Class-X Session 2022-23

Subject - Mathematics (Standard)

Sample Question Paper - 33

With Solution

BLUE PRINT

Ch. No.	Chapter Name	Per Unit Marks	Section-A (1 Mark)		Section-B (2 Marks)	Section-C (3 Marks)	Section-D (5 Marks)	Section-E (4 Marks)	Total Marks
			MCQ	A/R	VSA	SA	LA	Case-Study	
1	Real Number	6	4(Q1, 2, 7, 15)		1(Q21)				6
2	Polynomials	20						1(Q36)	4
3	Pair of Linear Equations in Two Variables		1(Q4)	1(Q19)					2
4	Quadratic Equations					1(Q26)	1(Q32)		8
5	Arithmetic Progression		1(Q3)				1(Q33)		6
6	Triangles	15	3(Q5, 9, 14)	1(Q20)		1(Q27)			7
7	Circles		1(Q17)		1(Q25)		1(Q34)		8
8	Coordinate Geometry	6	2(Q6, 12)		2(Q22, 23)				6
9	Introduction to Trigonometry	12	3(Q8, 16, 18)			2(Q28, 30)			9
10	Some Applications of Trigonometry					1(Q31)			3
11	Areas Related to Circles	10	1(Q11)						1
12	Surface Areas and Volumes						1(Q35)	1(Q37)	9
13	Statistics	11	1(Q13)			1(Q29)			4
14	Probability		1(Q10)		1(Q24)			1(Q38)	7
Total Marks (Total Questions)		80	18(18)	2(2)	10(5)	18(6)	20(4)	12(3)	80(38)

Note : The number given inside the bracket denotes question number, asked in the sample paper, while the number given outside the bracket are the number of questions from that particular chapter.

Time : 3 Hours **Max. Marks : 80**

General Instructions

1. *This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.*
2. *Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.*
3. *Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.*
4. *Section C has 6 Short Answer (SA)-type questions of 3 marks each.*
5. *Section D has 4 Long Answer (LA)-type questions of 5 marks each.*
6. *Section E has 3 case based/integrated units of assessment (4 marks each) with sub parts of values of 1, 1 and 2 marks each respectively.*

SECTION-A (Multiple Choice Questions)

Each question carries 1 mark.

1. The sum of exponents of prime factors in the prime-factorisation of 196 is

(a) 3 (b) 4 (c) 5 (d) 2

2. If , then $2x$ is

(a) $1.\overline{4}$ (b) $1.\overline{5}$ (c) $1.\overline{54}$ (d) $1.\overline{45}$

3. If eight times the 8^{th} term of an A.P. is equal to 12 times the 12^{th} term of the A.P. then its 20^{th} term will be

(a) -1 (b) 1 (c) 0 (d) 2

4. At present ages of a father and his son are in the ratio 7 : 3, and they will be in the ratio 2 : 1 after 10 years. Then the present age of father (in years) is

(a) 42 (b) 56 (c) 70 (d) 77

5. ΔABC is an isosceles triangle right angled at B. Similar triangles ACD and ABE are constructed on sides AC and AB. Ratio between the sides AB and AC

(a) $1:4$ (b) $2:1$ (c) $1:\sqrt{2}$ (d) $4:3$

6. The coordinates of the point which is reflection of point $(-3, 5)$ in x-axis are

(a) $(3, 5)$ (b) $(3, -5)$ (c) $(-3, -5)$ (d) $(-3, 5)$

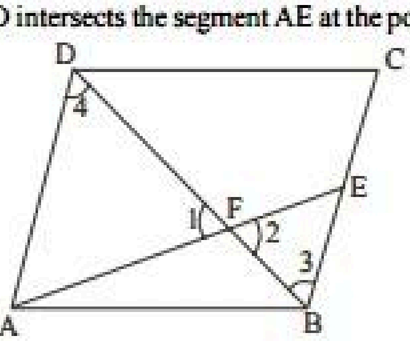
7. If n is an even natural number, then the largest natural number by which $n(n+1)(n+2)$ is divisible is

(a) 6 (b) 8 (c) 12 (d) 24

8. $\cos 1^\circ . \cos 2^\circ . \cos 3^\circ$ .... $\cos 179^\circ$ is equal to

(a) -1 (b) 0 (c) 1 (d) $1/\sqrt{2}$

9. The diagonal BD of a parallelogram ABCD intersects the segment AE at the point F, where E is any point on the side BC. Then



(a) $\frac{EF}{FA} = \frac{FB}{AB}$ (b) $DF \times EF = FB \times FA$ (c) $DF \times EF = (FB)^2$ (d) None of these

