CBSE Class 10 Mathematics Basic
Sample Paper - 06 (2020-21)

Maximum Marks: 80
Time Allowed: 3 hours

General Instructions:

i. This question paper contains two parts A and B.
ii. Both Part A and Part B have internal choices.

Part – A consists 20 questions

i. Questions 1-16 carry 1 mark each. Internal choice is provided in 5 questions.
ii. Questions 17-20 are based on the case study. Each case study has 5 case-based sub-parts. An examinee is to attempt any 4 out of 5 sub-parts.

Part – B consists 16 questions

i. Question No 21 to 26 are Very short answer type questions of 2 mark each,
ii. Question No 27 to 33 are Short Answer Type questions of 3 marks each
iii. Question No 34 to 36 are Long Answer Type questions of 5 marks each.
iv. Internal choice is provided in 2 questions of 2 marks, 2 questions of 3 marks and 1 question of 5 marks.

Part-A

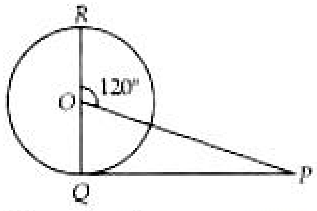
1. State whether $\frac{29}{343}$ will have terminating decimal expansion or a non-terminating repeating decimal expansion.

OR

If the product of two numbers is 2500 and their HCF is 50, find their LCM.

2. Write the nature of the roots of quadratic equation $4x^2 - 2x - 5 = 0$.
3. If $12x + 17y = 53$ and $17x + 12y = 63$ then find the value of $(x + y)$.
4. PQ is a tangent drawn from an external point P to a circle with centre O, QOR is the

diameter of the circle. If $\angle POR = 120^0$, What is the measure of OPQ?



5. What is the common difference of an A.P. in which $a_{21} - a_7 = 84$?

OR

Find the sum of n terms of the following series: $\left(4-\frac{1}{n}\right)+\left(4-\frac{2}{n}\right)+\left(4-\frac{3}{n}\right)+\ldots$

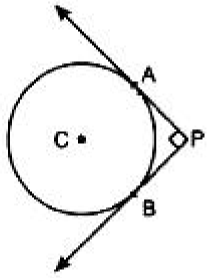
6. How many two-digit numbers are divisible by 3?

7. Determine the nature of the roots of quadratic equation: $5x^2 - 4x + 1 = 0$

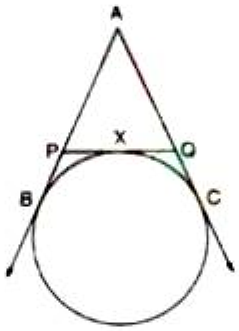
OR

Write the value of λ for which $x^2+4x+\lambda$ is a perfect square.

8. In figure, PA and PB are two tangents drawn from an external point P to a circle with centre C and radius 4 cm. If PA $\perp$ PB, find the length of each tangent.



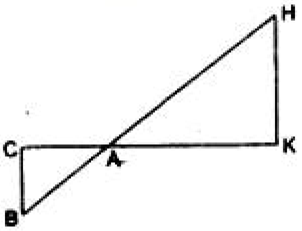
9. In the given figure, AB, AC and PQ are tangents. If AB = 5 cm, then find the perimeter of $\triangle APQ$.



OR

What term will you use for a line which intersect a circle at two distinct points?

10. In the adjoining figure, $\triangle AHK$ is similar to $\triangle ABC$. If AK = 10 cm, BC = 3.5 cm and HK = 7 cm, find AC.



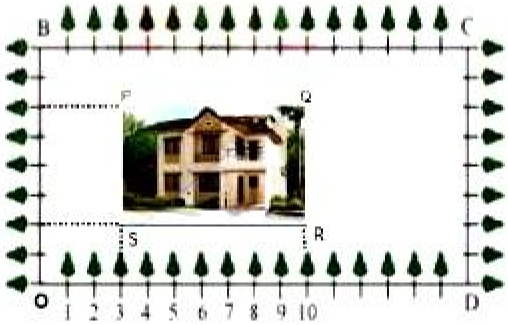
11. Find the indicated terms of the sequence whose nth terms are: $a_n = (-1)^n n$; a_3, a_5, a_8
12. Find the value of $\theta : 2\cos 3\theta = 1$
13. If $\tan\theta = \frac{1}{\sqrt{5}}$, write the value of $\frac{(cosec^2\theta - \sec^2\theta)}{(cosec^2\theta + \sec^2\theta)}$.
14. A cylinder and a cone have base radii 5 cm and 3 cm respectively and their respective heights are 4 cm and 8 cm. Find the ratio of their volumes.
15. If the numbers (2n -1), (3n + 2) and (6n-1) are in AP, find n and hence find these numbers.
16. A box contains 100 red balls, 200 yellow balls and 50 blue balls. If a ball is drawn at random from the box, then find the probability that it will be (i) a blue ball, (ii) not a yellow ball, (iii) neither yellow nor a blue ball.
17. **CASE STUDY:** CARTESIAN- PLANE

    Using Cartesian Coordinates we mark a point on a graph by **how far along** and **how far up** it is.

    The *left-right* (**horizontal**) direction is commonly called X-axis.

    The *up-down* (**vertical**) direction is commonly called Y-axis.

