 12 minutes less than her driving on normal days.

Thus, she would have saved 6 minutes each way. Hence, Ravi would have walked for 30 minutes (since his speed is $1/5^{th}$ of the car's speed).

In effect, Ravi spends 24 minutes extra on the walking (rather than if he had traveled the same distance by car).

Thus, if Ravi had got the car at the station only, he would have saved 24 minutes more and reached at $5 : 36$.

34. The following figure represents the travel of the two:
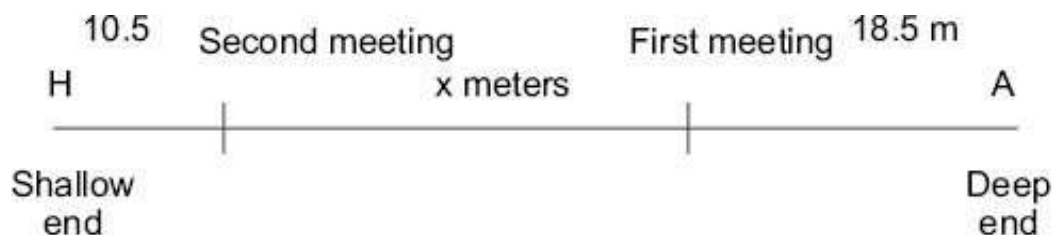
Once, you can visualize this figure, try to extract the value of *x* by taking the length as given in the options. For option (a) length of pool is 55.5 meters, the ratio of speeds of Ajay to Hemant on the basis of the first meeting = 18.5/37. The ratio of speeds on the basis of the second meeting = Ajay's travel to Hemant's travel = 47.5/ 63.5. The two ratios are not the same- which they should have been as both these ratios represent the speed ratio between Ajay and Hemant.

For option (b), length of pool is 45 meters, the ratio of speeds of Ajay to Hemant on the basis of the first meeting = 18.5/26.5. The ratio of speeds on the basis of the second meeting = Ajay's travel to Hemant's travel = 37/ 53. The two ratios are the same- which they should have been as both these ratios represent the speed ratio between Ajay and Hemant. Hence, this is the correct answer.

35. The distances covered in percentage would be, 10% + 6.66% + 8.33% + 16.66% + 5.833% + 31.666 + 2.0833 = 81.25%

    $(22.5/18.75) \times 100 = 120$ km

36. If you start at 12 noon, you would reach at 4:30 PM. You would be able to meet the train which left Mumbai at 8 AM, 9 AM, 10 AM, 11 AM, 12 Noon, 1 PM, 2 PM, 3 PM and 4 PM – a total of 9 trains.

37. The total time = time in the first part of the journey + time for the second part of the journey= $k/y + (x – k)/z$. Option (a) is correct.

38. If we assume the speed of the sound as 330 m/s, we can see that the distance traveled by the sound in 45 seconds is the distance traveled by the train in 11 minutes.

    $330 \times 45 = 660 \times s$ Æ $s = 22.5$ m/s = 81 kmph

39–40. In 9 hours, (7 pm to 4 pm) the Kalinga Express would cover 540 kms.

    Remaining distance = 260 kms

    Relative speed = 150 kmph.

    Time required = 260/150 =1.733 hours

    = 104 minutes.

39. $1.733 \times 90 = 156$ km.

40. 4 A.M. + 1 hr 44 minutes = 5 : 44 A.M.

41. The total distance the bird would travel would be dependent on the time that the cars crash with each other. Also, the speed of the bird is the same as the relative speed of the cars. Hence, the answer to question 41 will be 12 km.

42. The bird would travel at 120 kmph for 4 + 4/3 + 4/9 minutes. i.e 5.77 minutes. Hence, the answer is $(5.77/60) \times 120 = 11.55$ km.

43. The bird would be able to theoretically reach the bonnet of the second car an infinite number of times.

44. Initial distance = 25 dog leaps.

    Per minute Æ dog makes 5 dog leaps

    Per minute Æ Cat makes 6 cat leaps = 3 dog leaps.

    Relative speed = 2 dog leaps/minutes.

    An initial distance of 25 dog leaps would get covered in 12.5 minutes.

45. Refer to the following figure which helps us understand that the ratio of speeds of *A* to *B* would be

2:3.

P ————————————————————————————— Q

0.4 D means ratio of
speeds = 2:3

The 4th meeting would occur after a combined movement of $D + 6D = 7D$. 2/5th of this distance would be covered by A and 3/5th of this distance would be the distance covered by B. Thus, distance covered by A would be 2/5th of 7D --: distance covered by $A = 2.8D$ – which means that the 4th meeting occurs at a distance of $0.8D$ from P.

46. In 36 hours, there would be a gap of 8 minutes. The two watches would show the same time when the gap would be exactly 12 hours or 720 minutes.

    The no. of 36 hour time frames required to create this gap = 720/8 = 90.

    Total time = 90 × 36 = 3240 hours. Since this is divisible by 24, the watches would show 12 noon.

47. Solve through options. At 18 kmph the motorboat would take exactly 6 hours.

48. Check through options. Option (d) will give us 14 kmph and 9 kmph as the down stream and up stream speeds. This would mean that the total travel time would be 1.5 hours and 2.33 hours down stream and up stream respectively.

49. At 2:15 PM the distance between the two trains would be 550 km as the train from Hazipur to Muzaffarpur would already have traveled for 40 minutes. After that they would take 550/110 = 5 hours to meet. Thus, the train from Muzaffarpur would have traveled 250 kms before meeting. Option (c) is correct.

50. The dog loses 1/3rd of his normal time from the meeting point. (Thus normal time = 35 × 3 = 105 minutes)

    If the meeting occurred 24 km further, the dog loses 25 minutes.

    This means that the normal time for the new distance would be 75 minutes. Thus, normally the dog would cover this distance of 24 km in 30 minutes. Thus, normal speed = 48 km/hr.

1. At the ancient Athens Olympic games, in a duel between two runners, Portheus and Morpheus, they were made to start running in opposite direction from diametrically opposite ends of a circular race track of length (circumference) 2 kms. The first time they met was after 24 minutes. If the distance between them exactly 'n' minutes after they start is equal to a quarter of the length of the track, which of the following is a possible value of 'n'?

   (a) 124
   (b) 184
   (c) 160
   (d) 204

2. Aman and Biman started a walkathon around a circular track starting from the same point on the track in opposite directions. They met for the first after time 't'. Had they walked in the same direction with their speeds intact, they would have met after a time '$7t$'. It was also observed that Aman was slower than Biman, and Aman's speed was measured at 12 kmph. Find the speed of Biman.

   (a) 4 m/s
   (b) 5 m/s
   (c) 6 m/s
   (d) None of these

3. Abhishek and Aiswarya start from two opposite ends of a tunnel AB, which is 182 meters in length. Abhishek starts from A and Aiswarya starts from B. After they meet, they continue moving in their respective directions, till one of them reaches his end point and immediately reverses direction and starts walking back towards the other end. The ratio of their speeds is 7:6. At what distance (in metres) from A will they meet when Abhishek is in his 8th round?

   (a) 105
   (b) 130
   (c) 125
   (d) They would not meet.

4. For the above question, at what distance (in metres) from A will they meet when Abhishek is in his 12th round?

   (a) 126
   (b) 118
   (c) 91
   (d) They would not meet.

5. Two runners Portheus and Zeus, are running around a circular track at different speeds such that they meet after regular time intervals. The length of the track (circumference) is 1600 meters. If they run in opposite directions, they meet at eight different points while if they run in the same direction it is observed that they meet at 2 distinct points on the circular track. If they meet at intervals of 1.33 minutes when they run in the same direction, how much time does the faster runner (Portheus) take to complete one round?

   (a) 80 secs
   (b) 128 secs
   (c) 120 secs
   (d) None of these

6. At the Vijayantkhand Mini Stadium there are two circular race tracks— A with radii 40m and B 80 m respectively such that they touch each other at a point X. The coach Vijay Sir has a particular ritual with his best athletes Mridul and Odeon. Mridul runs at a speed of 80p m/min on

Race Track A and Odeon runs at a speed of 40 p m/min along the Race Track B. Both of them start from the point X and run multiple rounds. If Mridul gives Odeon a start of 4 mins exactly before he starts running himself, after how much time (in minutes) will the straight line distance between the two be exactly 240 m?

(a) 6   (b) 10

(c) 12.5   (d) Never

7. Bolt and Milkha, start running around a race track simultaneously. Bolt runs at a speed of 's' kmph, while Milkha runs at a speed of 'm' kmph. They meet for the first time when Bolt is in his third round. Which of the following can be the value of $x : y$?

(a) 11 : 6   (b) 11 : 5

(c) 17 : 8   (d) 9 : 4

8. Amar, Abhijit and Arun start running on a circular race track (from the same point). Amar and Abhijit run in a clockwise fashion while Arun runs anticlockwise. When Amar and Arun meet for the first time, Arun is at a distance which is equal to a quarter of the circumference of the circular race track. It is also known that Amar runs faster than Arun. The ratio of speeds of Amar, Arun and Abhijit cannot be...?

(a) 5 : 1 : 2   (b) 3: 1: 1

(c) 4 : 2 : 1   (d) 3 : 2 : 1

9. At what time between 6 and 7 o'clock is the miniute hand of a clock 4 minutes ahead of the hour hand?

(a) $34 \dfrac{1}{11}$ minutes past 6

(b) $36 \dfrac{5}{11}$ minutes past 6

(c) $37 \dfrac{1}{11}$ minutes past 6

(d) None of these

10. The minute hand of a clock overtakes the hour hand at intervals of 66 minutes of the correct time. How much time does the clock gain or lose in 4 hours?

