CBSE Sample Paper-01
SUMMATIVE ASSESSMENT –II
MATHEMATICS
Class – IX

Time allowed: 3 hours   Maximum Marks: 90

General Instructions:

a) All questions are compulsory.
b) The question paper consists of 31 questions divided into five sections – A, B, C, D and E.
c) Section A contains 4 questions of 1 mark each which are multiple choice questions, Section B contains 6 questions of 2 marks each, Section C contains 8 questions of 3 marks each, Section D contains 10 questions of 4 marks each and Section E contains three OTBA questions of 3 mark, 3 mark and 4 mark.
d) Use of calculator is not permitted.

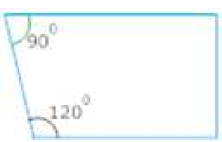
Section A

1. The diameter of a right circular cylinder is 21 cm and its height is 8 cm. The volume of the cylinder is

2. If the mean of 2, 4, 6, 8, x, y is 5 then find the value of x+y.

3. There are 5 balls, each of the colours white, blue, green, red and yellow in a bag. If 1 balls is drawn from the bag, then the Probability that the ball drawn is red is

4. Find the measure of angle a



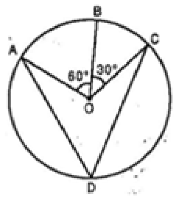
Section B

5. A cubical box has each edge 10 cm and a cuboidal box is 10 cm wide, 12.5 cm long and 8 cm high.

(i) Which box has the greater lateral surface area and by how much?
(ii) Which box has the smaller total surface area and how much?

6. Parveen wanted to make a temporary shelter for her car, by making a box-like structure with tarpaulin that covers all the four sides and the top of the car (with the front face as a flap which can be rolled up). Assuming that the stitching margins are very small and therefore negligible, how much tarpaulin would be required to make the shelter of height 2.5 m with base simensions 4 m x 3 m?

7. In figure, A, B, C are three points on a circle with centre O such that $\angle BOC = 30^{\circ}, \angle AOB = 60^{\circ}$. If D is a point on the circle other than the arc ABC, find $\angle ADC$.



8. If E, F, G and H are respectively the mid-points of the sides of a parallelogram ABCD, show that ar (EFGH) = $\frac{1}{2}$ ar (ABCD).

9. The value of π upto 15 decimal places is : 3. 419078023195679

(i) List the digits from 0 to 9 & make frequency distributions of the digit after the decimal points.

(ii) What are the most * the least frequently occurring digits?

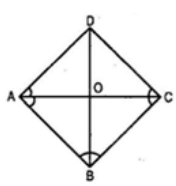
10. A random survey of the number of children of various age grout playing in the park was found:

Age [in years]	1 – 2	2 – 3	3 – 5	5 – 7	7 – 10
No. of children	3	5	7	10	13

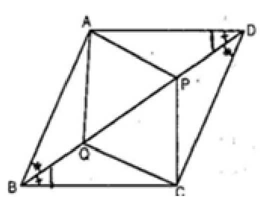
Draw a histogram to represent the data above?

Section C

11. ABCD is a rhombus. Show that the diagonal AC bisects $\angle A$ as well as $\angle C$ and diagonal BD bisects $\angle B$ as well as $\angle D$.



12. In parallelogram ABCD, two points P and Q are taken on diagonal BD such that DP = BQ (See figure). Show that:



(i) $\Delta APD \cong \Delta CQB$

(ii) AP = CQ

(iii) $\Delta AQB \cong \Delta CPD$

(iv) AQ = CP

(v) APCQ is a parallelogram.

13. Draw different pairs of circles. How many points does each pair have in common? What is the maximum number of common points?

14. The radius of a spherical balloon increases from 7 cm to 14 cm as air is being pumped into it. Find the ratio of surface areas of the balloon in the two cases.

15. A village having a population of 4000 requires 150 litres of water per head per day. It has a tank measuring 20 m by 15 m by 6 m. For how many days will the water of this tank last?

16. A godown measures 40 m x 25 m x 15 m. Find the maximum number of wooden crates each measuring 1.5 m x 1.25 m x 0.5 m that can be stored in the godown.