10. Which of the following cannot be the probability of an event?

(a) 2/3 (b) $-1/5$ (c) 15% (d) 0.7

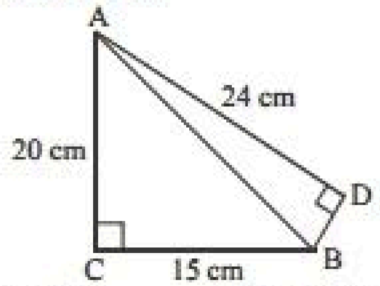
11. A race track is in the form of a ring whose inner and outer circumference are 437m and 503m respectively. The area of the track is

(a) 66 sq. cm (b) 4935 sq. cm (c) 9870 sq. cm (d) None of these

12. C is the mid-point of PQ, if P is $(4, x)$, C is $(y, -1)$ and Q is $(-2, 4)$, then x and y respectively are
(a) -6 and 1 (b) -6 and 2 (c) 6 and -1 (d) 6 and -2

13. The numbers 3, 5, 7 and 9 have their respective frequencies $x-2$, $x+2$, $x-3$ and $x+3$. If the arithmetic mean is 6.5, then the value of x is
(a) 3 (b) 4 (c) 5 (d) 6

14. From the given figure, then length of the sides AB and BD.

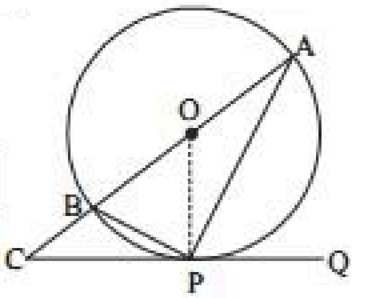


(a) 25 cm and 7 cm (b) 25 cm and 17 cm (c) 7 cm and 15 cm (d) 18 cm and 7 cm

15. The least number which when divided by 15, leaves a remainder of 5, when divided by 25, leaves a remainder of 15 and when divided by 35, leaves a remainder of 25, is
(a) 515 (b) 525 (c) 1040 (d) 1050

16. The value of $\dfrac{\tan 30^\circ}{\cot 60^\circ}$ is
(a) $\dfrac{1}{\sqrt{2}}$ (b) $\dfrac{1}{\sqrt{3}}$ (c) $\sqrt{3}$ (d) 1

17. A tangent CQ touches a circle with centre O at P. Diameter AB is produced to meet the tangent at C. If $\angle ACP = a^\circ$ and $\angle BPC = b^\circ$, the relation connecting a and b is
(a) $a^\circ + b^\circ = 180^\circ$ (b) $a^\circ + 2b^\circ = 90^\circ$
(c) $a^\circ - b^\circ = 60^\circ$ (d) $2a^\circ + b^\circ = 100^\circ$



18. If $\cos A = \dfrac{4}{5}$, then the value of $\tan A$ is
(a) $\dfrac{3}{5}$ (b) $\dfrac{3}{4}$ (c) $\dfrac{4}{3}$ (d) $\dfrac{5}{3}$

(ASSERTION-REASON BASED QUESTIONS)

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.
(a) ***Both A and R are true and R is the correct explanation of A.***
(b) ***Both A and R are true but R is not the correct explanation of A.***
(c) ***A is true but R is false.***
(d) ***A is false but R is true.***

19. **Assertion :** The value of $q = \pm 2$, if $x = 3$, $y = 1$ is the solution of the line $2x + y - q^2 - 3 = 0$
Reason : The solution of the line will satisfy the equation of the line

20. **Assertion :** If in a ΔABC, a line $DE \parallel BC$, intersects AB in D and AC in E, then $\dfrac{AB}{AD} = \dfrac{AC}{AE}$.
Reason : If a line is drawn parallel to one side of a triangle intersecting the other two sides, then the other two sides are divided in the same ratio.

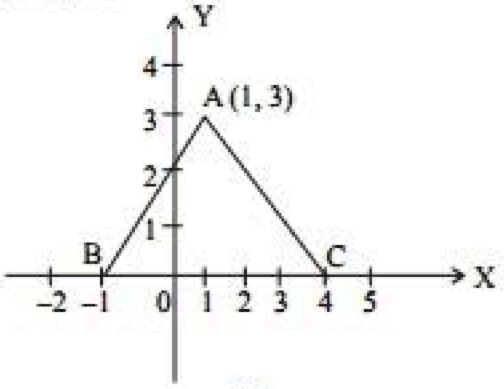
SECTION-B

This section comprises of very short answer type-questions (VSA) of 2 marks each.

21. Explain why 13233343563715 is a composite number?

22. If the point P $(k-1, 2)$ is equidistant from the points A $(3, k)$ and B $(k, 5)$, find the values of k.

23. In fig., the area of triangle ABC (in sq. units) is :



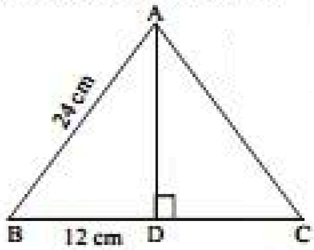
OR

Find the value of a, if the distance between the points A$(-3, -14)$ and B$(a, -5)$ is 9 units.