    In Green Park, New Delhi Ramesh is having a rectangular plot ABCD as shown in the following figure. Sapling of Gulmohar is planted on the boundary at a distance of 1m from each other. In the plot, Ramesh builds his house in the rectangular area PQRS. In the remaining part of plot, Ramesh wants to plant grass.



    i. The coordinates of vertices P and S of rectangle PQRS are respectively:
        a. (2,3), (6,3)

b. (3,2), (3,6)

c. (6,3), (2,3)

d. (3,6), (3,2)

ii. The coordinates of mid-point of diagonal QS is given by

a. $\left(\frac{13}{2}, 4\right)$

b. $\left(\frac{13}{4}, 2\right)$

c. $\left(\frac{4}{13}, 2\right)$

d. $\left(\frac{2}{13}, 4\right)$

iii. The area of rectangle PQRS is

a. 28 m^2

b. 28 km^2

c. 28m

d. 28m^3

iv. The coordinates of vertices R and Q of rectangle PQRS are respectively:

a. (10, 6), (10, 2)

b. (2, 10), (10, 6)

c. (10, 2), (10, 6)

d. (2,10), (6,1)

v. The length and breadth of rectangle PQRS respectively are:

a. 4, 7

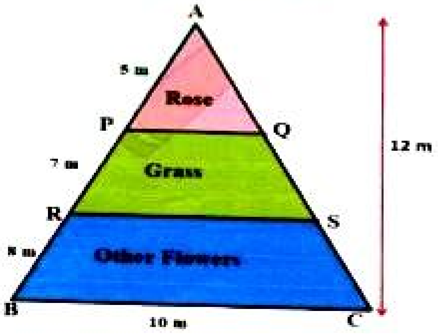
b. 7, 4

c. 6, 4

d. 4, 4

18. Shankar is having a triangular open space in his plot. He divided the land into three parts by drawing boundaries PQ and RS which are parallel to BC.

Other measurements are as shown in the figure.



i. What is the area of this land?

a. $120m^2$

b. $60m^2$

c. $20m^2$

d. $30m^2$

ii. What is the length of PQ?

a. 2.5 m

b. 5 m

c. 6 m

d. 8 m

iii. The length of RS is

a. 5 m

b. 6 m

c. 8 m

d. 4 m

iv. Area of $\triangle APQ$ is

a. $7.5\ m^2$

b. $10\ m^2$

c. $3.75\ m^2$

d. $5\ m^2$

v. What is the area of $\triangle ARS$?

a. $21.6\ m^2$

b. $10\ m^2$

c. $3.75\ m^2$

d. $6\ m^2$

19. Education with vocational training is helpful in making a student self-reliant and to help and serve the society. Keeping this in view, a teacher made the following table giving the frequency distribution of a student undergoing vocational training from the training institute.

Age (in years)	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-above

Frequency(no. of participants)	62	132	96	37	13	8	6	4	4	3

i. Median class of above data:
   a. 20 - 24
   b. 20.5 - 24.5
   c. 19.5 - 24.5
   d. 24.5 - 29.5
ii. Calculate the median.
   a. 24.06
   b. 30.07
   c. 24.77
   d. 42.07
iii. The empirical relationship between mean, median, mode:
   a. Mode = 3 Median + 2 Mean
   b. Mode = 3 Median - 2 Mean
   c. Mode = 3 Mean + 2 Median
   d. 3 Mode = Median - 2 Mean
iv. If mode = 80 and mean = 110, then find the median.
   a. 200
   b. 500

c. 190

d. 100

v. The mode is the:

a. middlemost frequent value

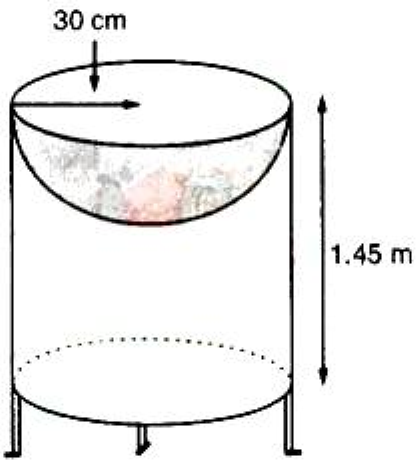
b. least frequent value

c. maximum frequent value

d. none of these

20. STUDY OF FIGURES AND SURFACES:

Mayank a student of class 7^{th} loves watching and playing with birds of different kinds. One day he had an idea in his mind to make a bird-bath on his garden. His brother who is studying in class 10^{th} helped him to choose the material and shape of the birdbath. They made it in the shape of a cylinder with a hemispherical depression at one end as shown in the Figure below. They opted for the height of the hollow cylinder as 1.45 m and its radius is 30 cm.



By using the above-given information, find the following:

i. The curved surface area of the hemisphere is:

a. $0.36\ m^2$

b. $0.46\ \mathrm{m}^2$

c. $0.26\ \mathrm{m}^2$

d. $0.56\ \mathrm{m}^2$

ii. The curved surface area of the cylinder is:

a. $0.78\pi\ \mathrm{m}^2$

b. $\frac{0.87}{2}\pi\ \mathrm{m}^2$

c. $0.87\pi^2\ \mathrm{m}^2$

d. $0.87\pi\ \mathrm{m}^2$

iii. The total surface area of the bird-bath is: (Take $\pi = \frac{22}{7}$)

a. $2.3\ \mathrm{m}^2$

b. $3.3\ \mathrm{m}^2$

c. $3.5\ \mathrm{m}^2$

d. $5.3\ \mathrm{m}^2$

iv. The Total surface area of the cylinder is given by:

a. $2\pi \times r \times h + 2\pi r^3$

b. $2\pi \times r \times h + \pi r^2$

c. $2\pi \times r \times h + 2\pi r^2$

d. $\pi \times r \times h + 2\pi r^2$

v. During the conversion of a solid from one shape to another the volume of the new shape will:

a. remain unaltered

b. decrease

c. double

d. increase

Part-B

21. Explain why $(7 \times 13 \times 11) + 11$ and $(7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1) + 3$ are composite numbers.

22. If the points (p, q), (m, n) and (p - m, q - n) are collinear, show that pn = qm.

OR

Find the points on the x-axis, each of which is at a distance of 10 units from the point

A(11, -8).