(a) $1 \dfrac{119}{121}$ minutes   (b) $1 \dfrac{114}{121}$ minutes

(c) 2 minutes   (d) None of these

11. Robin Varkey's watch always runs faster than the actual time – and gains time unifromly. He sets the watch to be 10 minutes behind time at 12 noon on a Sunday. He observes that the watch is 5 minutes 48 seconds faster the following Sunday at 12 noon. At what exact time would the watch be correct?

(a) $\dfrac{26}{79}$ hours past 10 PM on Thursday

(b) $\dfrac{13}{79}$ hours past 8 PM on Thursday

(c) $\dfrac{26}{79}$ hours past 6 PM on Thursday

(d) None of these

12. Prawin Tiwari sets his clock right at 10 AM on Monday morning. However, being a defective piece (the clock), it loses 32 minutes every day. He has to get up on Friday at exactly 2 AM to catch his flight to Lebuana. At what time on Friday morning should he set the alarm on his watch in order for the watch to ring at exactly 2 AM?

(a) 3 AM　　　　　　　　　　　　　　(b) 4 AM

(c) 5 AM　　　　　　　　　　　　　　(d) None of these

13. At what time, in minutes , between 4 o'clock and 5 o'clock, would both the hands of a clock coincide with each other?

(a) $22\dfrac{1}{11}$ 　　　　　　　　　　　(b) $21\dfrac{9}{11}$

(c) $22\dfrac{4}{11}$ 　　　　　　　　　　　(d) $21\dfrac{7}{11}$

14. At what time between 8 PM to 9 PM will the hands of a clock be in the same straight line pointing away from each other?

(a) $10\dfrac{8}{11}$ minutes past 8

(b) $10\dfrac{10}{11}$ minutes past 8

(c) $10\dfrac{3}{11}$ minutes past 8

(d) $9\dfrac{10}{11}$ minutes past 8

15. A watch which gains 5 seconds in 3 minutes was set right at 7 am. In the afternoon of the same day, when it indicated quarter past 4 o'clock, the true time is:

(a) $59\,\dfrac{7}{12}$ min. past 3　　　　(b) 4 p.m

(c) $58\,\dfrac{7}{11}$ min. past 3　　　　(d) $2\,\dfrac{3}{11}$ min. past 4

16. In a 2000 m race between Portheus and Cassius, Portheus gives Cassius a head start of a minute but still beats him by 200 m. When, he increases the head start to 80 seconds, the race ends in a dead heat. Find the speed of Portheus.

(a) 25 m/s

(b) 18 m/s

(c) 13.33 m/s

(d) 16.66 m/s

17. How many right angles would be formed between the minute and the hour hand of a watch in a day?

(a) 48

(b) 46

(c) 45

(d) 44

18. How many times between 2 PM and 4 PM does the minutes hand coincide with the seconds hand?

(a) 118

(b) 119

(c) 120

(d) 121

19. A man enters his house at some time between 6 to 7 PM. When he leaves his house sometime between 7 to 8, he observes that the minute hand and the hour hand have interchanged positions. At what exact time did the man enter the house?

(A) 38 $\dfrac{82}{121}$ minutes past 6

(b) 37 $\dfrac{42}{121}$ minutes past 6

(c) 37 $\dfrac{82}{121}$ minutes past 6

(d) 37 $\dfrac{62}{121}$ minutes past 6

20. How many straight lines would be formed between the minute and the hour hand of a watch in a day?

(a) 48

(b) 46

(c) 45

(d) 44

21. Two friends started simultaneously from Lucknow towards Kanpur in the same direction along a straight road. The faster friend Raveesh was on a bike while Prakash was in an auto. The ratio of their speeds was 1 : 5 respectively. Two hours later, Raveesh parked his bike and started running back towards Prakash's auto. His speed dropped by 80% as a result of this. They meet at a point which is 15 km from Kanpur. What was the speed of the auto?

(a) 2 km/hr

(b) 2.5 km/hr

(c) 3 km/hr

(d) None of these.

22. Two brothers came to know about their sister's wedding at the last minute. The wedding was to be held at a location which was 800 kms away from Mumbai where both of them lived. The elder

brother Kanhaiya came to know about the wedding at 6 PM and left immediately in his car. His younger brother Ramaiyya came to know about the wedding at 9:30 PM and left in his car immediately at a speed which was 15 kmph higher than the speed of his elder brother. At 4:30 AM it was found that the two cars were 70 km apart. If the cars had travelled continuously without taking any rest, find the speed (in km/hr) of car A.

(a) 40

(b) 50

(c) 60

(d) Cannot be determined

23. Ranatunga once challenged Bolt to a race. The distance of the race was set at 2 km. They start at the same time and the ratio of their speeds is seen to be 4:1 (obviously Bolt would be faster). After some time passes, Bolt realises that he is far ahead and calculates that even if he stops for a snack and a nap for 'n' minutes, he would still reach his destination and beat Ranatunga by 13 minutes. Hence, he plans to take a break of 'n' minutes. Ranatunga keeps walking during this whole time. However, when Bolt wakes up, he realises that he has stopped for a total of (n+15) minutes. He redoubles his efforts by increasing his speed to double his original speed. The race eventually ended in a dead heat. If it is known that Bolt overstayed his stop by 6n/5 mins, how long did Ranatunga take to complete the race?

(a) 32 mins

(b) 34 mins

(c) 25 mins

(d) None of these

24. A and B run a 300 m race where the initial speed of B is double the speed of A. After some time, going on these speeds, A realising that he would be losing the race redoubled his effort and increased his speed to four times his initial speed. As a result, they reached the end point at the same time and the race resulted in a dead heat. What was the distance traveled by B, when A quadrupled his speed?

(a) 100 m

(b) 200 m

(c) 150 m

(d) None of these

25. Amit and Bimal start running around a circular track of circumference 4200 metres. Their respective speeds are 15m/s and 3 m/s. Their 14th meeting occurs at point P and their 22nd meeting occurs at the point Q. Find the longer distance (along the circumference) between Points P and Q.

(a) 2800

(b) 1400

(c) 3500

(d) 3150

26. In a 2 km race, Ravi beats Sandeep by 45 seconds and Sandeep beats Tarun by a further 75 seconds. In the same race, Ravi beats Tarun by 400 m. Find the time in which Ravi can run the race (in seconds).

(a) 240

(b) 300

(c) 360

(d) 480

ANSWER KEY

1. (d)	2. (d)	3. (d)	4. (a)
5. (b)	6. (d)	7. (a)	8. (d)
9. (c)	10. (a)	11. (a)	12. (b)
13. (b)	14. (b)	15. (b)	16. (d)
17. (d)	18. (d)	19. (a)	20. (c)
21. (b)	22. (b)	23. (b)	24. (b)
25. (a)	26. (d)		

Solutions

1. They would first meet after 24 minutes (after covering 50% of the distance represented by the circumference of the circle). The next time they would meet would be at 72 minutes, then 120 minutes, then 168 minutes, 216 minutes and so on.

Every time they meet they would be together and after the meeting point they continue running in opposite directions till they meet again. Between two meeting points, the distance between them would be 25% of the length of the circle's circumference in two cases: first when they are going away from each other after meeeting (this would occur at a time of 12 minutes after the meeting point) and second when they are approaching each other before their next meeting (this would occur at a time of 12 minutes before the next meeting point.

The meeting times 24, 72, 120, 168, 216, 264 etc, the table would represent the times at which the distance would be 25% of the circumference:

(24 –12 = 12); (24 + 12 = 36); (72 – 12 = 60);

(72 + 12 = 84); (120 – 12 = 108); (120 + 12 = 132);

(168 – 12 = 156); (168 + 12 = 180);

(216 – 12 = 204).

Only Option (d) is possible and hence is the correct answer.

2. Let the speed of Biman be b kmph. The value of b should be such that. be x.

$b = 16$ kmph $= 16 \times 5 \div 18 = 80 \div 18$ m/s $= 4.44$ m/s. Option (d) is the correct answer.

3. When Abhishek would complete 7 rounds, Aiswarya would have completed: $7 \times 6 \div 7 = 6$ rounds.

This means that both of them would be at the point B at this time. Since Abhishek is faster than Aiswarya, during his eighth round there would be no meeting with Aiswarya. Hence, Option (d) is correct.

4. When Abhishek would complete 11 rounds, Aiswarya would have completed: $11 \times 6 \div 7$ rounds $= 9\frac{3}{7}$ rounds.

This means that Aiswarya would be at a distance of 3/7 from A, while Abhishek would be at B at this point of time. The distance between them would be 4/7 of the total distance between A and B. Aiswarya would further cover a distance of $4/7 \times 6/13$ in order to meet Abhishek. Thus the total distance from A is $(3/7 + 24/91) \times 182 = 63 \times 182 \div 91 = 126$ meters from A and 56 meters from B. Option (a) is correct.

5. Let the ratio of speeds be P:Z (where P>Z).

Since they meet at 8 distinct points on the circle when they move in opposite directions, it automatically means that the sum of P+Z = 8. (I would like to encourage you to discover this piece of logic through trial and error.)

Similar logic gives us that P-Z = 2 (since they meet at two distinct points when travelling in the same direction.

Using these two equations, we can determine that if P = 5, Z = 3. Let the speeds of P be 5x and Z be 3x (in m/s). Then we have: 1600/8x = 80 secs Æ x = 2.5 and hence the speeds are P = 12.5 m/s and Z = 7.5 m/s.