24. In ΔABC, if X and Y are points on AB and AC respectively such that $\frac{AX}{XB} = \frac{3}{4}$, $AY = 5$ cm and $YC = 9$ cm, then state whether XY and BC parallel or not.

OR

In an equilateral triangle of side 24 cm, find the length of the altitude.



25. If the difference between the circumference and the radius of a circle is 37 cm, then using $\pi = \frac{22}{7}$, the circumference (in cm) of the circle is:

SECTION-C

This section comprises of short answer type questions (SA) of 3 marks each.

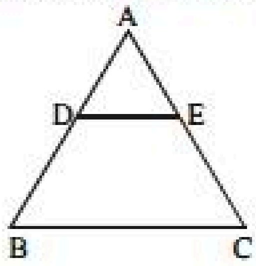
26. Sum of the areas of two squares is 400 cm^2. If the difference of their perimeters is 16 cm, find the sides of the two squares.

OR

Solve the following pair of linear equations by substitution method:

$$3x + 2y - 7 = 0$$
$$4x + y - 6 = 0$$

27. In given figure $DE \parallel BC$. If $AD = 3$ cm, $DB = 4$cm and $AE = 6$ cm, then find EC.



28. Evaluate : $\dfrac{5\cos^2 60° + 4\cos^2 30° - \tan^2 45°}{\sin^2 30° + \cos^2 60°}$

29. If the mean of the following data is 14.7, find the value of p and q.

Class	0 – 6	6 – 12	12 – 18	18 – 24	24 – 30	30 – 36	36 – 42	Total
Frequency	10	p	4	7	q	4	1	40

OR

On the sports day of a school, 300 students participated. Their ages are given in the following distribution:

Age (in years)	5 – 7	7 – 9	9 – 11	11 – 13	13 – 15	15 – 17	17 – 19
Number of students	67	33	41	95	36	13	15

Find the mean and mode of the data.

30. Evaluate : $\tan^2 30° \sin 30° + \cos 60° \sin^2 90° \tan^2 60° - 2 \tan 45° \cos^2 0° \sin 90°$

31. The angle of elevation of an aeroplane from a point on the ground is 60°. After a flight of 30 seconds the angle of elevation becomes 30°. If the aeroplane is flying at a constant height of $3000\sqrt{3}$ m, find the speed of the aeroplane.

SECTION-D

This section comprises of long answer-type questions (LA) of 5 marks each.

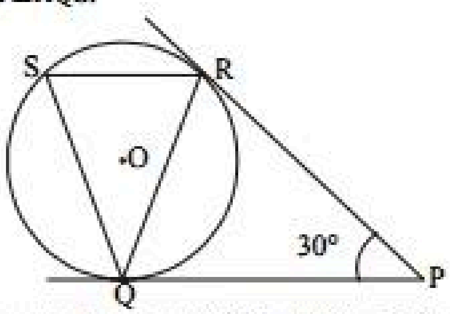
32. Solve for x : $\frac{1}{x+1} + \frac{2}{x+2} = \frac{4}{x+4}, x \neq -1, -2, -4$

OR

A motor boat whose speed is 24 km/h in still water takes 1 hour more to go 32 km upstream than to return downstream to the same spot. Find the speed of the stream.

33. In a school, students decided to plant trees in and around the school to reduce air pollution. It was decided that the number of trees, that each section of each class will plant, will be double of the class in which they are studying. If there are 1 to 12 classes in the school and each class has two sections, find how many trees were planted by the students. Which value is shown in this question?

34. In figure tangents PQ and PR are drawn from an external point P to a circle with centre O, such that $\angle RPQ = 30°$. A chord RS is drawn parallel to the tangent PQ. Find $\angle RQS$.



35. In a rain water harvesting system, the rain water from a roof of 22 m × 20 m drains into a cylindrical tank having diameter of base 2 m and height 3.5 m. If the tank is full, find the rainfall in cm. Write your views on water conservation.

OR

A well of diameter 4 m is dug 14 m deep. The earth taken out is spread evenly all around the well to form a 40 cm high embankment. Find the width of the embankment.

SECTION-E

This section comprises of 3 case study/passage - based questions of 4 marks each with three sub-parts (i), (ii), (iii) of marks 1, 1, 2 respectively.

36. **Case - Study 1:** Read the following passage and answer the questions given below.

An asana is a body posture, originally and still a general term for a sitting meditation pose, and later extended in hatha yoga and modern yoga as exercise, to any type of pose or position, adding reclining, standing, inverted, twisting, and balancing poses. In the figure, one can observe that poses can be related to representation of quadratic polynomial.