23. Find the zeros of the polynomial $x^2 + \frac{1}{6}x - 2$, and verify the relation between the coefficients and zeros of the polynomial.

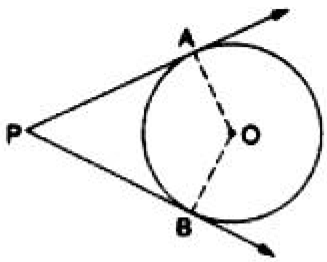
24. Draw a triangle ABC with sides BC = 6.3cm, AB = 5.2cm and $\angle ABC = 60^\circ$. Then construct a triangle whose sides are times $\frac{4}{3}$ the corresponding sides of $\triangle ABC$

25. Evaluate: $4\cot^2 45^\circ - \sec^2 60^\circ + \sin^2 60^\circ + \cos^2 90^\circ$

OR

Prove the following identity: $\cot^2 A\left(\frac{\sec A - 1}{1 + \sin A}\right) + \sec^2 A\left(\frac{\sin A - 1}{1 + \sec A}\right) = 0$

26. In the given figure, O is the centre of the circle. PA and PB are tangents. Show that AOBP is a cyclic quadrilateral.



27. If two positive integers p and q are written as $p = a^2b^3$ and $q = a^3 b$, a and b are a prime number then. Verify.LCM × (p.q.) × HCF (p.q.) = pq

28. The sum of two numbers is 15. If the sum of their reciprocals is $\frac{3}{10}$. Find the numbers.

OR

A two-digit number is 5 times the sum of its digits and is also equal to 5 more than twice the product of its digits. Find the number.

29. If α and β are the zeroes of the quadratic polynomial $3x^2 - 2x - 7$, then find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.

30. P and Q are points on the sides AB and AC respectively of a $\triangle ABC$. If AP = 2 cm, PB = 4 cm, AQ = 3 cm and QC = 6 cm, show that BC = 3PQ.

OR

ABCD is a parallelogram. AB is divided at P and CD at Q so that AP: PB = 3:2 and CQ: QD = 4: 1. If PQ meets AC at R, then prove that AR = $\frac{3}{7}$ AC.

31. A bag contains cards from 1 to 49. A card is drawn from the bag at random, after mixing

the cards thoroughly. Find the probability that the number on the drawn card is

i. an odd number
ii. a multiple of 5
iii. a perfect square
iv. an even prime number

32. As observed from the top of a light-house, 100 m high above sea level, the angle of depression of a ship, sailing directly towards it, changes from $30°$ to 60^0 . Determine the distance travelled by the ship during the period of observation. (Use $\sqrt{3}$ = 1.732)

33. Find the median for the following data:

Marks	30	35	40	45	25	70	20	60	90	15	80
Frequency	5	4	7	6	12	8	10	4	8	8	6

34. In a circle of radius 6 cm, a chord of length 10 cm makes an angle of 110° at the centre of the circle. Find:

i. the circumference of the circle,
ii. the area of the circle,
iii. the length of the arc AB,
iv. the area of the sector OAB.

35. The ratio of incomes of two persons is 11 : 7 and the ratio of their expenditures is 9 : 5. If each of them manages to save Rs 400 per month, find their monthly incomes.

36. An aeroplane flying horizontally 1 km above the ground is observed at an elevation of 60^0. After 10 seconds, its elevation is observed to 30^0. Find the speed of the aeroplane in km/hr.

CBSE Class 10 Mathematics Basic

Sample Paper - 06 (2020-21)

Solution

Part-A

1. We have,

   $\frac{29}{343} = \frac{29}{3^5}$

   Clearly, 343 is not of the form $2^m \times 5^n$.

   Hence, the decimal expansion of $\frac{29}{343}$ is non-terminating repeating

   OR

   LCM = $\frac{\text{Product of two numbers}}{\text{HCF}} = \frac{2500}{50}$ = 50

2. Given equation is $4x^2 - 2x - 5 = 0$

   Here $a = 4, b = -2, c = -5$

   $D = b^2 - 4ac =$ $(-2)^2 - 4 \times 4 \times (-5) = 84$

   $\because$ D > 0 therefore given quadratic equation has two unequal real roots.

3. $12x + 17y = 53$............(i)

   and $17x + 12y = 63$.....(ii)

   Adding (i) and (ii), we get

   $29x + 29y = 116$

   $\Rightarrow$ x + y = 4

4. PQ is a tangent drawn from an external point P to a circle with centre O, QOR is the diameter of the circle. If $\angle$POR = 120°, we need to find the measure of OPQ.

   In $\triangle OQP$, $\angle POR = \angle OQP + \angle OPQ$ (Exterior angle)

   $\therefore \angle OPQ = \angle POR - \angle OQP$

   = $120^\circ - 90^\circ$

   $= 30^\circ$

5. Let a be first term and d be the common difference.

   $a_{21} - a_7 = 84$

   $a + (21-1)d - a + (7-1)d = 84$

   $a + 20d - a - 6d = 84$

   $14d = 84$

$d = 6$

Therefore, common difference is 6.

OR

Required sum = (4 + 4 + ...n terms) - ($\frac{1}{n}$ + $\frac{2}{n}$ + ... + $\frac{n}{n}$)

= 4n - $\frac{n}{2}$ ($\frac{1}{n}$ + $\frac{n}{n}$) [sum = $\frac{n}{2}$ (a + l)

= 4n - $\frac{(1+n)}{2}$ = $\frac{1}{2}$ (7n - 1).

6. The two -digit numbers divisible by 3 start from 12,15,18,21,...,99

   Here,

   a = 12

   d = 3

   a_n = a + (n - 1)d

   ⇒ 99 = 12 + (n - 1)(3)

   ⇒ 99 = 12 + 3n - 3

   ⇒ 90 = 3n

   ⇒ n = 30

   Thus, 30 two-digit numbers are divisible by 3.

