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SAMPLE TEST PAPER 02 FOR CLASS X (2020-21)

SAMPLE ANSWER

Max. marks: 80 **Time Allowed: 3 hrs**

General Instruction:

1. This question paper contains two parts A and B.
2. Both Part A and Part B have internal choices.

Part – A:

1. It consists three sections- I and II.
2. Section I has 16 questions of 1 mark each.
3. Section II has 4 questions on 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:

1. Question No 21 to 26 are Very short answer Type questions of 2 mark each,
2. Question No 27 to 33 are Short Answer Type questions of 3 marks each
3. Question No 34 to 36 are Long Answer Type questions of 5 marks each.

PART - A

SECTION-I

Questions 1 to 16 carry 1 mark each.

1. Find the value of k so that the following system of equations has no solution: $3x – y – 5 = 0$, $6x – 2y + k = 0$

Here $a_1 = 3$, $b_1 = –1$, $c_1 = –5$,
and $a_2 = 6$, $b_2 = –2$, $c_2 = k$.

For no solution, $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \Rightarrow \frac{3}{6} = \frac{-1}{-2} \neq \frac{-5}{k} \Rightarrow \frac{1}{2} \neq \frac{-5}{k} \Rightarrow k \neq -10$

2. Find the number of solutions of the following pair of linear equations:
$x + 2y – 8 = 0$
$2x + 4y = 16$

$x + 2y – 8 = 0$ ... (i)
$2x + 4y – 16 = 0$ ... (ii)
Here, $a_1 = 1$, $b_1 = 2$, $c_1 = –8$
and $a_2 = 2$, $b_2 = 4$, $c_2 = –16$

Now, $\frac{a_1}{a_2} = \frac{1}{2}$, $\frac{b_1}{b_2} = \frac{2}{4} = \frac{1}{2}$, $\frac{c_1}{c_2} = \frac{-8}{-16} = \frac{1}{2}$

$\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

∴ Given pair of linear equations has infinite many solutions.

3. Find the ratio between the LCM and HCF of 5, 15, 20.

$5, 15 = 5 \times 3, 20 = 2 \times 2 \times 5$
$\text{LCM}(5, 15, 20) = 5 \times 3 \times 2 \times 2 = 60$
$\text{HCF}(5, 15, 20) = 5$

$\text{Ratio} = \frac{\text{LCM}}{\text{HCF}} = \frac{60}{5} = \frac{12}{1} = 12 : 1$

4. If the product of the zeroes of $x^2 – 3kx + 2k^2 – 1$ is 7, then find the values of k.

Product of zeroes = 7
$\Rightarrow 2k^2 – 1 = 7$
$\Rightarrow 2k^2 = 8 \Rightarrow k^2 = 4 \Rightarrow k = \pm 2$

5. For what value of k, are the roots of the quadratic equation $3x^2 + 2kx + 27 = 0$ real and equal.

$D = b^2 - 4ac \Rightarrow D = (2k)^2 - 4 \times 3 \times 27 = 4k^2 - 324$

For real and equal roots, $D = 0 \Rightarrow 4k^2 - 324 = 0 \Rightarrow 4k^2 = 324$

$\Rightarrow k^2 = \frac{324}{4} \Rightarrow k^2 = 81 \Rightarrow k = \pm 9.$

6. Write the nature of roots of quadratic equation $4x^2 + 4\sqrt{3}x + 3 = 0$.

Given equation is $4x^2 + 4\sqrt{3}\,x + 3 = 0$, Here $a = 4$, $b = 4\sqrt{3}$, $c = 3$

$D = b^2 - 4ac = 48 - 48 = 0$

As D = 0, the equation has real and equal roots.

7. Two APs have the same common difference. The first term of one of these is –1 and that of the other is –8. Then find the difference between their 4th terms.

$a_4 - b_4 = (a_1 + 3d) - (b_1 + 3d) = a_1 - b_1 = -1 - (-8) = 7$

8. If sec A = 15/7 and A + B = 90°, find the value of cosec B.

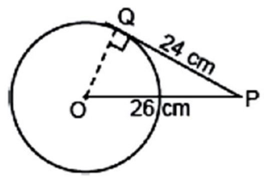
$\sec A = \frac{15}{7}$

$\Rightarrow \sec(90° - B) = \frac{15}{7}$ [$\because$ A + B = 90° $\Rightarrow$ A = 90° – B]

$\Rightarrow \text{cosec } B = \frac{15}{7}$ [$\because \sec(90° - \theta) = \text{cosec } \theta$]

9. A point P is 26 cm from the centre of the circle. The length of the tangent drawn from P to the circle is 24 cm. Find the radius of the circle.