TRIKONASANA

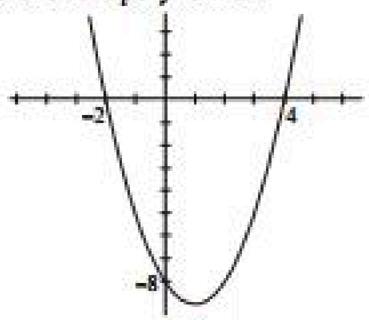
ADHOMUKHA SAVASANA

ADHO MUKHA SVANA

(i) The shape of the poses shown is

(ii) The graph of parabola opens downwards, and expression $f(x) = ax^2 + bx + c$ if

(iii) In the graph, how many zeroes are there for the polynomial?

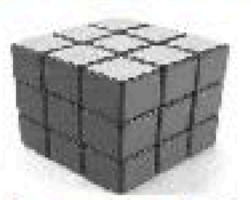


OR

According to graph zeros are

37. Case - Study 2: Read the following passage and answer the questions given below.

On a Sunday, your Parents took you to a fair. You could see lot of toys displayed, and you wanted them to buy a RUBIK's cube and strawberry ice-cream for you. Observe the figures and answer the questions-:



(i) The length of the diagonal if each edge measures 6cm is

(ii) Volume of the solid figure if the length of the edge is 7cm is-

(iii) What is the curved surface area of hemisphere (ice cream) if the base radius is 7cm?

OR

Find total surface area of cube if each side is 3 cm

38. Case - Study 3: Read the following passage and answer the questions given below.

On a weekend Rani was playing cards with her family. The deck has 52 cards. If her brother drew one card.

(i) Find the probability of getting a king of red colour.

(ii) Find the probability of getting a face card.

(iii) Find the probability of getting a jack of hearts.

OR

Find probability of getting a spade.

Solution

SAMPLE PAPER-6

1. (b) $196 = 2^2 \cdot 7^2$, sum of exponents $= 2 + 2 = 4$

2. (b) $10x = 7.\overline{7}$ or $x = 0.\overline{7}$

Subtracting, $9x = 7 \therefore x = \frac{7}{9}$

$2x = \frac{14}{9} = 1.555........ = 1.\overline{5}$

3. (c) $t_8 = a + 7d, t_{12} = a + 11d$

According to question, $8t_8 = 12t_{12}$ (given)

$\Rightarrow \quad 8(a + 7d) = 12(a + 11d)$

$\Rightarrow \quad 8a + 56d = 12a + 132d$

$\Rightarrow \quad 8a - 12a + 56d - 132d = 0$

$\Rightarrow \quad -4a - 76d = 0$

$\Rightarrow a + 19d = 0 \quad \ldots(i)$

$\therefore \quad t_{20} = a + 19d = 0$ using (i)

$\therefore \quad t_{20} = 0$

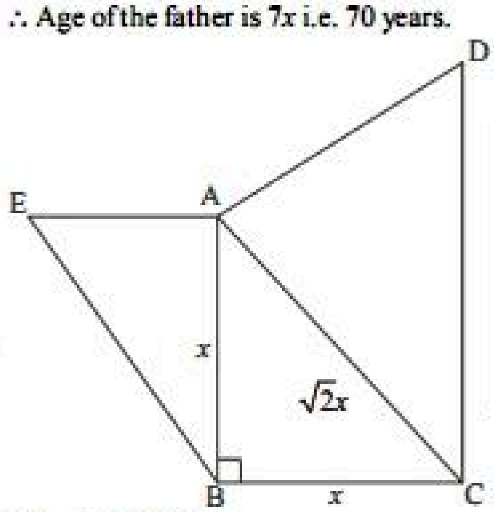
4. (c) Let the ages of father and son be $7x$, $3x$

After 10 years,

$\therefore (7x + 10) : (3x + 10) = 2 : 1$ or $x = 10$

$\therefore$ Age of the father is $7x$ i.e. 70 years.

5. (c)



Let $AB = BC = x$.

Since, ΔABC is right-angled with $\angle B = 90°$

$\therefore \quad AC^2 = AB^2 + BC^2 = x^2 + x^2 = 2x^2$

$\Rightarrow \quad AC = \sqrt{2}x$

Since, $\Delta ABE \sim \Delta ACD$

Thus, $\frac{AB}{AC} = \frac{1}{\sqrt{2}}$

Thus, required ratio is 1 : 2.

6. (c) For reflection of a point with respect to x-axis change sign of y-coordinate and with respect to y-axis change sign of x-coordinate.

7. (d) Out of n and $n + 2$, one is divisible by 2 and the other by 4, hence $n(n + 2)$ is divisible by 8. Also n, $n + 1$, $n + 2$ are three consecutive numbers, hence one of them is divisible by 3. Hence, $n(n + 1)(n + 2)$ must be divisible by 24. This will be true for any even number n.