7. Given: $5x^2 - 4x + 1 = 0$

   Comparing with standard quadratic equation $ax^2 + bx + c = 0$

   a = 5, b = -4, c = 1

   Discriminant, D = b^2 - 4ac

   = $(-4)^2$ - 4.5.1

   = 16 - 20 = -4 < 0

   Hence the equation has no real roots.

OR

According to the question the quadratic equation is $x^2 + 4x + \lambda$ = 0

This equation represent a perfect square, if its discriminant, D = 0

∴ $(4)^2 - 4(1)(\lambda) = 0$

∵ D = b^2 - 4ac

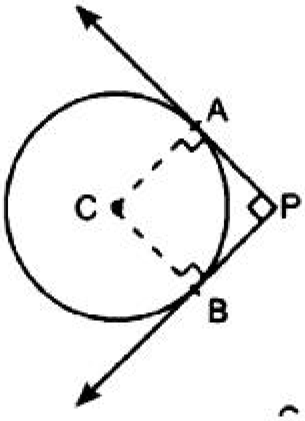
⇒ $16 - 4\lambda$ = 0

$\Rightarrow 4\lambda = 16$

$\Rightarrow \lambda = 4$

Thus, the value of λ is 4.

8. PA and PB are two tangents drawn from an external point P to a circle.



CA $\perp$ AP

CB $\perp$ BP

PA $\perp$ PB

$\therefore$ BPAC is a square.

$\Rightarrow$ AP = PB = BC = 4cm

9. Let PQ touch the circle at point R.

We know that,tangents drawn from a external point to a circle are equal in length.

$\therefore$ AB = AC = 5 cm

$\Rightarrow$ AP + BP = AQ + QC = 5 cm

$\Rightarrow$ AP + PR = AQ + QR = 5 cm ...(i) [$\because$ BP = PR and QC = QR]

Now,Perimeter of $\triangle APQ$ = Addition of all three sides = AP + PQ + AQ

= AP + RP + QR + AQ [$\because$ from (i)]

= 5 + 5

= 10 cm

The perimeter of $\triangle APQ$ is 10 cm.

OR

A line that interests a circle at two points in a circle is called a Secant.

10. $\triangle AHK \sim \Delta ABC$

$\Rightarrow \frac{AK}{AC} = \frac{HK}{BC}$

$\Rightarrow \frac{10}{x} = \frac{7}{3.5}$, when AC = x cm

$\Rightarrow \quad x = \frac{10\times3.5}{7} = 5$

$\therefore$ AC = 5 cm.

11. $a_n = (-1)^n n$

we need to find a_3, a_5 and a_8

Put n = 3

$a_3 = (-1)^3 (3) = -3$

Put n = 5

$a_5 = (-1)^5 (5) = -5$

Put n = 8

$a_8 = (-1)^8 (8) = 8$

12. Now we have,

$2\cos 3\theta = 1$

$\Rightarrow \cos 3\theta = \frac{1}{2}$

$\Rightarrow \cos 3\theta = \cos 60^\circ$ [Since, cos60°=(1/2)]

$\Rightarrow 3\theta = 60^\circ$

$\therefore \theta = 20^\circ$

13. $\tan\theta = \frac{1}{\sqrt{5}} \Rightarrow \tan^2\theta = \frac{1}{5}$

$\Rightarrow \sec^2\theta = 1 + \tan^2\theta = 1 + \frac{1}{5} = \frac{5+1}{5} = \frac{6}{5}$

now, $\operatorname{cosec}^2\theta = 1 + \cot^2\theta = 1 + (\sqrt{5})^2 = 1 + 5 = 6$

$\therefore \frac{\operatorname{cosec}^2\theta - \sec^2\theta}{\operatorname{cosec}^2\theta + \sec^2\theta} = \frac{6-\frac{6}{5}}{6+\frac{6}{5}} = \frac{\frac{30-6}{5}}{\frac{30+6}{5}} = \frac{24}{36} = \frac{2}{3}$.

14. Radius of the cylinder = 5cm

Height of the cylinder = 4cm

Volume of cylinder $= \pi(5)^2 \times 4\text{cm}^3$

$= 100\pi\text{cm}^3$

Radius of the cone = 3cm

Height of the cone = 8cm

Volume of cone $= \frac{1}{3}\pi \times 3^2 \times 8$

$= 24\pi cm^3$

Required ratio = Volume of cylinder : Volume of cone

$\therefore$ Required ratio $= 100\pi : 24\pi$

= 25 : 6.

15. Since (2n -1), (3n + 2) and (6n -1) are in AP, we have

(3 n + 2) - (2n -1) = (6n -1) - (3n + 2)

$\Rightarrow$ n + 3 = 3n - 3

$\Rightarrow$ 2n = 6 $\Rightarrow$ n= 3.

Hence, n = 3 and these numbers are 5,11 and 17.

16. Total number of all possible outcomes = total number of balls

= 100 + 200 + 50 = 350.

i. Number of blue balls = 50.

$\therefore$ P(getting a blue ball) $= \frac{50}{350} = \frac{1}{7}$.

ii. Number of balls which are not yellow = 100+50 = 150.

$\therefore$ P(getting a ball which is not yellow) $= \frac{150}{350} = \frac{3}{7}$.

iii. Number of balls which are neither yellow nor blue = 100.

$\therefore$ P(getting a ball which is neither yellow nor blue)

$= \frac{100}{350} = \frac{2}{7}$.

17. i. (d) The perpendiculars from P, Q, R and S intersect the x-axis at 3, 10, 10 and 3 respectively.

Also, the perpendiculars from P, Q, R and S intersect the y-axis at 6, 6, 2, 2 respectively.