17. If the mean of 8 observation x, x + 1, x + 3, x + 4, x + 5, x + 6, x + 7 is 50, find the mean of first 5 observation

18. The ages of 30 workers in a factory are as follows

Age (in yrs)	21-23	23-25	25-27	27-29	29-31	31-33	33-35
workers	3	4	5	6	5	4	3

Find the probability that the age of a works lies in the interval

(i) 27-29

(ii) 29-35

(iii) 21-27

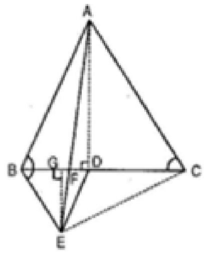
Section D

19. Construct a triangle ABC, in which $\angle B = 60°, \angle C = 45°$ and $AB + BC + CA = 11cm$

20. Construct a triangle PQR in which QR=6cm $\angle Q = 60°$ and $PR - PQ = 2cm$

21. Three girls Reshma, Salma and Mandip are standing on a circle of radius 5 m drawn in a park. Reshma throws a ball to Salma, Salma to Mandip, Mandip to Reshma. If the distance between Reshma and Salma and between Salma and Mandip is 6 m each, what is the distance between Reshma and Mandip?

22. In figure, ABC and BDF are two equilateral triangles such that D is the mid-point of BC. If AE intersects BC at F, show that:



(i) ar (BDE) = $\frac{1}{4}$ ar (ABC)

(ii) ar (BDE) = $\frac{1}{2}$ ar (BAE)

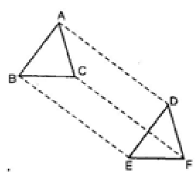
(iii) ar (ABC) = 2 ar (BEC)

(iv) ar (BFE) = ar (AFD)

(v) ar (BFE) = 2 ar (FED)

(vi) ar (FED) = $\frac{1}{8}$ ar (AFC)

23. An ΔABC and ΔDEF, AB = DE, AB || DE, BC = EF and BC || EF. Vertices A, B and C are joined to vertices D, E and F respectively (See figure). Show that:



(i) Quadrilateral ABED is a parallelogram.

(ii) Quadrilateral BEFC is a parallelogram.

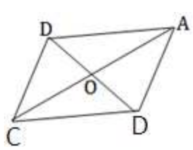
(iii) AD || CF and AD = CF

(iv) Quadrilateral ACFD is a parallelogram.

(v) AC = DF

(vi) ΔABC $\cong$ ΔDEF

24. In figure, diagonals AC and BD of quadrilateral ABCD intersect at O such that OB = OD. If AB = CD, then show that:



(i) ar (DOC) = ar (AOB)

(ii) ar (DCB) = ar (ACB)

(iii) DA|| CB or ABCD is a parallelogram.

25 A solid cube of side 12 cm is cut into eight cubes of equal volume. What will be the side of the new cube? Also, find the ratio between their surface areas.

26. The volume of a right circular cone is 9856 cm^3. If the diameter of the base if 28 cm, find:

(i) Height of the cone
(ii) Slant height of the cone
(iii) Curved surface area of the cone.

27. The average score of girls in class examination in a school is 67 and that of boys is 63. The average score for the whole class is 64.5 find the percentage of girls and boys in the class.

28. And organization selected 2400 families at random and surveyed them to determine a relationship between income level and the number of vehicles in a family. The information gathered is listed in the table below:

Monthly income (in Rs)	Number of Vehicles per family			
	0	1	2	Above 2
Less than 7000	10	160	25	0
7000-10000	0	305	27	2
10000-13000	1	535	29	1
13000-16000	2	469	59	25
16000 or more	1	579	82	88

Suppose a family is chosen. Find the probability that the family chosen is:

(i) earning Rs 10000 – 13000 Per month and owning exactly 2 vehicles

(ii) earning Rs 16000 or more per month and owning exactly 1 vehicle

(iii) Earning less than Rs 7000 Per month and not own any vehicle.

(iv) Earning Rs 13000-16000 per month and owning more than 2 vehicles

(v) Owning not more than 1 vehicle.

29. OTBA Question for 3 marks from Algebra. Material will be supplied later.

30. OTBA Question for 3 marks from Algebra. Material will be supplied later.

31. OTBA Question for 4 marks from Algebra. Material will be supplied later.

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(Answers)

Section A

Ans1. 2772 cu cm

Ans2. 10

Ans3. $\frac{1}{5}$

Ans4. 60°

Section B

Ans5. (i) Lateral surface area of a cube = 4 (side)^2 = 4 x (10)^2 = 400 cm^2

Lateral surface area of a cuboid = $2h(l+b)$ = 2 x 8 (12.5 + 10) = 16 x 22.5 = 360 cm^2

$\therefore$ Lateral surface area of cubical box is greater by (400 – 360) = 40 cm^2

(ii) Total surface area of a cube = 6 (side)^2 = 6 x (10)^2 = 600 cm^2

Total surface area of cuboid = $2(lb+bh+hl)$ = 2 (12.5 x 10 + 10 x 8 + 8 x 12.5)

= 2 (125 + 80 + 100)

= 2 x 305 = 610 cm^2

$\therefore$ Total surface area of cuboid box is greater by (610 – 600) = 10 cm^2

Ans6. Given: Length of base (l) = 4 m, Breadth (b) = 3 m and Height (h) = 2.5 m

Tarpaulin required to make shelter = Surface area of 4 walls + Area of roof

= $2h(l+b)+lb$

= 2 (4 + 3) 2.5 + 4 x 3

= 35 + 12

= 47 m^2

Hence 47 m^2 of the tarpaulin is required to make the shelter for the car.