P would take 1600 ÷ 12.5 = 128 seconds to complete one round.

Option (b) would be the correct answer.

6. Since the radii of the circles are 40m and 80m respectively, the circumference would be 80p and 160p meters respectively. Since Odeon's speed is 40pm/min, he would take 4 minutes to cover a round. This also means that when Mridul starts running, they would both be at point X, since Odeon would have covered 1 round exactly in 4 minutes. Also, for the straight line distance to be 240 m they should be at the diametrically opposite ends from the point X (of their respective circles). Mridul reaches the diametrically opposite end (from X) of his circle for the first time in 30 seconds and after that he would reach the same point every 1 minute at 1:30, 2:30 and so on. Odeon on the other hand would reach the diametrically opposite end at 2 minutes, 6 minutes, 10 minutes and so on. They would never be exactly 240 m apart. Option (d) is correct.

7. Check using the options. You can see that only in the case of Option (a) do they meet when Bolt is in his third round. For all other options, Bolt would cross Milkha when Bolt is in his second round.

8. Checking the options, it can be seen that the condition of diametrically opposite is satisfied in each of the first three options. It is only in Option (d) that it is not satisfied. Hence, Option (d) is correct.

9. At 6 o'clock, the minute hand is 30 minutes behind the hour hand.

From this position, we need to reach a position, where the minute hand is 4 minutes ahead of the hour hand. For this to occur, the minute hand has to gain (30 + 4) = 34 minute spaces on the hour hand. In one hour, the minute hand moves 60 mintues while the hour hand moves 5 minute spaces on the clock. Hence, the minute hand gains 55 minutes on the hour hand in an hour.

Hence, to gain, 34 minutes, the minute hand would take $\left(\frac{60}{55} \times 34\right) = 37\frac{1}{11}$ min.

The required answer would be $37\frac{1}{11}$ minutes past 6. Option (c) is correct.

10. Assume the clock to be a circular race track of 60 kms with each minute denoting 1 km. Also imagine two runners Mr. Minute and Mr. Hour running on this track. Normally, in a correct clock, Mr. Minute would cover 55 kms more than Mr. Hour every hour.

This means that they would be together (meaning Mr. Minute would overtake Mr. Hour) every $\left(\frac{60}{55} \times 60\right)$ min. $= 65\frac{5}{11}$ minutes. If they meet at longer time intervals than this, it means that the clock is slow. If the time intervals are shorter it would mean that the clock is fast.

In this problem they are together after 66 minutes. Thus, the clock loses time.

Loss in 66 minutes $= \left(66 - 65\frac{5}{11}\right) = \frac{6}{11}$ minutes.

Using unitary method we get loss in 4 hours $= \left(\frac{6}{11} \times \frac{60 \times 4}{66}\right)$ min. $= 1\frac{119}{121}$ minutes.

11. In one week the time elapsed is exactly 168 hours. Robin's watch gains 15 minutes 48 seconds in 168 hours. In other words it gains $\left(10 + 5\frac{4}{5}\right)$ min. or $\frac{79}{5}$ minutes in 168 hrs.

To be showing the exact time, the watch should have gained exactly 10 minutes.
Using Unitary method it can be seen that 10 minutes would be gained by the watch in:
$\left(168 \times \frac{5}{79} \times 10\right)$ hrs. $= 106\frac{26}{79}$ hours.

\ Watch is correct at $\frac{26}{79}$ hours past 10 PM on Thursday. Option (a) is the correct answer.

12. Time from 10 AM on Monday to 2 AM on Friday = 88 hours.
Now 23 hrs 28 minutes of this clock = 24 hours of correct clock.

\ $\frac{352}{15}$ hrs of this clock = 24 hours of correct clock

88 hrs of this clock $= \left(24 \times \frac{15}{352} \times 88\right)$ hrs of correct clock.

= 90 hrs of correct clock. This means that at 2 AM on Friday his clock would show 4 AM. Hence, if he needs to wake up at 2 AM, he should set his clock's alarm at 4 AM.
Hence, Option (b) is the correct answer.

13. Assume the clock to be a circular race track of 60 kms with each minute denoting 1 km. Also imagine two runners Mr. Minute and Mr. Hour running on this track. Normally, in a correct clock, Mr. Minute would cover 55 kms more than Mr. Hour every hour.
At 4 o'clock, the minute hand is 20 kms behind the hour hand.
It would hence, need to gain 20 kms to coincide with the hour hand.
In 60 minutes, it gains 55 kms.
In t minutes, it gains 20 kms.

$= \left(\frac{60}{55} \times 20\right)$ min. $= 21\frac{9}{11}$ minutes.

14. Thinking as in the previous question, we can think that at 8 PM the minute hand is 40 kms behind the hour hand. For it to become 30 kms behind the hour hand, we would need it to cover 10 kms over the hour hand.
In 60 minutes, it gains 55 kms.
In t minutes, it gains 10 kms.

$$= \left(\frac{60}{55} \times 10\right) \text{ min.} = 10\frac{10}{11} \text{ minutes.}$$

Option (b) is correct.

15. Time from 7 am to 4:15 pm = 9 hrs 15min = $\frac{37}{4}$ hrs

3 min 5 sec of this clock = 3 min of the correct clock.

fi $\frac{37}{720}$ hrs of this clock = $\frac{1}{20}$ hrs of the clock.

fi $\frac{37}{4}$ hrs of this clock = $\left(\frac{1}{20} \times \frac{720}{37} \times \frac{37}{4}\right)$ hrs of the correct clock

= 9 hrs of the correct clock

The correct time is 9 hrs after 7 AM i.e. 4 PM.

16. Since Cassius is able to get a dead heat when he gets a head start of 80 seconds, it means that he would cover 200 meters in 20 seconds. Hence, his speed is 10m/s.

Let the time taken by Portheus to finish the race be t seconds. Then tracking the movement of Cassius we get:

$t \times 10 + 60 \times 10 = 2000 - 200$.

So $t = 120$ seconds.

Hence, the speed of Portheus would be = 2000/120 = 250/15 = 50/3 = 16.666 m/s. Option (d) is correct.

17. There are 2 right angles that are formed every hour between the hands of a watch. Hence, in 24 hours, we would expect 48 right angles. However, between 2 to 4 AM and 2 to 4 PM the number of right angles formed is only 3, because the right angle formed at 3 O'Clock (both AM and PM) is the second right angle for the hour between 2 O'Clock and 3 O'Clock. It is also the first right angle between 3 O'Clock and 4 O'Clock. This makes the clock lose two of its 48 expected right angles. Similarly, two right angles are lost when the clock passes through 8 O'Clock to 10 O'Clock. Hence, ther would be a total of 44 right angles formed. Option (d) is correct.

18. In two hours, the minute hand completes 2 rounds around the circumference of the clock's dial. In the same time, the seconds hand covers 120 rounds. If we count 2 PM coincidence as the first one, the 4 pm coincidence would be the last one. There would be a total of 121 coincidences in 2 hours. Option (d) is correct.

19. Assume the clock to be a circular race track of 60 kms with each minute denoting 1 km. Also imagine two runners Mr. Minute and Mr. Hour running on this track. Normally, in a correct clock, Mr. Minute would cover 55 kms more than Mr. Hour every hour. For the conditions given in the problem, when the man enters the house, the time would be somewhere between 6:35 to 6:40 while when he leaves the time would be somewhere between 7:30 to 7:35.

Let, the distance between the two be equal to x kms. When the hands interchange positions, the hour hand would have traveled x kms and the minute hand would have traveled $(60 - x)$ kms.

Using unitary method we get:

When the minute hand travels 60 kms, the hour hand travels 5 kms.

When the minute hand travels '60 – x' kms, the hour hand travels 'x' kms.

$60x = 300 - 5x$ Æ $x = \dfrac{300}{55} = 5\dfrac{5}{11}$ minutes.

This means that when he comes home, the minute hand is $5\dfrac{5}{11}$ minutes ahead of the hour hand.

In order to find the exact time at which this happens between 6 to 7, we know that at 6, the minute hand is 30 kms behind the hour hand. For the minute hand to move $5\dfrac{5}{11}$ minutes ahead of the hour hand we would need the minute hand to cover $35\dfrac{5}{11}$ kms.

In 60 minutes, the minute hand covers 55 kms.

In t minutes, the minute hand covers $35\dfrac{5}{11}$ minutes.

$= 60 \times 35\dfrac{5}{11} \div 55 = \dfrac{12}{11} \times \dfrac{390}{11}$ minutes $= 4680 \div 121 = 38\dfrac{82}{121}$ minutes.

He comes home at $38\dfrac{82}{121}$ minutes past 6.

20. There are 2 times that the hands of a watch form straight lines every hour. Hence, in 24 hours, we would expect 48 straight lines. However, between 11 to 1 and between 5 to 7 we would 'lose' one straight line as the 12 o'clock straight line and the 6 o'clock straight lines are double counted. Hence, the number of straight lines = 48 – 1 (for 5 AM to 7AM) – 1 (for 11 AM to 1 PM) – 1 (for 5 PM to 7 PM). Hence, there would be a total of 45 straight lines formed in a day. Option (c) is correct.

21. Solve this through options. Option (b) matches the conditions of the problem and is hence the correct answer.

The thought process for this goes as follows:

If the auto's speed is 2.5, the bike's speed would be 12.5. Naturally 2 hours later, Raveesh would be at 25 kms. while Prakash would be at 5 kms. A distance of 20 kms. When Raveesh starts back his speed would be 2.5 kmph and hence the total speed at which they would approach each other would be 5 kmph. They would meet 6 hours after starting – and in this time Prakash would have covered 15 km and hence they would meet at 15 km from Kanpur. (This last bit would not match for the other options.)