8. (b) Hint $\cos 90° = 0$

9. (a) In ΔAFD & ΔFEB,

$\angle 1 = \angle 2$ (V.O.A)

$\angle 3 = \angle 4$ (Alternate angle)

$\therefore \Delta FBE \sim \Delta FDA$

So, $\frac{EF}{FA} = \frac{FB}{DF}$

10. (b) Probability lies from 0 to 1

11. (b) $2\pi r_1 = 503$ and $2\pi r_2 = 437$

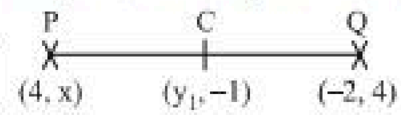
$\therefore \quad r_1 = \frac{503}{2\pi}$ and $r_2 = \frac{437}{2\pi}$

Area of ring $= \pi(r_1 + r_2)(r_1 - r_2)$

$= \pi\left(\frac{503 + 437}{2\pi}\right)\left(\frac{503 - 437}{2\pi}\right)$

$= \frac{940}{2}\left(\frac{66}{2\pi}\right) = 235 \times \frac{66}{22} \times 7 = 235 \times 21 = 4935$ sq. cm.

12. (a) Since, $C(y, -1)$ is the mid-point of $P(4, x)$ and $Q(-2, 4)$.



We have, $\frac{4 - 2}{2} = y$ and $\frac{4 + x}{2} = -1$

$\therefore y = 1$ and $x = -6$

13. (c) **Hint:** Add all entries then find mean

14. (a) From the right angled ΔACB,

$AB^2 = AC^2 + CB^2$

$= (20)^2 + (15)^2 = 400 + 225 = 625$

$\therefore \quad AB = \sqrt{625} = 25$cm

Again, from right angled ΔABD

$AB^2 = AD^2 + BD^2$

$\Rightarrow 625 = (24)^2 + (BD)^2$

$\Rightarrow \quad (BD)^2 = 625 - 576 = 49$

$\Rightarrow \quad BD = 7$ cm

15. (a) The number divisible by 15, 25 and 35 = L.C.M. (15, 25, 35) = 525

Since, the number is short by 10 for complete division by 15, 25 and 35.

Hence, the required least number = 525 – 10 = 515.

16. (d) $\frac{\tan 30°}{\cot 60°} = \frac{\frac{1}{\sqrt{3}}}{\frac{1}{\sqrt{3}}} = 1$

17. (b) Given, $\angle BPC = b°$ and $\angle ACP = a°$.

Also, $\angle OPA = \angle OAP = b°$ (Angles in an isosceles triangle OAP, angle in alternate segment.)

$\angle CPO = 90° \therefore \angle CPA = 90° + b°$

In ΔACP, $\angle ACP = 180° - [(b° + 90°) + b°]$

$\Rightarrow \quad a° + 2b° = 90°$

18. **(b)** Since $\cos A = \frac{4}{5}$

$\therefore$ $\sin A = \sqrt{1-\cos^2 A}$

$= \sqrt{1-\left(\frac{4}{5}\right)^2} = \sqrt{1-\frac{16}{25}}$

$= \sqrt{\frac{9}{25}} = \frac{3}{5}$

Now, $\tan A = \frac{\sin A}{\cos A} = \frac{\frac{3}{5}}{\frac{4}{5}} = \frac{3}{4}$

Hence, tan A is $\frac{3}{4}$.

19. **(a)** As $x = 3, y = 1$ is the solution
Then, $2x + y - q^2 - 3 = 0$
$2 \times 3 + 1 - q^2 - 3 = 0$
$q = \pm 2$

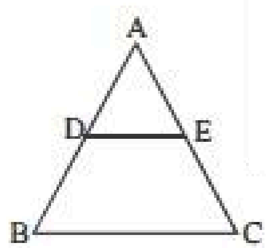
20. **(a)** Reason is true. [This is Thale's Theorem]
For Assertion
Since $DE \parallel BC$ $\therefore$ by Thale's Theorem

$\frac{AD}{DB} = \frac{AE}{EC} \Rightarrow \frac{DB}{AD} = \frac{EC}{AE}$

$\Rightarrow 1 + \frac{DB}{AD} = 1 + \frac{EC}{AE}$

$\Rightarrow \frac{AD + DB}{AD} = \frac{AE + EC}{AE}$

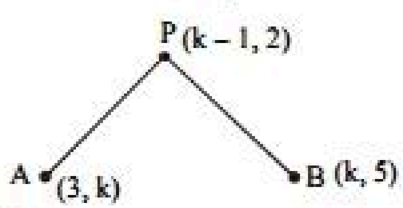
$\Rightarrow \frac{AB}{AD} = \frac{AC}{AE}$



$\therefore$ Assertion is true.
Since reason gives Assertion.

21. Since the given number ends in 5. which means it is a multiple of 5. Hence it is a composite number. [2 Marks]

22.