Let O is the centre of the circle and PQ is the tangent from P.



A.T.Q., OP = 26 cm and PQ = 24 cm

In ΔOQP, we have $\angle$Q = 90°

$OP^2 = OQ^2 + PQ^2$

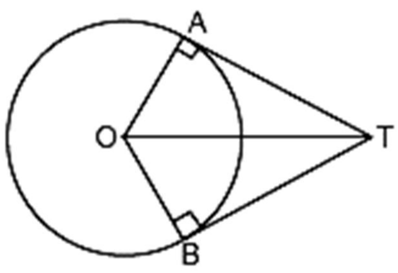
$\Rightarrow (26)^2 = OQ^2 + (24)^2$

$\Rightarrow OQ^2 = 676 - 576 = 100$

$\Rightarrow OQ = 10$ cm

$\Rightarrow$ Radius of the circle = 10 cm

10. In figure if $\angle$ATO = 40°, find $\angle$AOB.



In ΔOAT, $\angle$ATO = 40°, $\angle$OAT = 90°

$\therefore$ $\angle$AOT = 50° [Angle sum property]

Now $\angle$BTO = 40° as OT bisects $\angle$ATB

Similarly, $\angle$BOT = 50°

$\therefore$ $\angle$AOB = $\angle$AOT + $\angle$BOT = 50° + 50° = 100°

11. To divide a line segment PQ in the ratio 5 : 7, first a ray PX is drawn so that $\angle$QPX is an acute angle and then at equal distances points are marked on the ray PX and the last point is joined to Q. Write the minimum number of these equal distances points on ray PX.

Ans: 12

12. If cot θ = 7/8 evaluate $\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)}$

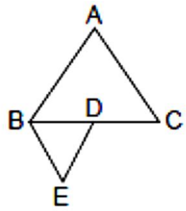
$$\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)} = \frac{1-\sin^2\theta}{1-\cos^2\theta} = \frac{\cos^2\theta}{\sin^2\theta} = \cot^2\theta = \left(\frac{7}{8}\right)^2 = \frac{49}{64}$$

13. ABC and BDE are two equilateral triangles such that D is mid-point of BC. Find the ratio of the areas of triangles ABC and BDE

$\because\ \Delta ABC \sim \Delta BDE$

$$\frac{ar(\Delta ABC)}{ar(\Delta BDE)} = \frac{BC^2}{BD^2} = \frac{(2BD)^2}{BD^2}$$

$= 4 : 1$



14. What is the perimeter of a sector of angle 45° of a circle with radius 7 cm?

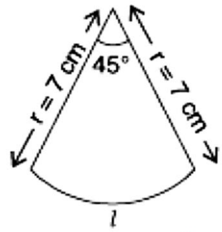
l = length of the arc $= \frac{\theta\pi r}{180°}$

$= \frac{45°}{180°} \times \frac{22}{7} \times 7 = \frac{11}{2}$ cm

$= (r + r + l) = \left(7 + 7 + \frac{11}{2}\right)$cm

$= \left(14 + \frac{11}{2}\right)$ cm $= \left(\frac{28+11}{2}\right)$cm

$= \frac{39}{2}$ cm $= 19.5$ cm



Perimeter of the sector

15. If the lateral surface area of a cylinder is 94.2 cm^2 and its height is 5 cm, then find radius of its base. [π = 3.14]

Lateral surface area = 94.2 cm^2, h = 5 cm

$2\pi rh = 94.2$

$\Rightarrow 2 \times 3.14 \times r \times 5 = 94.2$

$\Rightarrow r = \frac{94.2}{2 \times 3.14 \times 5} = 3$ cm

16. The letters of the word SOCIETY are placed at random in a row. Find the probability of getting a vowel.

Total number of letters = 7

Number of vowels = 3

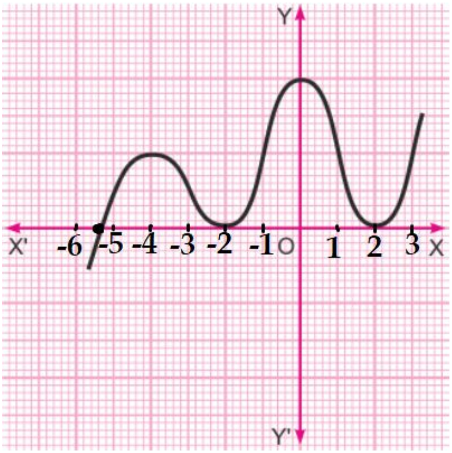
Required probability = 3/7

SECTION-II

Case study based questions are compulsory. Attempt any four sub parts of each question. Each subpart carries 1 mark