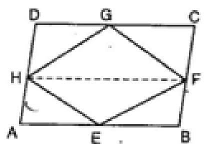
Ans7. $\angle$AOC = $\angle$AOB + $\angle$BOC $\Rightarrow$ $\angle$AOC = $60^\circ + 30^\circ = 90^\circ$

Now $\angle$AOC = 2$\angle$ADC

[$\because$ Angled subtended by an arc, at the centre of the circle is double the angle subtended by the same arc at any point in the remaining part of the circle]

$\Rightarrow \quad \angle ADC = \frac{1}{2}\angle AOC \qquad \Rightarrow \quad \angle ADC = \frac{1}{2}\times 90^\circ = 45^\circ$

Ans8. Given: A parallelogram ABCD. E, F, G and H are mid-points of AB, BC, CD and DA respectively.



To prove: $ar\,(EFGH) = \frac{1}{2}\,ar\,(ABCD)$

Construction: Join HF

Proof: $ar\,(\Delta\,GHF) = \frac{1}{2}\,ar\,(\|\,gm\ HFCD)$ ....(i)

And $ar\,(\Delta\,HEF) = \frac{1}{2}\,ar\,(\|\,gm\ HABF)$ ....(ii)

[If a triangle and a parallelogram are on the same base and between the same parallel then the area of triangle is half of area of parallelogram]

Adding eq. (i) and (ii),

$ar\,(\Delta\,GHF) + ar\,(\Delta\,HEF) = \frac{1}{2}\,ar\,(\|\,gm\ HFCD) + \frac{1}{2}\,ar\,(\|\,gm\ HABF)$

$\Rightarrow \quad ar\,(\|\,gm\ HEFG) = \frac{1}{2}\,ar\,(\|\,gm\ ABCD)$

Ans9. (i) Frequency distribution table

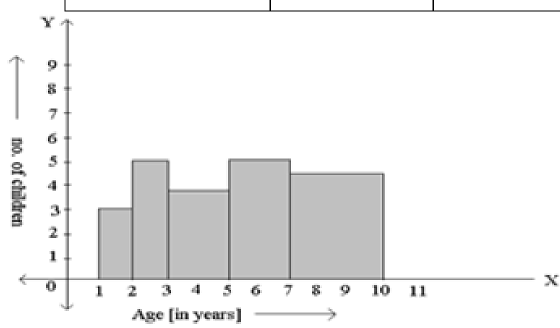
Digits	Tally Marks	Frequency
0	||	2
1	||	2
2	|	1
3	|	1
4	|	1
5	|	1
6	|	1
7	||	2
8	|	1

9	|||	3

(ii) Most frequency occurring digits = 9 & least frequently occurring digits = 2, 3, 4, 5, 6, 8

Ans10. Since the class intervals are not of equal width, we calculate the adjusted frequencies [AF] for histogram. Minimum class size [CS] = 1

Age [in years]	Frequency	Class Size [CS]	$AF = \frac{\text{minimum CS}}{\text{CS of this class}} \times \textit{Its}\text{ frequency}$
1 – 2	3	1	$\frac{1}{1} \times 3 = 3$
2 – 3	5	1	$\frac{1}{1} \times 5 = 5$
3 – 5	7	2	$\frac{1}{2} \times 7 = 3.5$
5 – 7	10	2	$\frac{1}{2} \times 10 = 5$
7 – 10	13	3	$\frac{1}{3} \times 13 = 4.3$



Now we draw rectangles with heights equal to the corresponding adjusted frequencies & bases equal to the given class intervals, to get the required histogram, as shown below.

Section C

Ans11. ABCD is a rhombus. Therefore AB = BC = CD = AD

Let O be the point of bisection of diagonals.

∴ OA = OC and OB = OD

In ΔAOB and ΔAOD,

OA = OA [Common]

AB = AD [Equal sides of rhombus]

OB = OD (diagonals of rhombus bisect each other]

$\therefore$ $\Delta AOB \cong \Delta AOD$ [By SSS congruency]

$\Rightarrow$ $\angle OAD = \angle OAB$ [By C.P.C.T.]

$\Rightarrow$ OA bisects $\angle A$ ……….(i)

Similarly $\Delta BOC \cong \Delta DOC$ [By SSS congruency]

$\Rightarrow$ $\angle OCB = \angle OCD$ [By C.P.C.T.]