For example if we check Option (a):

The thought process for this goes as follows:

If the auto's speed is 2, the bike's speed would be 10. Naturally 2 hours later, Raveesh would be at 20 kms while Prakash would be at 4 kms. A distance of 16 kms. When Raveesh starts back his speed would be 2 kmph and hence the total speed at which they would approach each other would be 4 kmph. They would meet 6 hours after starting – and in this time Prakash would have covered 12 km and hence they would meet at 12 km from Kanpur which does not match the information in the problem.

22. Solve using options. For option (b), at 4:30 AM the elder brother has travelled for 10:30 hours and hence must have covered 525 kms. The younger brother has traveled only for 7 hours and at a speed of 65 kmph, the distance traveled would be 455 km. This would mean that the distance between them would be 70 km (as given). Hence, this option works correctly. The other options do not work and can be tested in a similar way. For instance for option (a), 40 kmph does not work because $10.5 \times 40 - 7 \times 55 \neq 70$.

Similarly, Option (c) can be rejected because $10.5 \times 60 - 7 \times 75 \neq 70$

23. Since Bolt outstretched his time by $6n/5$ mins and this is also equal to 15 mins. Solving we get: $n = 12.5$ mins.

Let their original speeds be '$4s$' and 's' kmph respectively.

Had Bolt not overstretched his nap, he would have beaten Ranatunga by 13 min.

$\therefore \dfrac{2000}{4s} + 12.5 + 13 = \dfrac{2000}{s}$ $\Rightarrow$ $s = 1000/17$

Hence, the time taken by Ranatunga to complete the race = $2000 \times 17 \div 1000 = 34$ minutes.

Hence, Option (b) is correct.

24. The distance traveled by B in the initial phase of the race would be double the distance traveled by A during the same time. Likewise, in the second phase of the race, the distance traveled by A would be double the distance traveled by B. Also the total distance traveled by A and B would be 300 m. The only value which creates this symmetircal situation is if the initial phase is such that B travels 200 m and A travels 100 m. Hence, Option (b) is correct.

25. Imagine the circle to be a clock with 12 divisions on the circumference- each division equal to a distance of $4200 \div 12 = 350$ metres. (Imagine these are representing 1 o'Clock to 12 o'Clock for ease of understanding). Since they travel at a ratio of speed as 5:1, imagine Amit travels clockwise and Bimal travels anti clockwise. Their first meeting would occur at the point representing 10 o'Clock, the next at 8 o'clock, then 6 o'clock and so on. It can be seen that the 14th meeting would occur at 8 o'Clock and the 22nd meeting at 4 o'Clock. The longer distance between them would be equal to 8 markings on the clock. This distance would be $8 \times 350 = 2800$ metres. Option (a) is correct.

26. Ravi beats Tarun by 120 seconds or 400 meters. Hence, Tarun's speed is $400 \div 2 = 200$ m/minute. Also, when Ravi does 2000 meters, Tarun does 1600 meters – which he would do in 8 minutes. Thus Ravi takes 8 minutes = 480 seconds to complete the race. Option (d) is correct

Review Test 1

1. A man earns x% on the first ` 5,000 of his investment and $y$% on the rest of his investment. If he earns ` 1250 from `7,000 and `1750 from ` 9,000 invested, find the value of x.

   (a) 20%   (b) 15%

   (c) 25%   (d) None of these

2. The price of a telelvision set drops by 30% while the sales of the set goes up by 50% What is the percentage change in the total revenue from the sales of the set?

   (a) –4%   (b) –2%

   (c) +5%   (d) +2%

3. A person who has a certain amount with him goes to the market. He can buy 100 oranges or 80 mangoes. He retains 20% of the amount for petrol expenses and buys 40 mangoes and of the balance, he purchases oranges. The number of oranges he can purchase is:

   (a) 30   (b) 40

   (c) 15   (d) 20

4. A cloth merchant cheats his supplier and his customer to the tune of 20% while buying and selling cloth respectively. He professes to sell at the cost price but also offers a discount of 20% on cash payment, what is his overall profit percentage?

   (a) 20%   (b) 25%

   (c) 40%   (d) 15%

5. I sold two horses for ` 50000 each, one at the loss of 20% and the other at the profit of 20%. What is the percentage of loss (–) or profit (+) that resulted from the transaction?

   (a) (+) 20   (b) (–) 4

   (c) (+) 4   (d) (–) 20

6. The cost of a diamond varies directly as the square of its weight. A diamond fell and broke into four pieces whose weights were in the ratio 1:2:3:4. As a result the merchant had a loss of `700000. Find the original price of the diamond.

   (a) t` 14 lacs                   (b) t` 20 lacs

   (c) t` 10 lacs                   (d) t` 25 lacs

7. Two oranges, three bananas and four apples cost ` 25. Three oranges, two bananas and one apple cost ` 20. I brought 3 oranges, 3 bananas and 3 apples. How much did I pay ?

   (a) t`22.5                       (b) t`27

   (c) t`30   (d) Cannot be determined

8. From each of two given numbers, half the smaller number is subtracted. Of the resulting numbers the larger one is five times as large as the smaller one. What is the ratio of the two numbers?

(a) 2: 1   (b) 3: 1

(c) 3: 2   (d) None of these

Directions for Questions 9 and 10: Answer these questions based on the following information.

A watch dealer incurs an expense of `150 for producing every watch. He also incurs an additional expenditure of ` 30,000, which is independent of the number of watches produced. If he is able to sell a watch during the season, he sells it for ` 250. If he fails to do so, he has to sell each watch for ` 100.

9. If he is able to sell only 1,000 out of 1,500 watches he has made in the season, then he has made a profit of:

(a) t`90,000          (b) t`75,000

(c) t`45,000          (d) t`60, 000

10. If he produces 2000 watches, what is the number of watches that he must sell during the season (to the nearest 100) in order to break-even, given that he is able to sell all the watches produced?

(a) 700   (b) 800

(c) 900   (d) 1,000

11. A stockist wants to make some profit by selling oil. He contemplates about various methods. Which of the following would maximise his profit?

I. Sell oil at 20% profit.

II. Use 800 g of weight instead of 1 kg

III. Mix 20% impurities in oil and selling it at cost price.

IV. Increase the price by 10% and reduce weights by 10%.

(a) I or III   (b) II

(c) II and IV   (d) Profits are same

12. A dealer offers a cash discount of 20% and still makes a profit of 20%, when he further allows 160 articles when the customer buys 120. How much percent above the cost price were his wares listed?

(a) 100%   (b) 80%

(c) 75%   (d) 66(2/3)%

13. A man buys spirit at ` 600 per litre, adds water to it and then sells it at ` 750 per litre. What is the ratio of the spirit's weight to the weight of the water if his profit in the deal is 37.5%?

(a) 9:1   (b) 10:1

(c) 11:1   (d) None of these

Directions for Questions 14 to 16: Answer these questions based on the following information.

Aamir, on his death bed, keeps half his property for his wife and divides the rest equally among his three sons: Bimar, Cumar and Danger. Some years later, Bimar dies, leaving half his property to his widow and half to his brothers, Cumar and Danger together, sharing equally. When Cumar makes his will, he keeps

half his property for his widow and the rest he bequeaths to his younger brother Danger. When Danger dies some years later, he keeps half his property for his widow and the remaining for his mother. The mother now has `15,75,0000

14. What was the worth of the total property?

(a) t`3 crore

(b) t`0.8 crore

(c) t`1.8 crore

(d) t`2.4 crore

15. What was Cumar's original share ?

(a) t`40 lakh

(b) t` 120 lakh

(c) t`60 lakh

(d) t`50 lakh

16. What was the ratio of the property owned by the widows of the three sons, in the end?

(a) 7:9:13

(b) 8:10:17

(c) 5:7:9

(d) 9:12:13

17. At a bookstore, "MODERN BOOK STORE" is flashed using neon lights. The words are individually flashed at long intervals of $2\dfrac{1}{2}$, $4\dfrac{1}{4}$, $5\dfrac{1}{8}$ seconds respectively, and each word is put off after a second. The least time after which the full name of the bookstore can be read again, is:

(a) 49.5 seconds

(b) 73.5 seconds

(c) l744.5 seconds

(d) 855 seconds

18. A train approaches a tunnel AB. Inside the tunnel a cat is located at a point that is $2/5^{th}$ the distance AB measured from the entrance A. When the train whistles, the cat runs. If the cat moves to the entrance of the tunnel, A, the train catches the cat exactly at the entrance. If the cat moves to the exit B, the train catches the cat at exactly the exit. The speed of the train is greater than the speed of the cat by what order?

(a) 3 : 1

(b) 4: 1

(c) 5: 1

(d) None of these

19. Six technicians working at the same rate complete the work of one server in 2.5 hrs. If one of them starts at 11:00 a.m. and one additional technician per hour is added beginning at 5:00 p.m., at what time the server will be complete?

(a) 6:40 p.m,

(b) 7 p.m.

(c) 7:20 p.m.

(d) 8:00 p.m.

Directions for Questions 20 and 21: Answer the questions based on the following information.

A thief, after committing the burglary, started fleeing at 12 noon, at a speed of 60 km/hr. He was then chased by a policeman X. X started the chase, 15 min after the thief had started, at a speed of 65 km/hr.

20. At what time did X catch the thief?

(a) 3.30p.m.

(b) 3 p.m.