Hence coordinates of P and S are: P(3, 6) and S(3, 2).

ii. (b) Let M be the mid-point of QS.

So using mid-point formula, Coordinates of M are $\left(\frac{3+10}{2}, \frac{2+6}{2}\right) = \left(\frac{13}{2}, 4\right)$

iii. (a) Now, PQ $= \sqrt{(10-3)^2 + (6-6)^2} = \sqrt{49} = 7$ m

PS $= \sqrt{(3-3)^2 + (2-6)^2} = \sqrt{16} = 4$ m

Hence, area of rectangle PQRS = PQ $\times$ PS = 7 $\times$ 4 = 28 m^2

iv. (c) R(10, 2), Q(10, 6)

v. (b) 7, 4

18. i. (b) 60 m^2

ii. (a) 2.5 m

iii. (b) 6 m

iv. (c) 3.75 m^2

v. (a) 21.6 m^2

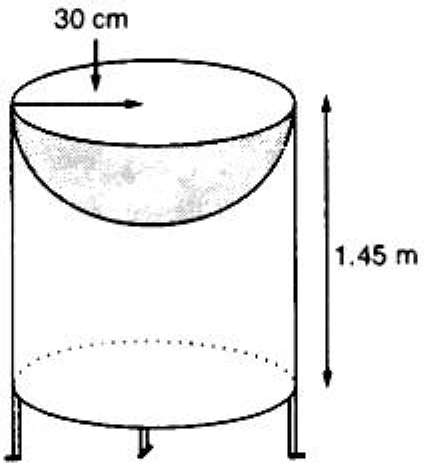
19. i. (c) 19.5 - 24.5

ii. (a) 24.06

iii. (b) Mode = 3 Median - 2 Mean

iv. (d) 100

v. (c) maximum frequent value

20. 

Let r be the common radius of the cylinder and hemisphere and h be the height of the hollow cylinder.

Then, r = 30 cm and h = 1.45 m = 145 cm.

i. (d) Curved surface area of the hemisphere = $2\pi r^2$

$= 2 \times 3.14 \times 30^2 = 0.56\ m^2$

ii. (d) Curved surface area of the cylinder = $2\pi rh = 2 \times \pi \times 0.3 \times 1.45 = 0.87\pi\ m^2$

iii. (b) Let S be the total surface area of the bird-bath.

S = Curved surface area of the cylinder + Curved surface area of the hemisphere

$\Rightarrow \quad S = 2\pi rh + 2\pi r^2 = 2\pi r(h + r)$

$\Rightarrow \quad S = 2 \times \frac{22}{7} \times 30(145 + 30) = 33000\ cm^2 = 3.3\ m^2$

iv. (c) $2\pi \times r \times h + 2\pi r^2$

v. (a) remain unaltered

Part-B

21. $(7 \times 13 \times 11) + 11 = 11 \times (7 \times 13 + 1)$

$= 11 \times (91 + 1)$

$= 11 \times 92$

$= 11 \times 2 \times 2 \times 23$

Hence the given number has 2,11 and 23 as its factors other than 1 and number itself.

Therefore, it is a composite number.

and $(7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1) + 3$

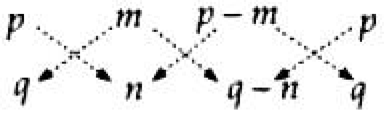
$= 3(7 \times 6 \times 5 \times 4 \times 2 \times 1) + 1$

$= 3 \times (1681) = 3 \times 41 \times 41$

Hence the given number has 3 and 41 as its factors other than 1 and number itself.

Therefore, it is a composite number.

22. Given points are collinear. Therefore



$[p \times n + m(q - n) + (p - m) q] - [m \times q + (p - m) n + p (q - n)] = 0$

$\Rightarrow (pn + qm - mn + pq - mq) - (mq + pn - mn + pq - pn) = 0$

$\Rightarrow (pn + p q - mn) - (mq - mn + pq) = 0$

$\Rightarrow pn - mq = 0$

$\Rightarrow pn = qm$

OR

Let P(x, 0) be the point on the x - axis. Then, as per the question, we have

AP = 10

$\Rightarrow \sqrt{(x-11)^2 + (0+8)^2} = 10$

Squaring both sides,

$\Rightarrow (x - 11)^2 + 8^2 = 100$

$\Rightarrow (x - 11)^2 = 100 - 64 = 36$

$\Rightarrow x - 11 = \pm 6$

$\Rightarrow x = 11 \pm 6$

$\Rightarrow x = 11 - 6, 11 + 6$

$\Rightarrow x = 5, 17$

Hence, the points on the x - axis are (5, 0) and (17, 0).

23. Let $f(x) = x^2 + \frac{1}{6} x - 2$.

Then, $f(x) = \frac{1}{6}(6x^2 + x - 12) = \frac{1}{6}(6x^2 + 9x - 8x - 12)$

$\Rightarrow f(x) = \frac{1}{6}\{(6x^2 + 9x) - (8x + 12)\}$

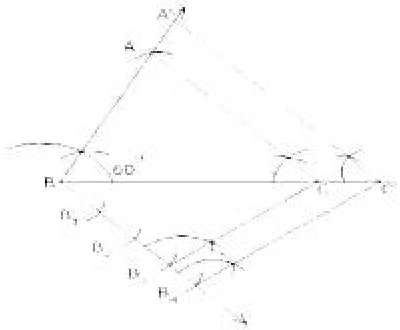
$= \frac{1}{6}\{3x(2x + 3) - 4(2x + 3)\}$

$= \frac{1}{6}(2x + 3)(3x - 4)$

Now for f(x)=0, we get

$x = -\frac{3}{2} \text{ or } x = \frac{4}{3}$

Hence, $\alpha = \frac{-3}{2} and \beta = \frac{4}{3}$ are the zeros of the given polynomial.
$Now\ \alpha + \beta = \frac{-3}{2} + \frac{4}{3} = \frac{-9+8}{6} = -\frac{1}{6}$
and $\alpha\beta = \frac{-3}{2} \times \frac{4}{3} = -2$
The given polynomial is f(x) $= x^2 + \frac{1}{6}x - 2$.
so a = 1 b = $\frac{1}{6}$ c = -2
$\alpha + \beta = -\frac{b}{a} = \frac{-\frac{1}{6}}{1} = -\frac{1}{6}$
and $\alpha\beta = \frac{c}{a} = \frac{-2}{1} = -2$
Hence, the relation between the coefficients and zeros is verified.