$\Rightarrow$ OC bisects $\angle C$ ……….(ii)

From eq. (i) and (ii), we can say that diagonal AC bisects $\angle A$ and $\angle C$.

Now in ΔAOB and ΔBOC,

OB = OB [Common]

AB = BC [Equal sides of rhombus]

OA = OC (diagonals of rhombus bisect each other]

$\therefore$ $\Delta AOB \cong \Delta COB$ [By SSS congruency]

$\Rightarrow$ $\angle OBA = \angle OBC$ [By C.P.C.T.]

$\Rightarrow$ OB bisects $\angle B$ ……….(iii)

Similarly $\Delta AOD \cong \Delta COD$ [By SSS congruency]

$\Rightarrow$ $\angle ODA = \angle ODC$ [By C.P.C.T.]

$\Rightarrow$ BD bisects $\angle D$ ……….(iv)

From eq. (iii) and (iv), we can say that diagonal BD bisects $\angle B$ and $\angle D$

Ans12. (i) In ΔAPD and ΔCQB,

DP = BQ [Given]

$\angle ADP = \angle QBC$ [Alternate angles ($AD \parallel BC$ and BD is transversal)]

AD = CB [Opposite sides of parallelogram]

$\therefore$ $\Delta APD \cong \Delta CQB$ [By SAS congruency]

(ii) Since $\Delta APD \cong \Delta CQB$

$\Rightarrow$ AP = CQ [By C.P.C.T.]

(i) In ΔAQB and ΔCPD,

BQ = DP [Given]

$\angle ABQ = \angle PDC$ [Alternate angles ($AB \parallel CD$ and BD is transversal)]

AB = CD [Opposite sides of parallelogram]

$\therefore$ $\Delta AQB \cong \Delta CPD$ [By SAS congruency]

(ii) Since $\Delta AQB \cong \Delta CPD$

$\Rightarrow$ AQ = CP [By C.P.C.T.]

(iii) In quadrilateral APCQ,

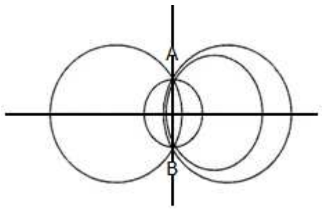
AP = CQ [proved in part (i)]

AQ = CP [proved in part (iv)]

Since opposite sides of quadrilateral APCQ are equal.

Hence APCQ is a parallelogram.

Ans13. From the figure, we observe that when different pairs of circles are drawn, each pair have two points (say A and B) in common.

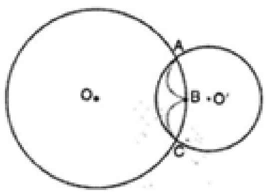


Maximum number of common points are two in number.

Suppose two circles C (O, r) and C (O', s) intersect each other in three points, say A, B and C.

Then A, B and C are non-collinear points.

We know that:



There is one and only one circle passing through three non-collinear points.

Therefore a unique circle passes through A, B and C.

$\Rightarrow$ O' coincides with O and $s = r$.

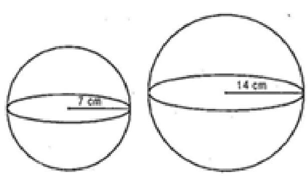
A contradiction to the fact that C (O', s) $\neq$ C (O, r)

$\therefore$ Our supposition is wrong.

Hence two different circles cannot intersect each other at more than two points.

Ans14. I case: Radius of balloon (r) = 7 cm

Surface area of balloon = $4\pi r^2 = 4\pi\times7\times7\,\text{cm}^2$ ....(i)

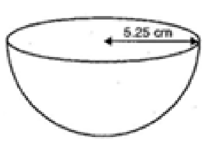


II case: Radius of balloon (R) = 14 cm

Surface area of balloon = $4\pi R^2 = 4\pi\times14\times14\ cm^2$ ....(ii)

Now, Ratio [from eq. (i) and (ii)],

$$\frac{\text{CSA in first case}}{\text{CSA in second case}} = \frac{4\pi\times7\times7}{4\pi\times14\times14} = \frac{1}{4}$$



Hence, required ratio = 1 : 4

Ans15. Capacity of cuboidal tank = $l\times b\times h$ = 20 m x 15 m x 6 m = 1800 m^3 = 1800 x 1000 liters

$\left[\because 1000l = 1\text{m}^3\right]$

= 1800000 liters

Water required by her head per day = 150 liters

Water required by 4000 persons per day = 150 x 4000 = 600000 liters

Number of days the water will last = $\dfrac{\text{Capacity of tank (in liter)}}{\text{Total water required per day (in liters)}}$

$= \dfrac{1800000}{600000} = 3$

Hence water of the given tank will last for 3 days.