(c) 3.15 p.m.   (d) None of these

21. If another policeman had started the same chase along with X, but at a speed of 60 km/hr, then how far behind was he when X caught the thief?

(a) 18.75 km   (b) 15 km

(c) 21 km   (d) 37.5km

22. Two typists undertake to do a job. The second typist begins working one hour after the first. Three hours after the first typist has begun working, there is still 9/20 of the work to be done. When the assignment is completed, it turns out that each typist has done half the work. How many hours would it take each one to do the whole job individually?

(a) 12 hr and 8 hr   (b) 8 hr and 5.6 hr

(c) 10 hr and 8hr   (d) 5 hr and 4 hr

23. A man can walk up a moving 'up' escalator in 30 s. The same man can walk down this moving 'up' escalator in 90s. Assume that his walking speed is same upwards and downwards. How much time will he take to walk up the escalator, when it is not moving?

(a) 30s   (b) 45s

(c) 60s   (d) 90s

Directions for Questions 24 and 26: Answer the questions based on the following information.

Boston is 4 hr ahead of Frankfurt and 2 hrs behind India. X leaves Frankfurt at 6 p.m. on Friday and reaches Boston the next day. After waiting there for 2 hrs, he leaves exactly at noon and reaches India at 1 a.m. On his return journey, he takes the same route as before, but halts at Boston for 1 hr less than his previous halt there. He then proceeds to Frankfurt.

24. If his journey, including stoppage, is covered at an average speed of 180 mph, what is the distance between Frankfurt and India?

(a) 3,600 miles   (b) 4,500 miles

(c) 5580 miles   (d) Data insufficient

25. If X had started the return journey from India at 2.55 a.m. on the same day that he reached there, after how much time would he reach Frankfurt?

(a) 24 hrs   (b) 25 hrs

(c) 26 hrs   (d) Data insufficient

26. What is X's average speed for the entire journey (to and fro)?

(a) 176 mph   (b) 180 mph

(c) 165 mph   (d) Data insufficient

1. A car after traveling 18 km from a point A developed some problem in the engine and the speed became 4/5th of its original speed. As a result, the car reached point B 45 minutes late. If the engine had developed the same problem after travelling 30 km from A, then it would have reached B only 36 minutes late. The original speed of the car (in km per hour) and the distance between the points A and B (in km) are

   (a) 25,130   (b) 30,150

   (c) 20,190   (d) None of these

2. A, B and C individually can finish a work in 6,8 and 15 hours respectively. They started the work together and after completing the work got `94.60. when they divide the money among themselves. A, B and C will get respectively (in `)

   (a) 44,33,17.60   (b) 43,27,24.60

   (c) 45,30,19.60   (d) 42,28,24.60

3. Two trains are traveling in opposite direction at uniform speed 60 and 50 km per hour respectively. They take 5 seconds to cross each other. If the two trains had traveled in the same direction, then a passenger sitting in the faster moving train would have overtaken the other train in 18 seconds. The length of the trains in metres are

   (a) 112, 78.40   (b) 97.78, 55

   (c) 102.78, 50   (d) 102.78, 55

4. Assume that an equal number of people are born on each day. Find approximately the percentage of the people whose birthday will fall on 29th February.

   (a) 0.374   (b) 0.5732

   (c) 0.0684   (d) None of these.

5. A sum of money compounded annually becomes `625 in two years and `675 in three years. The rate of interest per annum is

   (a) 7%   (b) 8%

   (c) 6%   (d) 5%

6. Every day Asha's husband meets her at the city railway station at 6:00 p.m. and drives her to their residence. One day she left early from the office and reached the railway station at 5:00 p.m. She started walking towards her home, met her husband coming from their residence on the way and they reached home 10 minutes earlier than the usual time. For how long did she walk?

   (a) 1 hour   (b) 50 minutes

   (c) ½ hour   (d) 55 minutes

7. Three machines, A, B and C can be used to produce a product. Machine A will take 60 hours to produce a million units. Machine B is twice as fast as Machine A. Machine C will take the same amount of time to produce a million units as A and B running together. How much time will be required to produce a million units if all the three machines are used simultaneously?

   (a) 12 hours   (b) 10 hours

(c) 8 hours   (d) 6 hours

8. Mr. and Mrs. Shah travel from City A to City B and break journey at City C in between. Somewhere between City A and City C, Mrs. Shah asks "How far have we travelled?" Mr. Shah replies, "Half as far as the distance from here to city C". Somewhere between City C and City B, exactly 200 km from the point where she asked the first question, Mrs. Shah asks "How far do we have to go?" Mr. Shah replies "Half as far as the distance from City C to here." The distance between Cities A and B in km. is

(a) 200   (b) 100

(c) 400   (d) 300

9. A shop sells ball point pens and refills. It used to sell refills for 50 paise each, but there were hardly any takers. When he reduced the price, the remaining refills were sold out enabling the shopkeeper to realize ` 35.89. How many refills were sold at the reduced price?

(a) 37   (b) 71

(c) 89   (d) 97

10. Anand and Bharat can cut 5 kg of wood in 20 min, Bharat and Chandra can cut 5 kg of wood in 40 min. Chandra and Anand can cut 5 kg. of wood in 30 min. How much time Chandra will take to cut 5 kg of wood alone?

(a) 120 minutes   (b) 48 minutes

(c) 240 minutes   (d) (240/7) minutes

11. If 200 soldiers eat 10 tons of food in 200 days, how much will 20 soldiers eat in 20 days?(1ton = 1000 kgs)

(a) 1 ton   (b) 10 kg

(c) 100 kg   (d) 50 kg

12. A servant is paid ` 100 plus one shirt for a full year of work. He works for 6 months and gets ` 30 plus the shirt. What is the cost of the shirt? (in Rupees)?

(a) 20   (b) 30

(c) 40   (d) 50

13. A train without stopping travels at 60 km per hour and with stoppages at 40 km per hour. What is the time taken for stoppages on a route of 300 km?

(a) 11 hours   (b) 22 hours

(c) 5 hours   (d) 2.5 hours

14. A contractor receives a certain sum every week for paying wages. His own capital together with the weekly sum enables him to pay 45 men for 52 weeks. If he had 60 men and the same wages his capital and weekly sum would suffice for 13 weeks, how many men can be maintained for 26 weeks?

(a) 60   (b) 52

(c) 50   (d) 65

15. A supply of water lasts for 150 days if 12 gallons leak off every day, but only for 100 days if 15

gallons leak off daily. What is the total quantity of water in the supply?

(a) 900   (b) 1125

(c) 3350   (d) 1250

16. If a dealer were to diminish the selling price of his wares by 10% he would double his sale making the same profit as before. In what ratio would his profit diminish if he were to increase his selling price by 10% and thereby halve his sale?

(a) 2:1.5   (b) 5:4

(c) 1:1.5   (d) 9:7

17. A can is full of paint. Out of this 5 litres are removed and a thinning liquid substituted. The process is repeated. Now the ratio of paint to thinner is 49:15. What is the full capacity of the can?

(a) 20 litres   (b) 60 litres

(c) 40 litres   (d) 50 litres

Directions for Questions 18 to 20: Use the following information.

Kachua Bhaiya started to move from point B towards point A exactly an hour after Jiggly Pup started from A in the opposite direction. Kachua Bhaiyas's speed was twice that of Jiggly Pup. When Jiggly Pup had covered one-sixth of the distance between the points A and B, Kachua Bhaiya had also covered the same distance.

18. The point where the two would meet is

(a) Closer to A

(b) Exactly between A and B

(c) Closer to B

(d) P and Q will not meet at all

19. How many hours would Jiggly Pup take to reach B?

(a) 2   (b) 5

(c) 6   (d) 12

20. How many more hours would Jiggly Pup (compared to Kachua Bhaiya) take to complete his journey?

(a) 4   (b) 5

(c) 6   (d) 7

21. A group of workers was put on a publishing job. From the second day onwards one worker was withdrawn each day. The job was finished when the last worker was withdrawn. Had no worker been withdrawn at any stage, the group would have finished the job in two-thirds the time. How many workers were there in the group?

(a) 2   (b) 3

(c) 5   (d) 10

22. A ship leaves on a long voyage. When it is 18 miles from the shore, a seaplane, whose speed is ten times that of the ship, is sent to deliver mail. How far from the shore does the seaplane catch up with the ship?

(a) 24 miles (b) 25 miles

(c) 22 miles (d) 20 miles

23. One man can do as a woman can do in 2 days. A child does one-third the work in a day as a woman. If an estate-owner hires 39 pairs of hands, men, women and children in the ratio 6:5:2 and pays them in all `1113 at the end of days work, what must the daily wages of a child be, if the wages are proportional to the amount of work done?

(a) t`14 (b) t`5

(c) t`20 (d) t`7

24. A water tank has three taps A, B and C. A fills four buckets in 24 mins, B fills 8 buckets in 1 hour and C fills 2 buckets in 20 minutes. If all the taps are opened together a full tank is emptied in 2 hours. If a bucket can hold 5 litres of water, what is the capacity of the tank?

(a) 120 litres (b) 240 litres

(c) 180 litres (d) 60 litres

25. A man buys spirit at `60 per litre, adds water to it and then sells it at `75 per litre. What is the ratio of spirit to water if his profit in the deal is 37.5%?

(a) 9:1 (b) 10:1

(c) 11:1 (d) None of these

Review Test 3

1. There is a leak in the bottom of a tank. This leak can empty a full tank in 8 hours. When the tank is full, a tap is opened into the tank which admits 6 litres per hour and the tank is now emptied in 12 hours. What is the capacity of the tank?