24. 

Steps of construction:

i. Draw a line segment BC = 6.3cm.
ii. At B make $\angle CBX = 60^\circ$
iii. With B as centre and radius equal to 5.2cm, draw an arc intersecting BX at A.
iv. Join AC, then $\triangle$ABC is the required triangle.
v. Draw any ray by making an acute angle with BC on the opposite side to the vertex A.
vi. Locate the points B_1, B_2, B_3 and B_4 on BY so that $BB_1 = B_1B_2 = B_2B_3 = B_3B4$.
vii. Join B_3 to C and draw a line through B_4 parallel to B_3C intersecting the extended line segment BC at C'.
viii. Draw a line through C' parallel to CA intersecting the extended line segment BA at A'. Thus, $\triangle$A'BC' is the required triangle.

25. We have,
$4\cot^2 45^\circ - \sec^2 60^\circ + \sin^2 60^\circ + \cos^2 90^\circ$
$= 4(\cot 45^\circ)^2 - (\sec 60^\circ)^2 + (\sin 60^\circ)^2 + (\cos 90^\circ)^2$
$= 4 \times (1)^2 - (2)^2 + \left(\frac{\sqrt{3}}{2}\right)^2 + 0 = 4 - 4 + \frac{3}{4} + 0 = \frac{3}{4}$

OR

On simplifying each term separately, we get

$$\frac{\cos^2 A}{\sin^2 A}\left(\frac{\sec A-1}{1+\sin A}\right)+\sec^2 A\left(\frac{\sin A-1}{1+\sec A}\right)$$

$$\frac{(1-\sin^2 A)(\sec A-1)}{(1-\cos^2 A)}+\sec^2 A\left(\frac{\sin A-1}{1+\sec A}\right)$$

$$=\frac{(1-\sin A)\sec^2 A}{(1+\sec A)}-\frac{\sec^2 A(1-\sin A)}{1+\sec A}=0$$

26. We know that the radius and tangent are perpendicular at their point of contact

$\because \angle OBP=\angle OAP=90^\circ$

Now, In quadrilateral AOBP

$\angle APB+\angle AOB+\angle OBP+\angle OAP=360^\circ$

$\Rightarrow \angle APB+\angle AOB+90^\circ+90^\circ=360^\circ$

$\Rightarrow \angle APB+\angle AOB=180^\circ$

Since, the sum of the opposite angles of the quadrilateral is 180°

Hence, AOBP is a cyclic quadrilateral.

27. Given, $p = a^2b^3$

and $q = a^3b$

$HCF(p,q) = a^2b$

$LCM(p, q) = a^3b^3$

$pq = a^2b^3 \times a^3b = a^5b^4$ ...(1)

$LCM(p, q) \times HCF(p, q) = a^3 b^3 \times a^2 b = a^5 b^4$ ... (2)

From equation (1) and (2) We get

$LCM(p, q) \times HCF(p, q) = pq$

28. Let the numbers be x and 15 - x.

According to question,

$\frac{1}{x}+\frac{1}{15-x}=\frac{3}{10}$

$\Rightarrow \quad \frac{15-x+x}{x(15-x)}=\frac{3}{10}$

$\Rightarrow \quad \frac{15}{x(15-x)}=\frac{3}{10}$

$\Rightarrow 150=3x(15-x)$

$\Rightarrow 150=45x-3x^2$

$\Rightarrow 150=3(15x-x^2)$

$\Rightarrow x^2 - 15x + 50 = 0$

$\Rightarrow x^2 - 10x - 5x + 50 = 0$

$\Rightarrow$ x(x - 10) - 5(x -10) = 0

$\Rightarrow$ (x - 10)(x - 5) = 0

$\Rightarrow$ x - 10 = 0 or, x - 5 = 0

$\Rightarrow$ x = 10 or, x = 5

Therefore, the two numbers are 10 and 5

OR

Let the digit at tens' place be 'x' and digit at ones' place be 'y'.

Hence, the number is 10x + y.

It is given that the number is 5 times the sum of its digits.

So,10x + y = 5(x + y)$\Rightarrow$ 10x+y=5x+5y$\Rightarrow$ 4y = 5x.

$\Rightarrow$ y = $\frac{5x}{4}$ ......(i)

Also, given that the number is 5 more than twice the product of its digits.