17. Case Study based-1: Heavy Storm

One day, due to heavy storm an electric wire got bent as shown in the figure. It followed some mathematical shape of curve. Answer the following questions below.



(a) How many zeroes are there for the polynomial (shape of the wire)
(i) 2 (ii) 3 (iii) 4 (iv) 5
Ans: (ii) 3

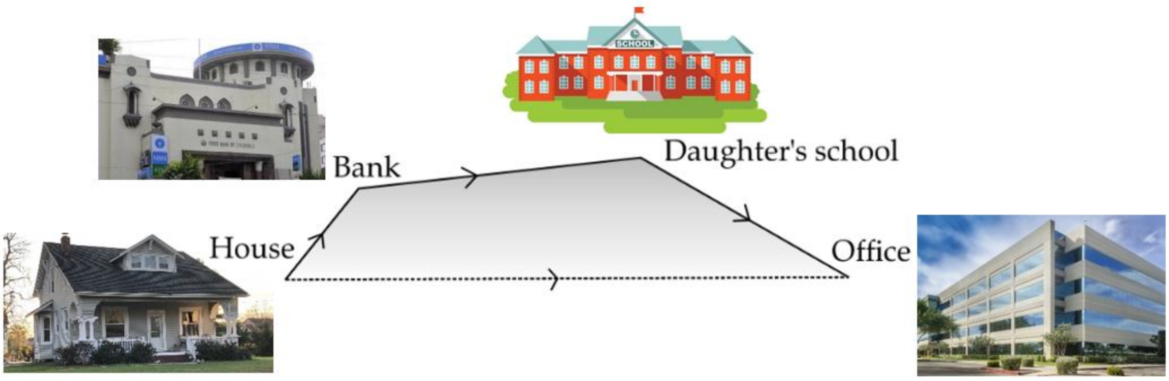
(b) Find the zeroes of the polynomial.
(i) 2, 0, -2 (ii) 2, -2, -5 (iii) -2, 2, -5.5 (iv) None of these
Ans: (iv) None of these

(c) Find the quadratic polynomial whose zeros are -3 and 4.
(i) $x^2 + 4x + 2$ (ii) $x^2 – x – 12$
(iii) $x^2 – 7x – 12$ (iv) None of these
Ans: (ii) $x^2 – x – 12$

(d) Name the type of expression of the polynomial in the above graph?
(i) quadratic (ii) cubic (iii) linear (iv) bi-quadratic
Ans: (ii) cubic

(e) If one zero of the polynomial $x^2 – 5x – 6$ is -1 then find the other zero.
(i) 6 (ii) -6 (iii) 2 (iv) -2
Ans: (i) 6

18. Case Study based-2:
Aditya Starts walking from his house to office. Instead of going to the office directly, he goes to a bank first, from there to his daughter's school and then reaches the office. (Assume that all distances covered are in straight lines). If the house is situated at (2, 4), bank at (5, 8), school at (13, 14) and office at (13, 26) and coordinates are in km.



(a) What is the distance between house and bank?
(i) 5 (ii) 10 (iii) 12 (iv) 27
Ans: (i) 5

(b) What is the distance between Daughter's School and bank?
(i) 5 (ii) 10 (iii) 12 (iv) 27
Ans: (ii) 10

(c) What is the distance between house and office?
(i) 24.6 (ii) 26.4 (iii) 24 (iv) 26
Ans: (i) 24.6

(d) What is the total distance travelled by Aditya to reach the office?
(i) 5 (ii) 10 (iii) 12 (iv) 27
Ans: (iii) 12

(e) What is the extra distance travelled by Aditya?
(i) 2 (ii) 2.2 (iii) 2.4 (iv) none of these
Ans: (iii) 2.4

19. Case Study based-3:

A group of students went to another city to collect the data of monthly consumptions (in units) to complete their Statistics project. They prepare the following frequency distribution table from the collected data gives the monthly consumers of a locality.