AP = BP

$\Rightarrow \sqrt{(k-1-3)^2+(2-k)^2} = \sqrt{(k-1-k)^2+(2-5)^2}$
[By Distance formula]

$\Rightarrow (k-4)^2+(2-k)^2 = 1+9$ [1 Mark]

$\Rightarrow k^2+16-8k+4+k^2-4k = 10$

$\Rightarrow 2k^2-12k+10 = 0 \Rightarrow k^2-6k+5 = 0$

$\Rightarrow (k-5)(k-1) = 0 \Rightarrow k = 1, 5$ [1 Mark]

23. Since, the coordinates of given triangle are A (1, 3), B (–1, 0) and C (4, 0).
So, the area of triangle ABC [1 Mark]

$= \frac{1}{2}[1(0-0)+(-1)(0-3)+4(3-0)]$

$= \frac{1}{2}[3+12] = \frac{15}{2} = 7.5$ sq. units. [1 Mark]

OR

Given that
Distance between $A(-3,-14)$ and $B(a,-5)$, $AB = 9$
$\therefore$ using distance formula

$\sqrt{(a+3)^2+(-5+14)^2} = 9$ [½ Mark]

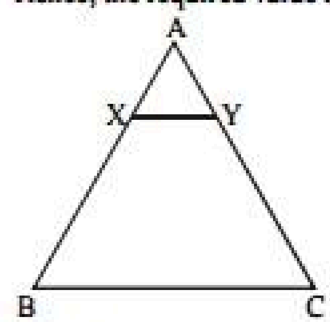
$\Rightarrow \sqrt{(a+3)^2+(9)^2} = 9$ [½ Mark]

On squaring both the sides, $(a+3)^2+81 = 81$

$\Rightarrow (a+3)^2 = 0 \Rightarrow a = -3$ [1 Mark]

Hence, the required value of a is –3.

24.



$\frac{AX}{XB} = \frac{3}{4}$, $AY = 5$, $YC = 9$ (Given) [1 Mark]

$\frac{AX}{XB} = \frac{3}{4}$ and $\frac{AY}{YC} = \frac{5}{9}$

$\frac{AX}{XB} \neq \frac{AY}{YC}$ (By B.P.T.)

Hence XY is not parallel to BC. [1 Mark]

OR

Consider ΔABC be an equilateral triangle of side 24 cm and AD is altitude which is also a perpendicular bisector of side BC.

Hence $BD = \frac{BC}{2} = 12$ cm

$AB = 24$ cm [1 Mark]

$\therefore$ $AD = \sqrt{AB^2 - BD^2}$

$AD = \sqrt{(24)^2 - (12)^2}$

$AD = \sqrt{576-144}$

$AD = \sqrt{432}$

$\therefore$ $AD = 12\sqrt{3}$ cm [1 Mark]

25. Since, the difference between the circumference and the radius of a circle is 37 cm.
So, $2\pi r - r = 37$

$r\left(\frac{44}{7}-1\right) = 37$

$r \times \frac{37}{7} = 37$

$r = 7$ cm. [1 Mark]

Therefore, circumference of the circle $= 2\pi r$

$= 2 \times \frac{22}{7} \times 7 = 44$ cm²

[1 Mark]

26. Suppose the sides of given two squares are a and b.
As, the sum of the areas of two squares is 400 cm^2.
So, $a^2 + b^2 = 400$ ...(i)
Now, the difference of their perimeters is 16 cm.
Therefore,

$4a - 4b = 16$ ...(ii)

$\therefore\ a - b = 4$ ... (iii)

Putting a = b + 4 in the equation (i), we get,

$(b+4)^2 + b^2 = 400$ [1 Mark]

$b^2 + 16 + 8b + b^2 = 400$

$2b^2 + 8b - 384 = 0$

$b^2 + 4b - 192 = 0$

$b^2 + 16b - 12b - 192 = 0$

$b(b+16) - 12(b+16) = 0$

$(b-12)(b+16) = 0$ [1 Mark]

b = 12 cm [$\because$ b cannot be negative]

From equation (iii),

$a = 4 + b$

$= 4 + 12$

$= 16$ cm [1 Mark]

Hence, the sides of two squares are 12 cm and 16 cm.

OR

$3x + 2y - 7 = 0$ ... (i)

$4x + y - 6 = 0$ ... (ii)

From (ii), $y = 6 - 4x$

Value of y put in eqn. (i)

$3x + 2y - 7 = 0$

$\Rightarrow\ 3x + 2(6 - 4x) - 7 = 0$

$\Rightarrow\ 3x + 12 - 8x - 7 = 0$

$\Rightarrow\ 5x = 5$

$\therefore\ x = 1$ [2 Marks]

Substitute the value of x in eq(ii) to get value of y,

$4x + y - 6 = 0$

$\Rightarrow\ 4(1) + y - 6 = 0$

$\Rightarrow\ 4 + y - 6 = 0$

$\Rightarrow\ y - 2 = 0$

$\therefore\ y = 2$ [1 Mark]

Hence, values of x and y are 1 and 2.