   (a) 28.8 litres
   (b) 36 litres
   (c) 144 litres
   (d) cannot be determined

2. The winning relay team in a high school sports competition clocked 48 minutes for a distance of 13.2 km. Its runners A, B, C and D maintained speeds of 15 kmph, 16, 17 kmph and 18 kmph respectively. What is the ratio of the time taken by B to that taken by D?

   (a) 5:16
   (b) 5:17
   (c) 9:8
   (d) 8:9

3. Three bells chime at intervals of 18,24 and 32 minutes respectively. At a certain time they begin to chime together. What length of time will elapse before they chime together again?

   (a) 2 hours 24 minutes
   (b) 4 hours 48 minutes
   (c) 1 hours 36 minutes
   (d) 5 hours

4. In a race of 200 meters run, Ashish beats Sunil by 20 metres and Nalin by 40 metres. If Sunil and Nalin are running a race of 100 metres with exactly the same speeds as before, then by how many metres will Sunil beat Nalin?

   (a) 11.11 metres
   (b) 10 metres
   (c) 12 metres
   (d) 25 metres

5. A man invests `3000 at a rate of 5% per annum. How much more should he invest at a rate of 8%, so that he can earn a total of 6% per annum?

   (a) t`1200
   (b) t`1300
   (c) t`1500
   (d) t`2000

Use the following data for questions 6 to 9: Helitabh and Ruk Ruk are running along a circular course of radius 14 km in opposite directions such that when they meet they reverse their directions as well as they interchange their speeds i.e. after they meet Helitabh will run at the speed of Ruk Ruk and vice-versa. However, this interchange occurs only when they meet outside the starting point. They do not interchange directions or speeds when they meet at the starting point. Initially, the speed of Helitabh is thrice the speed of Ruk Ruk. Assume that they start from M_0 and they first meet at M_1, then at M_2, next M_3, and finally at M_4.

6. What is the shortest distance between M_1 and M_2?

   (a) 22 km.
   (b) $14\sqrt{2}$ km
   (c) 14 km
   (d) 28 km

7. What is the shortest distance between M_1 and M_3 along the course?

   (a) 44 km
   (b) $28\sqrt{2}$ km

(c) $44\sqrt{2}$ km   (d) 28 km

8. Which is the point that coincides with M_0?

   (a) M_1 (b) M_2

   (c) M_3 (d) M_4

9. What is the distance travelled by Helitabh when they meet at M_3?

   (a) 154 km.   (b) 132 km

   (c) 198 km   (d) 176 km

Directions for Questions 10 to 12: A certain race is made up of three stretches A, B and C, each 4 km long, and to be covered by a certain mode of transport. The following table gives these modes of transport for the stretches, and the minimum and maximum possible speeds (in kmph) over these stretches. The speed over a particular stretch is assumed to be constant. The previous record for the race is ten minutes.

Stretch	Mode of transport	Min. Speed	Max Speed
A	Car	80	120
B	Motor-cycle	60	100
C	Bicycle	20	40

10. Anshuman travels at minimum speed by car over A and completes stretch B at the fastest possible speed. At what speed should he cover stretch C in order to break the previous record?

   (a) Max. speed for C

   (b) Min. speed for C

   (c) This is not possible

   (d) None of these

11. Mr. Hare completes the first stretch at the minimum speed and takes the same time for stretch B. He takes 50% more time than the previous record to complete the race. What is Mr. Hare's speed for the stretch C?

   (a) 21.8 kmph   (b) 26.66 kmph

   (c) 34.2 kmph   (d) None of these

12. Mr. Tortoise completes the race at an average speed of 40 kmph. His average speed for the first two stretches is 4 times that for the last stretch. Find his speed over stretch C.

   (a) 30 kmph   (b) 24 kmph

   (c) 20 kmph   (d) This is not possible

13. After allowing a discount of 11.11% a trader still makes a gain of 20%. At what percent above the cost price does he mark his goods?

   (a) 28.56%   (b) 35%

   (c) 22.22%   (d) None of these

14. A dealer buys oil at `100, `80 and `60 per liter. He mixes them in the ratio 5:6:7 by weight and sells them at a profit of 50%. At what price does he sell oil?

   (a) t`80/liter                          (b) t`116.666/ liter

   (c) t`95/liter   (d) None of these

15. An express train travelling at 80 kmph overtakes a goods train twice as long and going at 40 kmph on a parallel track, in 54 seconds. How long will the express train take to cross a station 400 m long?

   (a) 36 sec   (b) 45 sec

   (c) 27 sec   (d) none of these

16. A man earns x% on the first 2000 rupees and y% on the rest of his income. If he earns `700 from `4000 and `900 from `5000 of income. Find x.

   (a) 20   (b) 15

   (c) 25   (d) None of these

17. In the famous Harrods museum, the value of each of a set of gold coins varies as the square of its diameter, if its thickness remains constant and it varies as the thickness, if the diameter remains constant. If the diameters of the two coins are in the ratio 4:3, what should the ratio of their thickness be if the value of the first is 4 times that of the second?

   (a) 16:9   (b) 9:4

   (c) 9:16   (d) 4:9

A thief after committing a burglary, started fleeing at 12:00 noon at the speed of 60 kmph. He was then chased by a policeman X. X started the chase 15 minutes after the thief had started at a speed of 65 kmph.

18. At what time did X catch the thief?

   (a) 3:30 p.m.   (b) 3:00p.m.

   (c) 3:15 p.m.   (d) None of these

19. If another policeman has started the same chase along with X, but at a speed of 60 kmph, then how far behind was he when X caught the thief?

   (a) 18.75 km   (b) 15 km

   (c) 21 km   (d) 47.5 km

20. A and B walk from X to Y, a distance of 27 km at 5 kmph and 7 kmph respectively. B reaches Y and immediately turns back meeting A at Z. What is the distance from Y to Z?

   (a) 2 km   (b) 4.5 km

   (c) 3 km   (d) 7 km

21. A motorist leaves the post office to go to the airport to collect mail. The plane arrives early, and the mail is sent on a horse-cart. After half an hour, the motorist meets the horse-cart, collects the mail and returns to the post office, thus saving 20 minutes. How many minutes early did the plane arrive?

(a) 20   (b) 25

(c) 30   (c) 40

22. In his book on Leonardo da Vinci, Sigmund Freud, after a detailed psychoanalysis concluded that Goethe could complete the masterpiece in nine days as he could channelize overly but was more possessed as a result of which he could generate 50% more efficiency than Goethe. The number of days it takes Leonardo da Vinci to do the same piece of work that Goethe completes in nine days is:

(a) 4 (1/2) days   (b) 6 days

(c) 13 (1/2) days   (d) None of these

23. The North South Express is a pair of trains between the cities Jammu & Chennai. A train leaves Jammu for Chennai exactly at 12 noon every day of the week. Similarly, there is a train that leaves from Chennai to Jammu on every day of the week at exactly 12 noon. The time required by a train to cover the distance between Chennai & Jammu is exactly 7 days and 1 minute. Find the number of trains from Chennai to Jammu which a train from Jammu to Chennai will encounter in completing its journey. (Assume all trains run exactly on time).

(a) 7   (b) 8

(c) 14   (d) 15

24. For the question above, the minimum number of rakes that the Indian Railways will have to devote for running this daily service will be:

(a) 16   (b) 32

(c) 30   (d) None of these

25. There are two candles each of the same initial length. The first candle can burn for 24 hours, while the second candle can burn for 16 hours. Both of them are lit at the same time. After sometime, it was found that one of the candles was twice as long as the second. For how long had the candle been burning?

(a) 6 hours   (b) 8 hours

(c) 10 hours   (d) 12 hours

Review Test 4

1. The menu at a local café at Mumbai reads as under:

Item		Price (`)
Samosa and Coffee	–	ac
Parathe	–	bc
Sweet Dish, Samosa and Coffee	–	bd
Samosa, Coffee and Parathe	–	ca
Parathe, Sweet Dish, Samosa and Coffee	–	db

   In the price list, each of the entry in the right hand column stands for a two digit number and each of the different letter stands for a different digit. What is the price of the sweet dish?

   (a) t`6                             (b) t`11

   (c) t`41                           (d) t`22

2. Two trains, a passenger train and a freight train, are running in the same direction on parallel railway tracks. The passenger train takes three times as long to pass the freight train as when they are going in opposite directions.

   If the trains run at uniform speeds with goods train running at a maximum speed of 25 km/h, what is the speed of passenger train (p) in km/h?

   (a) $p = 50$ (b) $p £ 50 (p > 0)$

   (c) $0 £ p £ 50$ (d) $20 £ p £ 50$

3. Rambilas, a rice merchant does not think much of ethical practice and neither does he think too much about his reputation; his only aim is to earn as much profit as possible. Which of the following would serve his purpose best?

   I. Fixing selling price one-eighth above the cost price.

   II. Mix stones (available for free) 12.5% by weight and fixing selling price at cost price

   III. Use an 8.75 kg weight for 10 kg weight and selling at cost price

   IV. Selling $15/16^{th}$ only, by cheating, of the weight kept on balance and fixing the selling price 6.25% above cost price.

   (a) I   (b) I and II

   (c) IV   (d) II and III

Directions for Questions 4 to 6: A motorboat race is held in the Suvarnarekha river in Jharkhand. The race is held over 3 stretches namely *M, N* and *O*. The maximum speed allowed in the stretch *M* is 80 km/hr and the maximum speeds allowed in stretches *N* and *O* are 65 km/hr and 30 km/hr respectively. The minimum speeds allowed over the 3 stretches are 50 km/hr, 40 km/hr and 15 km/hr respectively. Each of the stretches is 4 km in length and speed over a stretch is assumed constant. Current record for the race is 12 min. 30 sec.