Ans16. Capacity of cuboidal godown = 40 m x 25 m x 15 m = 15000 m^3

Capacity of wooden crate = 1.5 m x 1.25 m x 0.5 m = 0.9375 m^3

Maximum number of crates that can be stored in the godown = $\dfrac{\text{Volume of godown}}{\text{Volume of one crate}}$

$= \dfrac{15000}{0.9375} = 16000$

Hence maximum 16000 crates can be stored in the godown.

Ans17. Mean = $\bar{x} = \dfrac{\sum x_i}{n}$

$$\bar{x} = \frac{x+(x+1)+(x+2)+(x+3)+(x+4)+(x+5)+(x+6)+(x+7)}{8}$$

$$50 = \frac{8x+28}{8}$$

$$400 - 28 = 8x$$

$$\therefore x = \frac{372}{8} = 46.5$$

$\therefore$ The given set of 8 observations is

46.5, 47.5, 48.5, 50.5, 49.5, 51.5, 52.5, 53.5

So, the mean of first 5 observations is given by

$$\bar{x} = \frac{46.5+47.5+48.5+49.5+50.5}{5} = \frac{242.5}{5} = 48.5$$

Ans18. I Part

The no. of workers lies in the interval 27-29 are = 6

Total no. of workers = 30

Required probability = $\frac{6}{30}=\frac{1}{5}$

II Part

No. of workers having age between 29 - 35 = 5+4+3 = 12

Total no. of workers = 30

Required Probability = $\frac{12}{30}=\frac{2}{5}$

III Part

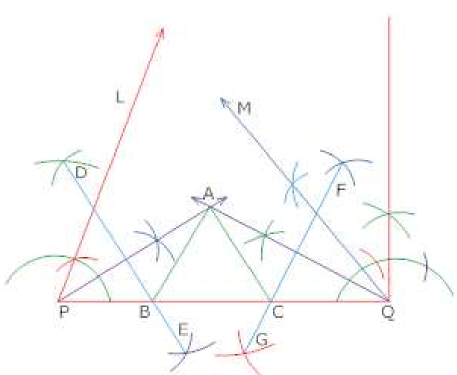
No. of workers having age between 21 -27 = 3+4+5=12

Total no. of workers = 30

Required Probability = $\frac{12}{30}=\frac{2}{5}$

Section D

Ans19. Steps of construction



(1) Draw a line segment $PQ = 11cm\left(= AB + BC + CA\right)$

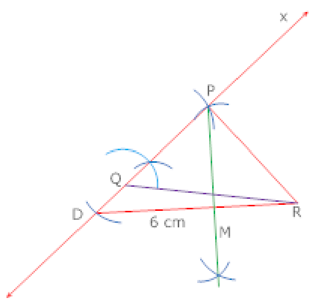
(2) At P construct an angle of $60°$ and at Q an angle of $45°$

(3) Bisects these angles let bisectors of these intersect at point A

(4) Draw perpendicular bisectors DE of AP to intersect PQ at B and FG of AQ to intersect PQ at C.

(5) Join AB and AC Then ABC is required triangle.

Ans20. Steps of construction



(1) Draw line segment QR = 6cm

(2) Cut line segment QD =PR-PQ= 2cm

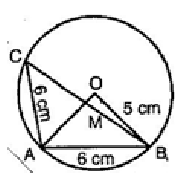
from line x extended on opposite side of line segment QR

(3) Join DR and draw the perpendicular bisector say MN of DR

(4) Let MN bisect DX at point P. join PR

(5) PQR is required triangle

Ans21. Let Reshma, Salma and Mandip takes the position C, A and B on the circle.



Since AB = AC

The centre lies on the bisector of $\angle$BAC.

Let M be the point of intersection of BC and OA.

Again, since AB = AC and AM bisects $\angle$CAB.

$\therefore$ AM $\perp$ CB and M is the mid-point of CB.

Let OM = x, then MA = $5-x$

From right angled triangle OMB, $OB^2 = OM^2 + MB^2$

$\Rightarrow$ $5^2 = x^2 + MB^2$ ....(i)

Again, in right angled triangle AMB, $AB^2 = AM^2 + MB^2$

$\Rightarrow \quad 6^2 = (5-x)^2 + MB^2$ ……….(ii)

Equating the value of MB^2 from eq. (i) and (ii),

$5^2 - x^2 = 6^2 - (5-x)^2 \quad \Rightarrow \quad (5-x)^2 - x^2 = 6^2 - 5^2$

$\Rightarrow \quad 25 - 10x + x^2 - x^2 = 36 - 25 \quad \Rightarrow \quad 10x = 25 - 11$