Monthly consumption (in units)	No. of consumers
65 - 85	4
85 -105	5
105 - 125	13
125 - 145	20
145 - 165	14
165 - 185	8
185 - 205	4

(a) What is the lower limit of median class?
(i) 125 (ii) 145 (iii) 165 (iv) 185
Ans: (i) 125

(b) What is the lower limit of modal class?
(i) 125 (ii) 145 (iii) 165 (iv) 185
Ans: (i) 125

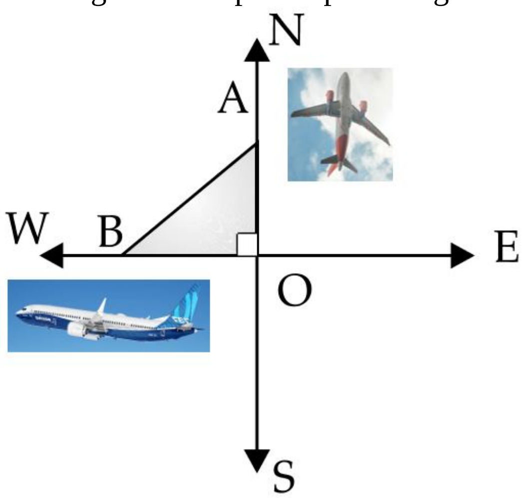
(c) What is the mean of upper limits of median and modal class?
(i) 125 (ii) 145 (iii) 165 (iv) 185
Ans: (ii) 145

(d) What is the width of the class?
(i) 10 (ii) 15 (iii) 20 (iv) 25

Ans: (iii) 20

(e) The median is :
(i) 137 (ii) 135 (iii) 125 (iv) 135.7
Ans: (i) 137

20. Case Study based-4:
Mohan went to Airport two and half hours before his departure time. He observes that an aeroplane leaves an airport and flies due north at a speed of 1,000 km per hour. At the same time, he observes another aeroplane leaves the same airport and flies due west at a speed of 1,200 km per hour. After the departure of the two aeroplanes, now he is rough sketch of drawing the four directions along with aeroplanes pictures given below:



(a) What is the distance travelled by aeroplane towards north after 1 ½ hours?
(i) 1000 km (ii) 1200 km (iii) 1500 km (iv) 1800 km
Ans: (iii) 1500 km

(b) What is the distance travelled by aeroplane towards west after 1 ½ hours?
(i) 1000 km (ii) 1200 km (iii) 1500 km (iv) 1800 km
Ans: (iv) 1800 km

(c) ∠AOB is
(i) 90° (ii) 45° (iii) 30° (iv) 60°
Ans: (i) 90°

(d) How far apart will be the two planes after 1½ hours?
(i) $\sqrt{22,50,000}$ (ii) $\sqrt{32,40,000}$ (iii) $\sqrt{54,90,000}$ (iv) none of these
Ans: (iii) $\sqrt{54,90,000}$

(e) The given problem is based on which concept?
(i) Triangles (ii) Co-ordinate geometry (iii) Height and Distance (iv) None of these
Ans: (i) Triangles

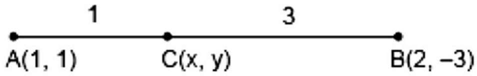
PART – B

(Question No 21 to 26 are Very short answer Type questions of 2 mark each)

21. 4 Bells toll together at 9.00 am. They toll after 7, 8, 11 and 12 seconds respectively. How many times will they toll together again in the next 3 hours?

$7 = 7 \times 1$
$8 = 2 \times 2 \times 2$
$11 = 11 \times 1$
$12 = 2 \times 2 \times 3$
$\therefore$ LCM of 7, 8, 11, 12 = $2 \times 2 \times 2 \times 3 \times 7 \times 11 = 1848$
$\therefore$ Bells will toll together after every 1848 sec.
$\therefore$ In next 3 hrs, number of times the bells will toll together = $\frac{3 \times 3600}{1848} = 5.84$
$\Rightarrow$ 5 times.

22. If C is a point lying on the line segment AB joining A(1, 1) and B(2, – 3) such that 3AC = CB, then find the coordinates of C.