4. Shoaib completes the first stretch at minimum speed but is able to maintain the same speed in the second stretch also. If he takes 60% more time than the current record, then speed of Shoalb over stretch O is approximately:

(a) 23 km/hr   (b) 17 km/hr

(c) 28.8 km/hr   (d) 32 km/hr

5. Amitabh covers stretch M at minimum speed but completes the next stretch at maximum permissible speed. What should be Amithabh's speed in the stretch O if he now aims at breaking the current record?

(a) 30 km/hr   (b) Indeterminate

(c) Breaking Record is not possible

(d) 40 km/hr

6. Steven Miles completes the race at an average speed 30 km/hr. If his average speed over stretches M and N is 300% more than his speed over stretch O, what is his speed over stretch O?

(a) 24 km/hr   (b) 27 km/hr

(c) 18 km/hr   (d) 15 km/hr

7. Ali along with his friend embarked on a boat journey. While making all his preparations for the journey, he checked with the boat manufacturer's data and was glad to learn that the boat was really dependable as it could float even if it was upto 75% full of water (with more water it could sink). Unfortunately, the boat developed a hole during his journey—the hole filling up water @ 2 liter per minute. The boat was also equipped with a drainage pump which could empty a boatful of water in 32 hrs. If Ali figures that they have a maximum of 12 hrs to reach a safe place (before they sink), what is the capacity of the boat?

(a) 1280 liter   (b) 1480 liter

(c) 1600 liter   (d) 1056 liter

8. The number of votes not cast for Pappu's party increased by $33\frac{1}{3}$ % over those not cast for it in the previous polls in the Farrukhabad city constituency where the only other candidate belongs/belonged to the Jhussu Party. If a total of 4,50,000 people voted each time and Pappu's Party loses by a majority one-third times as large as that by which it had won in the last polls, How many people voted for Pappu's Party in the current polls?

(a) 150000   (b) 210000

(c) 240000   (d) 180000

Directions for Questions 9 and 10: On the planet of Krypton (yes the same one from where Superman origninated) A small scale businessman owns an ancillary unit that manufactures 6 types of tools namely A, B, C, D, E and F. These tools for their manufacturing require work on machine X and machine Y in that order. The time taken on these machines to manufacture one unit of a tool is as follows:

Tool Æ		A	B	C	D	E	F
Time (hrs)	Machine X	6	24	10	4	18	22

	Machine Y	16	20	18	12	6	2

Presently, the businessman has received orders to manufacture one unit of each of the tools. There is no constraint to work on the machines and these machines can be run non-stop.

9. For a particular order from Earth, the tools are to be manufactured in the sequence FEBCAD, what is the minimum time taken to execute the order?

(a) 158 hrs

(b) 110 hrs

(c) 130 hrs

(d) 120 hrs

10. If a revolutionary technology is imported from the earth, the time required for working on each tool is reduced to half it's current time on both machines. With this technology in place, what is the shortest possible time in which the above order can be executed?

(a) 65 hrs

(b) 51 hrs

(c) 55 hrs

(d) None of these

11. A man can climb up a greased pole 30 ft high in 15 seconds (where 10 seconds is used for climbing up and 5 seconds when he is slipping down). If grease causes a downward slip of 2 ft a second, the time taken by the man to climb a non greased pole would be:

(a) 8 seconds

(b) 10 seconds

(c) 7.5 seconds

(d) 9 seconds

12. A state's GDP during 2011-12 grew by a healthy 6.3%. During the same period service sector growth was 7.0%: average growth for agricultural, manufacturing, and service sector (excluding ITES and IT) was 5.8%. If weightage given to agricultural sector is 25%, to manufacturing sector 42%, and to service sector as a whole 33% (IT sector 13% and ITES 9%), then what is the approximate growth rate for service sector (excluding ITES and IT)?

(a) 6.4%

(b) 5.9%

(c) 5.0%

(d) 5.8% to 7.0% (depending on weightage)

13. The village of Hara Kiri has two-thirds of its male population married to 90% of its women population. Each of such man is married to exactly two of such women. What is the minimum possible 4 digit population of the village (Children are not counted as part of the population unless they are married)?

(a) 1005

(b) 1026

(c) 1080

(d) Cannot be determined/None of these

14.
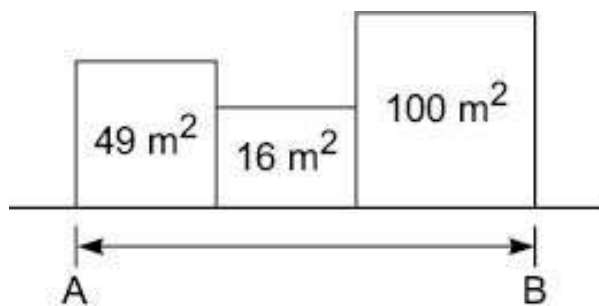
The figure contains three squares with areas of 100 m², 49 m², and 16 m² lying side by side. Rahim wishes to reduce the length *AB* to 19 m by reducing area of only one of the squares without altering its shape, what is the maximum reduction (in %) in the area of that square?

(a) (Approx) 33%

(b) 50%

(c) (Approx) 66%

(d) 75%

15. Tingal and Sagar practice in the local Gomati Nagar stadium daily. One day, they started running around the circular track simultaneously from the same point in opposite directions. Thereafter they met a total of ten times when the practice session was terminated. If they meet at a point diametrically opposite to the starting point when they meet for the second time, what could be ratio of their speed?

(a) 1 : 1

(b) 2 : 1

(c) 1 : 3

(d) Data insufficient

16. The Sinhagad Express and the Gomati Express consisting of 41 and 42 carriages respectively are traveling @ 36 kmph in opposite directions. The carriage length (including inter-carriage lengths averaged over number of carriages) averages 10 m and is half the engine length. If the trains cross each other on parallel tracks, in how much time will they complete the crossing?

(a) 1 min 20 sec

(b) 42 seconds

(c) 38 seconds

(d) 40 seconds

17. The selling price and the cost price of an article which is being sold at a profit have increased by *r*% YOY for a period of 3 years. Which of the following statements summarizes the effect of the inflationary pressure?

(a) The profitability of the article has increased at the same rate *r*% every year for the 3-year period.

(b) The profit has increased YOY at the same rate of *r*% while the profitability has remained constant.

(c) The profit has increased YOY at the same rate *r*% but profitability has increased at a rate which is less than the rate of increase of profits.

(d) The profit has increased YOY at the same rate of *r*%, while the profitability has decreased over the 3 year period.

18. The Hosur Computer Company gets a large supply order for assembled computers of two different configurations *A* and *B* from the Karnataka government. The supply order for *A*-type computers being double that of the *B*-type. A team of hardware experts was assigned the task which worked on *A*-type computers. For the second day, the team was split into two equal groups: the first

continued work on *A*-type computers and completed the work order by day end. The second group, however could not complete work order for *B*-type computers on the second day and this work order could only be completed by employing two experts for the whole of the third day. What was the strength of the team if it is known that a *B*-type computer takes 20% less time to assemble than *A*-type?

(a) 5   (b) 20

(c) 16   (d) 24

19. In a learning experiment at Stanford University it was found that the square of the inverse of learning time varies directly as the age of a rat in weeks, while the inverse of learning time and complexity index of the maze are directly related. If the age of the rat in the second trial of the experiment is 40% more than in the first trial and the learning time is 16.67% less, then find change in complexity index of the maze

(a) Increase of 10%   (b) Increase of 5%

(c) Increase of 1%   (d) Decrease of 5%

20. Ramu is standing at an intersection where two roads intersect at right angles. He observes through his binoculars that two cars start moving towards the intersection at the same time along these two roads, one of them is moving at a speed of 13.333 m/sec and starts at a point 40 km from the intersection. The second car is moving at 10 m/sec and starts at a point 50 km from the intersection. In how many minutes from the start will the distance between the two be minimum?

(a) 83 min   (b) 62 min

(c) 50 min   (d) (1) or (3)

Directions for Questions 1 and 2: Refer to data below: In a motorcycle race, three motorcycles started out. The first motorcycle was 15 km/h faster than the second, while the third was 3 km/h slower than the second. The second motorcycle driven by Ayrton Senna arrived at the finish 12 min after the first motorcycle and 3 minutes before the third one. There were no stops on route.

1. What is the length of the race?

   (a) 150 km
   (b) 72 km
   (c) 75 km
   (d) 90 km

2. What is the speed of the slowest motor cycle?

   (a) 75 km/h
   (b) 90 km/h
   (c) 72 km/h
   (d) 64 km/h

3. Naman Sweets, a sweet shop in down town Allahabad, manufactures Rossagullas for export. They are currently experimenting with an ideal sugar syrup concentration for their new product. Originally, the sugar in the syrup is $33\frac{1}{3}$ % by weight. The syrup is heated till 25% of the water in it evaporates. The resultant solution is mixed with a 40% sugar syrup in the ratio 5 : 3. The sugar syrup so obtained is again heated to evaporate $33\frac{1}{3}$ % of water in it. Find the strength of this solution assuming the solution never saturates.

   (a) 50%
   (b) slightly more than 90%
   (c) slightly more than 75%
   (d) 35%

4. Two sets of boys are playing a match of catching. It is decided that once the ball falls on the ground from the hands of a side it would get the other side as many points as the number of meters the ball travels before coming to rest and the play won't resume until that happens. It is also known that height of a fall is exactly 150% of that of the bounce for the kind of balls to be used for the match. In the first instance Raghav's team dropped the ball a height of 45 m. How many points does Shaurya's team gain?