$\Rightarrow \quad 10x = 14 \quad \Rightarrow \quad x = \frac{14}{10}$

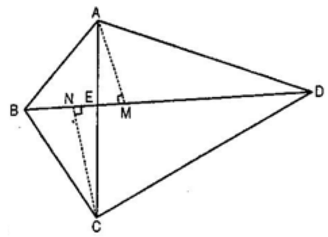
Hence, from eq. (i),

$$MB^2 = 5^2 - x^2 = 5^2 - \left(\frac{14}{10}\right)^2 = \left(5 + \frac{4}{10}\right)\left(5 - \frac{14}{10}\right) = \frac{64}{10} \times \frac{36}{10}$$

$\Rightarrow \quad MB = \frac{8 \times 6}{10} = 4.8$ cm

$\therefore \quad BC = 2MB = 2 \times 4.8 = 9.6$ cm

Ans22. Join EC and AD.



Since Δ ABC is an equilateral triangle.

$\therefore \quad \angle A = \angle B = \angle C = 60^\circ$

Also Δ BDE is an equilateral triangle.

$\therefore \quad \angle B = \angle D = \angle E = 60^\circ$

If we take two lines, AC and BE and BC as a transversal.

Then $\angle B = \angle C = 60^\circ$ [Alternate angles]

$\Rightarrow \quad BE \parallel AC$

Similarly for lines AB and DE and BF as transversal.

Then $\angle B = \angle C = 60^\circ$ [Alternate angles]

$\Rightarrow \quad BE \parallel AC$

(i) Area of equilateral triangle BDE = $\frac{\sqrt{3}}{4}(BD)^2$ ……….(i)

Area of equilateral triangle ABC = $\frac{\sqrt{3}}{4}(BC)^2$ ……….(ii)

Dividing eq. (i) by (ii),

$$\frac{ar(\Delta BDE)}{ar(\Delta ABC)} = \frac{\frac{\sqrt{3}}{4}(BD)^2}{\frac{\sqrt{3}}{4}(BC)^2} \quad \Rightarrow \quad \frac{ar(\Delta BDE)}{ar(\Delta ABC)} = \frac{\frac{\sqrt{3}}{4}(BD)^2}{\frac{\sqrt{3}}{4}(2BD)^2} \quad [\because BD = DC]$$

$\Rightarrow \quad \frac{ar(\Delta BDE)}{ar(\Delta ABC)} = \frac{(BD)^2}{(2BD)^2} \quad \Rightarrow \quad \frac{ar(\Delta BDE)}{ar(\Delta ABC)} = \frac{1}{4}$

$\Rightarrow$ ar (Δ BDE) = $\frac{1}{4}$ ar (Δ ABC)

(ii) In Δ BEC, ED is the median.

$\therefore$ ar (Δ BEC) = ar (Δ BAE) ....(i)

[Median divides the triangle in two triangles having equal area]

Now BE || AC

And Δ BEC and Δ BAE are on the same base BE and between the same parallels BE and AC.

$\therefore$ ar (Δ BEC) = ar (Δ BAE) ....(ii)

Using eq. (i) and (ii), we get

Ar (Δ BDE) = $\frac{1}{2}$ ar (Δ BAE)

(iii) We have ar (Δ BDE) = $\frac{1}{4}$ ar (Δ ABC) [Proved in part (i)] ....(iii)

ar (Δ BDE) = $\frac{1}{4}$ ar (Δ BAE) [Proved in part (ii)]

ar (Δ BDE) = $\frac{1}{4}$ ar (Δ BEC) [Using eq. (iii)] ....(iv)

From eq. (iii) and (iv), we het

$\frac{1}{4}$ ar (Δ ABC) = $\frac{1}{4}$ ar (Δ BEC)

$\Rightarrow$ ar (Δ ABC) = 2 ar (Δ BEC)

(iv) Δ BDE and Δ AED are on the same base DE and between same parallels AB and DE.

$\therefore$ ar (Δ BDE) = ar (Δ AED)

Subtracting Δ FED from both the sides,

ar (Δ BDE) – ar (Δ FED) = ar (Δ AED) – ar (Δ FED)

$\Rightarrow$ ar (Δ BFE) = ar (Δ AFD) ....(v)

(v) An in equilateral triangle, median drawn is also perpendicular to the side,

$\therefore$ AD $\perp$ BC

Now ar (Δ AFD) = $\frac{1}{2}$ x FD x AD ....(vi)

Draw EG $\perp$ BC

$\therefore$ ar (Δ FED) = $\frac{1}{2}$ x FD x EG ....(vii)