Hence, 10x + y = 2xy + 5

$\Rightarrow 10x + \frac{5x}{4} = 2x \times \frac{5x}{4} + 5$ [using (i)]

$\Rightarrow \frac{40x + 5x}{4} = \frac{10x^2 + 20}{4}$

$\Rightarrow 45x = 10x^2 + 20$

$\Rightarrow 10x^2 - 45x + 20 = 0$

$\Rightarrow 2x^2 - 9x + 4 = 0$

Dividing both sides by 5

$\Rightarrow 2x^2 - 8x - x + 4 = 0$

$\Rightarrow 2x(x - 4) - 1(x - 4) = 0$

$\Rightarrow 2x - 1 = 0$ or x - 4 = 0

$\Rightarrow x = \frac{1}{2}$ or x = 4

$x \neq \frac{1}{2}$ (since it is not a digit)

So, x = 4

so, from (i),

$y = \frac{5x}{4} = \frac{5 \times 4}{4} = 5$

Hence the number 10x + y= $10 \times 4 + 5 = 45$

29. The given polynomial is $3x^2 - 2x - 7 = 0$

a = 3, b = - 2, c = –7

Let zeroes be α, β

Sum of zeroes $\alpha + \beta = \frac{-b}{a} = \frac{-(-2)}{3} = \frac{2}{3}$

Product of zeroes $\alpha \times \beta = \frac{c}{a} = \frac{-7}{3}$

$\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2+\beta^2}{\alpha\beta}$

$= \frac{(\alpha+\beta)^2-2\alpha\beta}{\alpha\beta}$

$= \frac{\left(\frac{2}{3}\right)^2-2\left(-\frac{7}{3}\right)}{-\frac{7}{3}}$

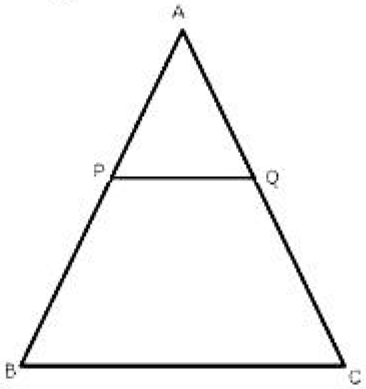
$= \frac{\frac{4}{9}+\frac{14}{3}}{-\frac{7}{3}}$

$= \frac{\frac{4+42}{9}}{-\frac{7}{3}}$

$= \frac{\frac{46}{9}}{-\frac{7}{3}}$

$= \frac{46}{9} \times \frac{-3}{7}$

$= \frac{-46}{21}$

30. 

It is given that, AP = 2 cm, PB = 4 cm, AQ = 3 cm, and QC = 6 cm.

To Prove: BC = 3PQ

Proof: From the given figure, we have AB = AP + PB = 2 + 4 = 6 cm and AC = AQ + QC = 3 + 6 = 9 cm.

Now, $\frac{AP}{PB} = \frac{2}{4} = \frac{1}{2}$

and $\frac{AQ}{QC} = \frac{3}{6} = \frac{1}{2}$

$\Rightarrow \frac{AP}{PB} = \frac{AQ}{QC}$

$\Rightarrow \angle A = \angle A$

Therefore, by SAS criteria of similarity, we obtain

$\triangle APQ \sim \triangle ABC$

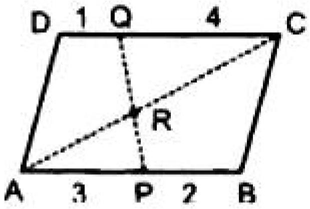
$\Rightarrow \frac{AP}{AB} = \frac{PQ}{BC} = \frac{AQ}{AC}$

$\Rightarrow \frac{PQ}{BC} = \frac{AQ}{AC}$

$\Rightarrow \frac{PQ}{BC} = \frac{3}{9}$
$\Rightarrow$ BC = 3PQ

OR

Let AB = DC = x
AP = $\frac{3}{5}$ AB = $\frac{3}{5}$ x
QC = $\frac{4}{5}$ DC = $\frac{4}{5}$ x



Now, in ARP and CRQ

$\angle \mathrm{PAR} = \angle \mathrm{RCQ}$

Also, $\angle ARP = \angle CRQ$ (alternate interior angles $\because$ AB $\|$ CD)

$\therefore \quad \triangle \mathrm{ARP} \sim \triangle \mathrm{CRQ}$ (Vertically opposite angles)

$\Rightarrow \quad \frac{\mathrm{RC}}{\mathrm{AR}} = \frac{\mathrm{QC}}{\mathrm{AP}} \Rightarrow \frac{\mathrm{RC}}{\mathrm{AR}} = \frac{\frac{4}{5}x}{\frac{3}{5}x} = \frac{4}{3}$ (AA similarity)

Using components,

$\frac{\mathrm{RC+AR}}{\mathrm{AR}} = \frac{4+3}{3} \Rightarrow \frac{\mathrm{AC}}{\mathrm{AR}} = \frac{7}{3} \Rightarrow \mathrm{AR} = \frac{3}{7}\mathrm{AC}$

31. Total no of cards = 49

Total outcomes = 49

i. Let A be event of getting an odd number

Total odd numbers = 1, 3......49

This is an A.P. with first term = 1, common difference = 2 and last term = 49

We need to find, number of terms = n

Applying the formula for nth terms of an A.P,

$a_n = a + (n - 1)d$

49 = 1 + (n – 1)2

2n – 2 + 1 = 49

2n – 1 = 49

2n = 50

n = 25

So, number of favourable outcomes = 25

P(A) = $\frac{25}{49}$

ii. Let B be event of getting a multiple of 5

No. of a perfect square from 1 to 49 are = 9

Favouring outcomes = 9

P(B) = $\frac{9}{49}$

iii. Let C be event of getting a perfect square

No. of a perfect square from 1 to 49 are = 1,4,9,16,25,36,49

Favouring outcomes = 7

P(C) = $\frac{7}{49} = \frac{1}{7}$

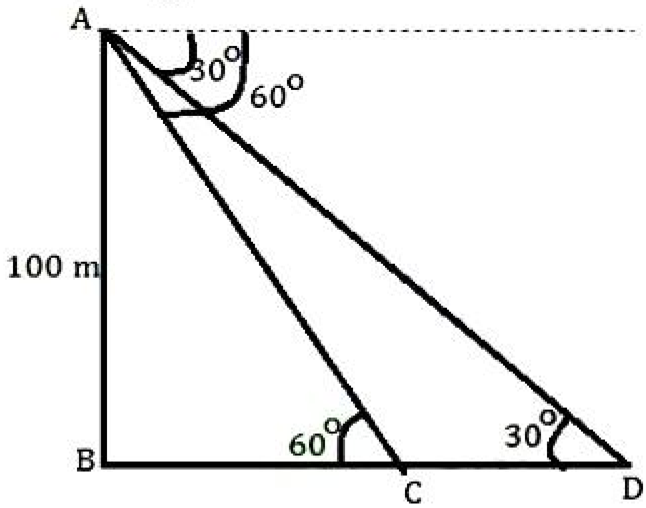
iv. Let D be event of getting an even prime number.