   (a) 90
   (b) 135
   (c) 225
   (d) None of these

5. Akhilesh was experimenting with time measurement using a pair of sandglasses. The following pairs of sand glasses are available (sand glass of one pair cannot be combined with sand glass of another pair)

   A – 9 min and 12 min

   B – 4 min and 7 min

   C – 6 min and 7 min

In how many ways can he choose his pair of sand glasses in order to be able to measure exactly 15 minutes?

(a) 3   (b) 2

(c) 1   (d) None

6. In a 4000 meter race around a circular track (in the stadium at IIM Bangalore) having a circumference of 1000 meters, the fastest runner and the slowest runner reach the same point at the end of the 5th minute, for the first time after the start of the race. All the runners have the same starting point and each runner maintains a uniform speed throughout the race. If the slowest runner runs at half the speed of the fastest runner, what is the time taken by the slowest runner to finish the race?

(a) 40 min.   (b) 30 min.

(c) 20 min.   (d) 15 min.

Directions for Questions 7 and 8: Answer these questions based on the following information:

Prabhjeet made a trip from Hyderabad to Bengaluru to attend an interview. He had been traveling at a speed which would have ensured that he reaches the interview on time. He had a flat tyre on the way and it took 100 min. to mend it. He arrived 15 min. late for the interview. The distance between Bengaluru and Hyderabad is 260 km.

7. If the speed after the flat tyre was 20% more than the original speed, find the normal time taken by Prabhjeet to reach the destination from the site of the accident.

(a) 8 hr. 30 min.   (b) 1 hr. 45 min.

(c) 6 hr.   (d) 8 hr. 30 min.

8. If the normal time taken to reach Bengaluru after the start was 10 hr. at what distance from Bengaluru did the flat tyre occur? (Use data of Question 7)

(a) 39 km.   (b) 221 km.

(c) 169 km.   (d) Can't be determined

9. Steven fell in love with Ankita who lived 630 miles away. He decided to propose his beloved and invited her to travel to his place and offered to meet her en route and bring her home. Steven is able to cover 4 miles per hour to Ankita's 3 miles per hour. How far will each have travelled upon meeting?

(a) Steven = 270 miles; Ankita = 360 miles

(b) Steven = 360 miles; Ankita = 270 miles

(c) Steven = 400 miles; Ankita = 230 miles

(d) Steven = 450 miles; Ankita = 180 miles

10. The evergreen shrubs at Ramesh's nursery are planted in rows on a square plot of land measuring 2,401 sq. ft. The shrubs are planted in such a manner that the centers of the shrubs are 7 ft. apart and the outer shrubs are planted along the edges of the plot, with a shrub at each corner. Ramesh spent $1792 to cover all the costs necessary for raising this crop of the evergreen shrubs. If Ramesh succeeds in selling each shrub for $63, his profit will be what percentage of his total

cost?

(a) 100%   (b) 50%

(c) 125%   (d) 150%

11. Chashmish is repaid a loan that he had given to Mucchad such that each year the amount he gets is 1/20 lesser than what he got in the previous year. Mucchad being a sly person, decides to give Chashmish ` 2500 as a lump sum and not pay anything later. Who gains from this agreement and what is the breakeven value, if the initial installment is ` 100? (Consider no time value of money.)

(a) Chashmish, ` 2000

(b) Mucchad, ` 3000

(c) Chashmish, ` 100

(d) Mucchad, ` 10000

12. NTPC Gas power plant in Dibyapur can produce upto 120 MW of power every month. The cost of the power is partly fixed and partly varying. The cost is ` 250 million, when 80 MW are produced and it is ` 300 million, when 100 MW is produced. On the other hand, the part of selling price per unit goes on decreasing linearly as more power is consumed. The selling rate per unit is ` 3.30 at 80 MW sell and it is ` 3.20, when 100 MW power is sold. What will be the profit or loss when it produces 110 MW of power and sells it all?

(a) Profit, ` 26.5 million

(b) Profit, ` 21.5 million

(c) Loss, ` 26.5 million

(d) Loss, ` 21.5 million

13. Divyansh Awasthi buys some apples and Chikoos from the market at a rate such that a Chikoo is two times costlier than an apple and he sells them such that a Chikoo is sold at thrice the cost price of an apple. By selling the apple at twice its cost price, he makes 150% profit. Find the proportion of Chikoos to the apples.

(a) 1 : 6   (b) 3 : 4

(c) 1 : 2   (d) Cannot be determined

14. Arundhati bets a certain portion of her total money on betting. On a particular day, when she won, the betting rate was 12 : 1 (i.e. if you bet 1 rupee you stand to gain 12 rupees if you win the bet) and her total money became 8 times the initial total money. What is the proportion of her initial total money to the money she put on bet?

(a) 3 : 2   (b) 7 : 5

(c) 8 : 5   (d) None of these

15. On 26th July, Mumbai was flooded. Rainshield enterprises is in the business of manufacturing umbresllas and raincoats. An umbrella can shield 2 people while a raincoat can shield 1 person. People under an umbrella can walk at $1/3^{rd}$ the speed of a person wearing a raincoat. The cost of an umbrella and cost of the raincoat are in the ratio 2 : 5. Points A and B are 100 m apart and it takes 20 minutes for a person wearing a raincoat to travel the distance. At the maximum how many

people will be transported today from *A* to *B*, if only ` 1000 is available for transporting 20 people? Cost of traveling time is ` 2 per min. per head (Assume cost of a raincoat to be ` 100.)

(a) 6

(b) 7

(c) 4

(d) None of these

16. A manufacturing job was wrongly estimated to be completed in 10 days by *x* machines. By deploying 3 extra machines, the job was completed in 12 days. If only one additional machine was used, how many days more than that estimated would it have taken to complete the job?

(a) $\dfrac{2x-18}{x+3}$

(b) $\dfrac{2x+13}{x+1}$

(c) $\dfrac{2x+26}{x+1}$

(d) Cannot be determined

17. A tank in Gauri Apartments is full of water and is fitted with pumps of equal capacity. Besides it is also fitted with a certain number of inlet pipes which are always kept open. When the tank is full, 10 pumps of equal capacity empty the tank in 12 hrs., while 15 pumps of the same capacity empty the tank in 6 hrs. In how much time would 25 pumps of the same capacity empty the tank, if the tank is initially full? (All the pipes pouring water into the tank are always open)

(a) 3 hrs.

(b) $2\dfrac{1}{2}$ hrs.

(c) 4 hrs.

(d) $3\dfrac{1}{2}$ hrs.

18. A group of 4 people—Raghav, Golu, Shaurya and Arjit, arrive in a car to a friend's house. The group was forced to park around the corner due to lack of parking space. It was raining heavily and the group had only one umbrella. They decided to share it. Two persons would go at a time to the friends house and one of them would come back with the umbrella. The process would be repeated unless all four people reach the friends house. If Raghav, Golu, Shaurya and Arjit take 1, 2, 5 and 10 minutes respectively at their fastest speed to go to the friend's house, what is the minimum time required for all of them to reach the friend's house? (A faster person slows down to accompany a slower one)

(a) 15 mins

(b) 17 mins

(c) 22 mins

(d) 19 mins.

19. At a shooting competition, Rathore and Bindra had *x* bullets between them. Bindra fired '*a*' bullets per min. while Rathore fired '*b*' bullets per min. After time '*t*', both of them had the same number of bullets. What is the initial number of bullets with Rathore?

(a) $x - \dfrac{a+b}{2}$

(b) $x + \dfrac{t(a-b)}{2}$

(c) $\dfrac{x - t(a-b)}{2}$

(d) None of these

ANSWER KEY

Review Test 1

1. (b)	2. (c)	3. (a)	4. (a)
5. (b)	6. (c)	7. (b)	8. (b)
9. (c)	10. (c)	11. (b)	12. (a)
13. (b)	14. (d)	15. (a)	16. (b)
17. (b)	18. (c)	19. (d)	20. (c)
21. (b)	22. (c)	23. (b)	24. (b)
25. (a)	26. (a)		

Review Test 2

1. (d)	2. (a)	3. (c)	4. (c)
5. (b)	6. (d)	7. (b)	8. (d)
9. (d)	10. (c)	11. (c)	12. (c)
13. (d)	14. (c)	15. (a)	16. (a)
17. (c)	18. (a)	19. (d)	20. (c)
21. (b)	22. (d)	23. (d)	24. (b)
25. (b)			

Review Test 3

1. (c)	2. (c)	3. (b)	4. (a)
5. (c)	6. (b)	7. (a)	8. (d)
9. (a)	10. (c)	11. (b)	12. (c)
13. (b)	14. (b)	15. (c)	16. (b)
17. (b)	18. (c)	19. (b)	20. (b)
21. (d)	22. (b)	23. (d)	24. (a)
25. (d)			

Review Test 4

1. (b)	2. (b)	3. (d)	4. (a)
5. (c)	6. (d)	7. (a)	8. (b)
9. (c)	10. (a)	11. (c)	12. (c)
13. (a)	14. (d)	15. (c)	16. (c)
17. (b)	18. (b)	19. (b)	20. (b)

Review Test 5

1. (d)	2. (c)	3. (a)	4. (c)
5. (a)	6. (c)	7. (a)	8. (b)
9. (b)	10. (c)	11. (a)	12. (b)
13. (c)	14. (a)	15. (b)	16. (a)
17. (a)	18. (d)	19. (d)	