Dividing eq. (vi) by (vii), we get

$\frac{ar(\Delta AFD)}{ar(\Delta FED)} \frac{\frac{1}{2} \times FD \times AD}{\frac{1}{2} \times FD \times EG} \quad \Rightarrow \quad \frac{ar(\Delta AFD)}{ar(\Delta FED)} = \frac{AD}{EG}$

$\Rightarrow \quad \dfrac{ar(\Delta AFD)}{ar(\Delta FED)} = \dfrac{\frac{\sqrt{3}}{4}BC}{\frac{\sqrt{3}}{4}BD}$ [Altitude of equilateral triangle = $\frac{\sqrt{3}}{4}$ side]

$\Rightarrow \quad \dfrac{ar(\Delta AFD)}{ar(\Delta FED)} = \dfrac{2BD}{BD}$ [D is the mid-point of BC]

$\Rightarrow \quad \dfrac{ar(\Delta AFD)}{ar(\Delta FED)} = 2$ $\Rightarrow$ ar (Δ AFD) = 2 ar (Δ FED) ……(viii)

Using the value of eq. (viii) in eq. (v),

Ar (Δ BFE) = 2 ar (Δ FED)

(vi) ar (Δ AFC) = ar (Δ AFD) + ar (Δ ADC) = 2 ar (Δ FED) + $\frac{1}{2}$ ar (Δ ABC) [using (v)

= 2 ar (Δ FED) + $\frac{1}{2}$ [4 x ar (Δ BDE)] [Using result of part (i)]

= 2 ar (Δ FED) + 2 ar (Δ BDE) = 2 ar (Δ FED) + 2 ar (Δ AED)

[Δ BDE and Δ AED are on the same base and between same parallels]

= 2 ar (Δ FED) + 2 [ar (Δ AFD) + ar (Δ FED)]

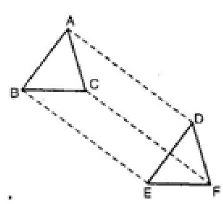
= 2 ar (Δ FED) + 2 ar (Δ AFD) + 2 ar (Δ FED) [Using (viii)]

= 4 ar (Δ FED) + 4 ar (Δ FED)

$\Rightarrow$ ar (Δ AFC) = 8 ar (Δ FED)

$\Rightarrow$ ar (Δ FED) = $\frac{1}{8}$ ar (Δ AFC)

Ans23. (i) In Δ ABC and Δ DEF



AB = DE [Given]

And AB || DE [Given]

$\therefore$ ABED is a parallelogram.

(ii) In Δ ABC and Δ DEF

BC = EF [Given]

And BC || EF [Given]

$\therefore$ BEFC is a parallelogram.

(iii) As ABED is a parallelogram.

$\therefore$ AD || BE and AD = BE ……….(i)

Also BEFC is a parallelogram.

$\therefore$ CF || BE and CF = BE ……….(ii)

From (i) and (ii), we get

$\therefore$ AD $\parallel$ CF and AD = CF

(iv) As AD $\parallel$ CF and AD = CF

$\Rightarrow$ ACFD is a parallelogram.

(v) As ACFD is a parallelogram.

$\therefore$ AC = DF

(vi) In Δ ABC and Δ DEF,

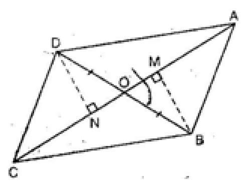
AB = DE [Given]

BC = EF [Given]

AC = DF [Proved]

$\therefore$ $\Delta ABC \cong \Delta DEF$ [By SSS congruency]

Ans24. (i) Draw BM $\perp$ AC and DN $\perp$ AC.



In Δ DON and Δ BOM,

OD = OB [Given]

$\angle$DNO = $\angle$BMO = 90° [By construction]

$\angle$DON = $\angle$BOM [Vertically opposite]

$\therefore$ $\Delta DON \cong \Delta BOM$ [By RHS congruency]

$\Rightarrow$ DN = BM [By CPCT]

Also ar (Δ DON) = ar (Δ BOM) ....(i)

Again, In Δ DCN and Δ ABM,

CD = AB [Given]

$\angle$DNC = $\angle$BMA = 90° [By construction]

DN = BM [Prove above]

$\therefore$ $\Delta DCN \cong \Delta BAM$ [By RHS congruency]

$\therefore$ ar (Δ DCN) = ar (Δ BAM) ....(ii)

Adding eq. (i) and (ii),

ar (Δ DON) + ar (Δ DCN) = ar (Δ BOM) + ar (Δ BAM)

$\Rightarrow$ ar (Δ DOC) = ar (Δ AOB)

(ii) Since ar (Δ DOC) = ar (Δ AOB)

Adding ar Δ BOC both sides,

ar (Δ DOC) + ar Δ BOC = ar (Δ AOB) + ar Δ BOC

$\Rightarrow$ ar (Δ DCB) = ar (Δ ACB)

(iii) Since ar (Δ DCB) = ar (Δ ACB)

Therefore these two triangles in addition to be on the same base CB lie between two same parallels CB and DA.