No. of an even prime number from 1 to 49 are = 1 (2 only)

Favouring outcomes = 1

P(D) = $\frac{1}{49}$

32.



Height of the tower = 100 m

Let BC = x and BD = y

Consider the $\triangle ABC$,

$\frac{AB}{BC} = \tan 60^\circ$

$\Rightarrow \frac{100}{x} = \sqrt{3}$

$\Rightarrow x = \frac{100}{\sqrt{3}} m$

Consider the $\triangle ABD$,

$\frac{AB}{BD} = \tan 30^\circ$

$\frac{1}{\sqrt{3}} = \frac{100}{y}$

$y=100\sqrt{3}$

We know that ,

BD = BC + CD

y = x + CD

CD = y - x

= $100\sqrt{3}-\frac{100}{\sqrt{3}}$

$=\frac{200}{\sqrt{3}}\mathrm{m}$

$=\frac{200\sqrt{3}}{3}\mathrm{m}$

$=115.466\mathrm{m}$

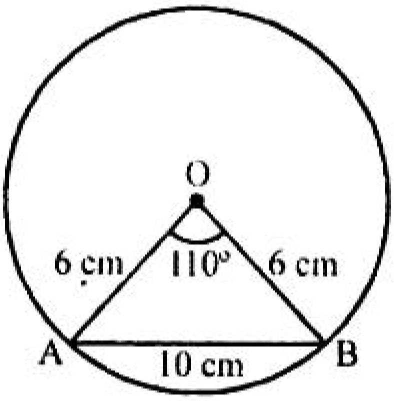
33. Table:

Marks	Frequency	c.f.
15	8	8
20	10	18
25	12	30
30	5	35
35	4	39
40	7	46
45	6	52
60	4	56
70	8	64
80	6	70
90	8	78

N = 78

Median = average of 39th and 40th observation

Median = $\frac{35+40}{2}$ = 37.5

34. 

Radius of the circle(r) = 6 cm

Length of chord = 10 cm

and central angle = 110°

i. Circumference of the circle = $2\pi r$

$= 2 \times 6 \times 3.14 = 37.68$

ii. Area of the circle = $\pi r^2 = 3.14 \times 6 \times 6 \mathrm{cm}^2$

= 113.04 cm^2

iii. Length of the arc =$2\pi r \times \frac{\theta}{360^{\circ}}$

$= 2 \times 3.14 \times 6 \times \frac{110^{\circ}}{360^{\circ}} \mathrm{cm}$

$= 12 \times 3.14 \times \frac{11}{36} = \frac{34.54}{3} = 11.51 \mathrm{cm}$

iv. Area of the sector OAB = $\pi r^2 \times \frac{\theta}{360^{\circ}}$

$= 3.14 \times 6 \times 6 \times \frac{110^{\circ}}{360^{\circ}} \mathrm{cm}^2$

$= 36 \times 3.14 \times \frac{11}{36} \mathrm{cm}^2 = 34.54 \mathrm{cm}^2$

35. Let the incomes of two persons be 11x and 7x.

And the expenditures of two persons be 9y and 5y

$\therefore 11x - 9y = 400$....(i)

$7x - 5y = 400$ ....(ii)

Multiplying (i) by 5 and (ii) by 9 and subtracting,

$$\begin{array}{r} 55x - 45y = 2{,}000 \\ 63x - 45y = 3{,}600 \\ - \quad + \qquad - \\ \hline \end{array}$$

$-8x = -1600$

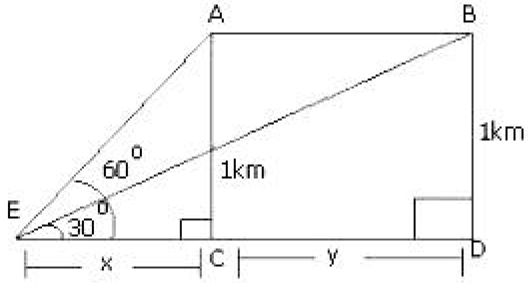
$\therefore -8x = -1600$

$x = \frac{-1{,}600}{-8} = 200$

Therefore, Their monthly incomes are

11 × 200 = Rs 2200

7×200 = Rs1400

36. 

In right $\triangle ACE$

$\frac{AC}{x} = \tan 60^\circ$

$\Rightarrow \frac{1}{x} = \frac{\sqrt{3}}{1}$

$\Rightarrow x = \frac{1}{\sqrt{3}} m$

In right $\triangle BDE$

$\frac{1}{x+y} = \tan 30^\circ$

$\Rightarrow \frac{1}{\frac{1}{\sqrt{3}}+y} = \frac{1}{\sqrt{3}}$

$\Rightarrow \frac{\sqrt{3}}{1+\sqrt{3}y} = \frac{1}{\sqrt{3}}$

$\Rightarrow 1 + \sqrt{3y} = 3$

$\Rightarrow y = \frac{2}{\sqrt{3}} km$

Speed = $\frac{distance}{time}$

$= \frac{\frac{2}{\sqrt{3}}}{\frac{10}{3600}}$

$= 240\sqrt{3}\text{km/hr}$