27. Since DE || BC

$\therefore\ \frac{AD}{AB} = \frac{AE}{EC}$ (By B.P.T.)

$\Rightarrow\ \frac{3}{4} = \frac{6}{EC}$ [2 Marks]

$\therefore$ EC = 8 cm [1 Mark]

28. $\frac{5\cos^2 60° + 4\cos^2 30° - \tan^2 45°}{\sin^2 30° + \cos^2 60°}$

$= \frac{5\left(\frac{1}{2}\right)^2 + 4\left(\frac{\sqrt{3}}{2}\right)^2 - (1)^2}{\left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^2}$ [2 Marks]

$= \frac{\frac{5}{4} + 3 - 1}{\frac{1}{4} + \frac{1}{4}} = \frac{\frac{5}{4} + 2}{\frac{1}{2}} = \frac{\frac{13}{4}}{\frac{1}{2}} = \frac{13}{2}$ [1 Mark]

29.

x_i	f_i	$x_i f_i$
3	10	30
9	p	$9p$
15	4	60
21	7	147
27	q	$27q$
33	4	132
39	1	39
Total	$\sum f_i = 26 + p + q$	$\sum x_i f_i = 408 + 9p + 27q$

Given $\sum fi = 40$, [1 Mark]

$\Rightarrow 26 + p + q = 40$

$\Rightarrow p + q = 14$

$\therefore$ Mean, $\bar{x} = \frac{\sum x_i f_i}{\sum f_i} \Rightarrow 14.7 = \frac{408 + 9p + 27q}{40}$

$\Rightarrow 588 = 408 + 9p + 27q \Rightarrow p + 3q = 20$

Subtracting eq.(i) from eq. (ii), $2q = 6$

$\Rightarrow q = 3$ [1 Mark]

Putting this value of q in eq. (i),

$p = 14 - q = 14 - 3 = 11$ [1 Mark]

$\therefore p = 11, q = 3$

OR

Here, maximum frequency = 95, so Modal class = 11 – 13

$l = 11, f_1 = 95, f_0 = 41, f_2 = 36, h = 2$ [1 Mark]

$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$

$= 11 + \left(\frac{95 - 41}{190 - 41 - 36}\right) \times 2 = 11 + \frac{54}{113} \times 2$

$\therefore$ Mode = 11 + 0.95 = 11.95 [1 Mark]

Now, let us calculate Mean :

Age	x_i	f_i	$f_i x_i$
5 – 7	6	67	402
7 – 9	8	33	264
9 – 11	12	41	410
11 – 13	14	95	1140
13 – 15	16	36	504
15 – 17	18	13	208
17 – 19	5	15	270
		$\sum f_i = 300$	$\sum f_i x_i = 3{,}198$

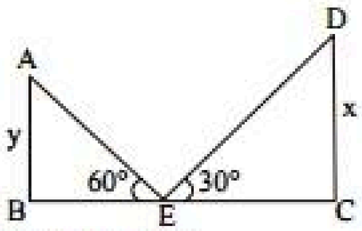
Mean $= \frac{3198}{300} = 10.66$ [1 Mark]

30. $\tan^2 30° \sin 30° + \cos 60° \sin^2 90° \tan^2 60° - 2\tan 45° \cos^2 0° \sin 90°$

$$= \frac{1}{3} \times \frac{1}{2} + \frac{1}{2} \times 1 \times 3 \times -2 \times 1 \times 1 \times 1 \quad = \frac{1}{6} + \frac{3}{2} - 2 = -\frac{1}{3}$$

[3 Marks]

31.



Given : BE = EC [1 Mark]

In ΔABE, $\tan 60° = \frac{y}{BE}$

$\Rightarrow \quad \sqrt{3}BE = y$ ...(i)

In ΔDCE, $\tan 30° = \frac{x}{EC}$ [1 Mark]

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

$\Rightarrow \quad \frac{BE}{\sqrt{3}} = x$ ...(ii)

From (i) and (ii),

$x : y = \frac{1}{\sqrt{3}} : \sqrt{3} \Rightarrow x : y = 1 : 3$ [1 Mark]

32. $\frac{1}{x+1} + \frac{2}{x+2} = \frac{4}{x+4}, x \neq -1, -2, -4$

$\Rightarrow \quad \frac{(x+2)+2(x+1)}{(x+1)(x+2)} = \frac{4}{x+4}$ [1½ Marks]

$\Rightarrow \quad \frac{3x+4}{(x+1)(x+2)} = \frac{4}{x+4}$

$\Rightarrow \quad (3x+4)(x+4) = 4(x+1)(x+2)$

$\Rightarrow \quad 3x^2 + 16x + 16 = 4x^2 + 12x + 8 \Rightarrow x^2 - 4x - 8 = 0$

$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4 \times 1 \times (-8)}}{2}$ [1½ Marks]

[By quadratic formula]

$\Rightarrow \quad x = \frac{4 \pm \sqrt{48}}{2} \Rightarrow x = \frac{4 \pm 4\sqrt{3}}{2} x = 2 \pm 2\sqrt{3}$ [1 Mark]

OR

Given : Speed of the boat in still water = 24 km/h

Let the speed of the stream be x km/h.