$\therefore$ DA || CB

Now AB = CD and DA || CB

Therefore ABCD is a parallelogram.

Ans25. Volume of solid cube = $(\text{side})^3$ = $(12)^3$ = 1728 cm^3

According to question, Volume of each new cube = $\frac{1}{8}$ (Volume of original cube)

$= \frac{1}{8} \times 1728$ = 216 cm^3

$\therefore$ Side of new cube = $\sqrt[3]{216}$ = 6 cm

Now, Surface area of original solid cube = 6 (side)^2

= 6 x 12 x 12 = 864 cm^2

Now, Surface area of original solid cube = 6 (side)^2

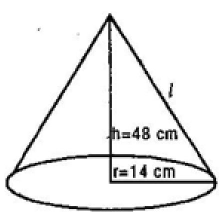
= 6 x 6 x 6 = 216 cm^2

Now according to the question,

$$\frac{\text{Surface area of original cube}}{\text{Surface area of new cube}} = \frac{864}{216} = \frac{4}{1}$$

Hence required ration between surface area of original cube to that of new cube = 4 : 1.

Ans26. (i) Diameter of cone = 28 cm



$\therefore$ Radius of cone = 14 cm

Volume of cone = 9856 cm^3

$\Rightarrow \frac{1}{3}\pi r^2 h = 9856$

$\Rightarrow \frac{1}{3} \times \frac{22}{7} \times 14 \times 14 \times h = 9856$

$\Rightarrow h = \frac{9856 \times 3 \times 7}{22 \times 14 \times 14}$ = 48 cm

(ii) Slant height of cone $(l) = \sqrt{r^2 + h^2}$

$= \sqrt{(14)^2 + (48)^2} = \sqrt{196 + 2304}$

$= \sqrt{2500}$ = 50 cm

(iii) Curved surface area of cone = $\pi r l = \frac{22}{7} \times 14 \times 50$ = 2200 cm^2

Ans27. Let the number of girls and boys be n_1 and n_2 respectively.

We have:
$\bar{X}_1$ = Average score of girls = 67
$\bar{X}_2$ = Average score of boys = 63
$\bar{X}$ = Average score of the whole class = 64.5

$$\bar{X} = \frac{n_1\bar{X}_1 + n_2\bar{X}_2}{n_1 + n_2}$$

$$\Rightarrow \quad 64.5 = \frac{67n_1 + 63n_2}{n_1 + n_2}$$

$$\Rightarrow \quad 64.5n_1 + 64.5n_2 = 67n_1 + 63n_2$$
$$\Rightarrow \quad 2.5n_1 = 1.5n_2$$
$$\Rightarrow \quad 25n_1 = 15n_2$$
$$\Rightarrow \quad 5n_1 = 3n_2$$

Total number of students in the class = $n_1 + n_2$

$$\therefore \quad \text{Percentage of girls} = \frac{n_1}{n_1 + n_2} \times 100$$
$$= \frac{n_1}{n_1 + \frac{5n_1}{3}} \times 100 \qquad [\because 5n_1 = 3n_2]$$
$$= \frac{3n_1}{3n_1 + 5n_1} \times 100$$
$$= \frac{3}{8} \times 100 = 37.5$$

And percentage of boys,

$$= \frac{n_2}{n_1 + n_2} \times 100$$
$$= \frac{n_2}{\frac{3n_2}{5} + n_2} \times 100$$

$$= \frac{5n_2}{3n_2 + 5n_2} \times 100$$
$$= 62.5$$

Ans28. (i) From the table number of families owning 2 vehicles and earning between Rs 10,000 – Rs 13,000 =29

Total no. of families = 2400

$\therefore$ Required Probability = $\frac{29}{2400}$

(ii) No. of families owning 1 vehicle and earning more than Rs 16000 is 579

$\therefore$ Required Probability = $\frac{579}{2400}$

(iii) P (earning < Rs 7,000 and no vehicle) $= \frac{10}{2400} = \frac{1}{240}$

(iv) P (earning between Rs 13,000 – Rs 16,000 and owning > 2 vehicles) $= \frac{25}{2400} = \frac{1}{96}$

(v) Number of families with not more than 1 vehicle

= 10+160+0+305+1+535+2+469+1+579 = 2062

$\therefore$ P (Family with not more than 1 vehicle) = $\frac{2062}{2400} = \frac{1031}{1200}$