Now, speed of the boat upstream = (24 – x) km/h

and, speed of the boat downstream = (24 + x) km/h

Time taken in the upstream journey – Time taken in the downstream journey = 1 h

$\Rightarrow \frac{32}{(24-x)} - \frac{32}{(24+x)} = 1$ [1½ Marks]

$\Rightarrow \frac{32(24+x-24+x)}{(24-x)(24+x)} = 1 \Rightarrow \frac{64x}{576-x^2} = 1$ [2 Marks]

$\Rightarrow \quad x^2 + 64x - 576 = 0 \Rightarrow x^2 + 72x - 8x - 576 = 0$

$\Rightarrow \quad x(x+72) - 8(x+72) = 0 \Rightarrow (x-8)(x+72) = 0$

$\Rightarrow \quad x = 8$ or $x = -72$ [1 ½ Marks]

[$x \neq -72$ as the speed cannot be negative]

So, the speed of the stream is 8 km/h.

33. According to the question,

A.P. = 4, 8, 12, ... 48. [1 Mark]

First term of A.P. = a = 4

Common difference of A.P. = d = 4

$a_n = 48 \therefore a + (n-1)d = 48$

$4 + (n-1)4 = 48$

$n = 12$ [2 Marks]

$S_{12} = \frac{12}{2}[4 + 48] = 12 \times 26 = 312$ [2 Marks]

Total 312 trees were planted by the students.

The value of planting trees is to reduce air pollution and increase the quantity of oxygen in air and reduces the soil erosion.

34. Given that :

$PR = PQ \Rightarrow \angle PRQ = \angle PQR = \frac{(180-30)°}{2} = 75°$ [1 Mark]

Now, SR ∥ QP and QR is a transversal $\Rightarrow \angle SRQ = 75°$

$\therefore \quad \angle ORQ = \angle RQO = 90° - 75° = 15°$ [2 Marks]

$\therefore \angle QOR = (180 - 2 \times 15)° = 150° \Rightarrow \angle QSR = 75°$

$\angle RQS = 180° - (\angle SRQ + \angle SQR) = 30°$ [2 Marks]

35. Volume of tank $= \pi r^2 h = \frac{22}{7} \times (1)^2 \times 3.5 = 11 \text{ m}^3$

[2 Marks]

So, rainfall $= \frac{11}{22 \times 20} \text{m} = \frac{11 \times 100}{22 \times 20} \text{cm} = 2.5 \text{ cm}$

[3 Marks]

Water conservation is required due to shortage of fresh water.

OR

Volume of earth taken out after digging the well $= \pi r^2 h$

$= \left(\frac{22}{7} \times 2 \times 2 \times 14\right) \text{cu.m} = 176 \text{ cu.m}$ ....(i) [2 Marks]

[where r = 2 and h = 14]

Let x be the width of embankment formed

Volume of embankment

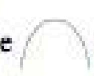
$= \frac{22}{7}\left[(2+x)^2 - (2)^2\right] \times \frac{40}{100} = 176 \Rightarrow x^2 + 4x - 140 = 0$

$\Rightarrow \quad (x + 14)(x - 10) = 0 \Rightarrow x = 10$

$x \neq -14$, ∵ Length can't be negative [3 Marks]

$\therefore$ Width of embankment = 10 m

36. **(i)** Parabola. [1 Mark]

(ii) $a < 0$, Graphs look like  open downwards

[1 Mark]

(iii) According to graph, there are two zeros one at (–2) and 2nd at 4, –2, 4 [2 Marks]

OR

(–2, 4)

37. **(i)** Length of diagonal $= \sqrt{3l^2} = 6\sqrt{3}$ [1 Mark]

(ii) Volume of cube = $(\text{side})^3 = 343 \text{ cm}^3$ [1 Mark]

(iii) Curved surface area of hemisphere = $2\pi r^2 = 308 \text{ cm}^2$

[2 Marks]

OR

$6.3^2 = 54$ [2 Marks]

38. **(i)** P(king of red colour) $= \frac{2}{52} = \frac{1}{26}$ [1 Mark]

(ii) P(getting a face card) $= \frac{12}{52} = \frac{3}{13}$ [1 Mark]

(iii) P(getting a jack of hearts) $= \frac{1}{52}$ [2 Marks]

OR

There are 13 spactes of the cards hence porobality is $P(S) = \frac{1}{4}$ [2 Marks]