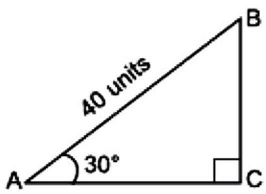
$\frac{AC}{CB} = \frac{1}{3}$ [Given]

Coordinates of C $(x, y) = \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$,

$\therefore\ x = \frac{2+3}{4} = \frac{5}{4}$ and $y = \frac{-3+3}{1+3} = 0$

$\therefore (x, y) = \left(\frac{5}{4}, 0\right)$

23. ABC is a right triangle, right angled at C. If A = 30° and AB = 40 units, find the remaining two sides of ΔABC.



Since $\angle A + \angle B + \angle C = 180°$
$30° + \angle B + 90° = 180° \Rightarrow \angle B = 60°$

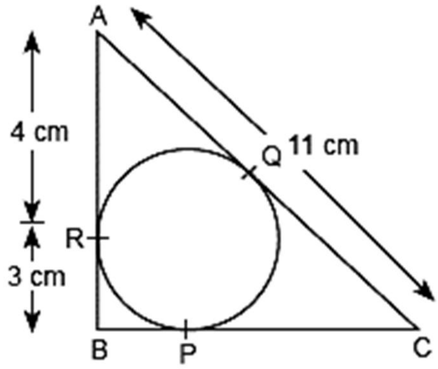
Now, $\cos A = \frac{AC}{AB}$

$\Rightarrow \cos 30° = \frac{AC}{40} \Rightarrow \frac{\sqrt{3}}{2} = \frac{AC}{40}$

$\Rightarrow$ AC = $20\sqrt{3}$ units.

and, $\sin A = \frac{BC}{AB} \Rightarrow \sin 30° = \frac{BC}{40} \Rightarrow \frac{1}{2} = \frac{BC}{40} \Rightarrow$ BC = 20 units

24. In figure, ΔABC is circumscribing a circle. Find the length of BC.



AR = 4 cm
Also, AR = AQ $\Rightarrow$ AQ = 4 cm
Now, QC = AC – AQ = 11 cm – 4 cm = 7 cm ...(i)
Also, BP = BR
$\therefore$ BP = 3 cm and PC = QC
$\therefore$ PC = 7 cm [From (i)]
BC = BP + PC = 3 cm + 7 cm = 10 cm

25. Draw a pair of tangents to a circle of radius 4 cm which are inclined to each other at an angle of 45°.

Steps of Construction:

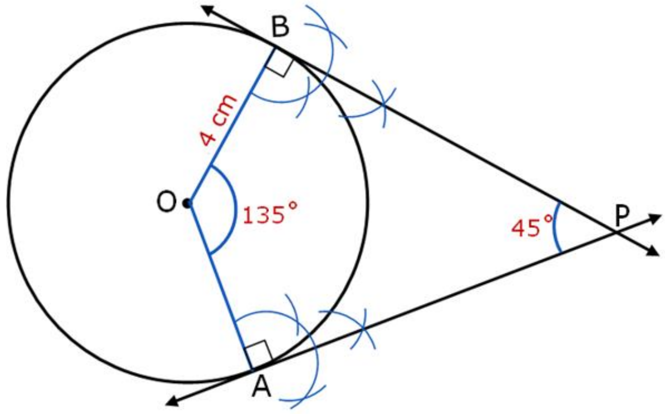
(*i*) Draw a circle with centre O and radius = 4 cm.

(*ii*) Draw any radius OA.

(*iii*) Draw another radius OB such that $\angle AOB = 180° - 45° = 135°$.

(*iv*) At point A draw $AP \perp OA$.

(*v*) At point B draw $BR \perp OB$, intersecting AP at C. AC and BC are required tangents.



26. In an AP, the 24th term is twice the 10th term. Prove that the 36th term is twice the 16th term.

Let 1st term = *a*, common difference = *d*.

$a_{10} = a + 9d$, $a_{24} = a + 23d$

According to the question, $a_{24} = 2 \times a_{10}$

$\Rightarrow a + 23d = 2(a + 9d) \Rightarrow a + 23d = 2a + 18d \Rightarrow a = 5d$

Now, $a_{16} = a + 15d = 5d + 15d = 20d$ ...(i)

$a_{36} = a + 35d = 5d + 35d = 40d$ ...(ii)

From (i) and (ii), we get

$a_{36} = 2 \times a_{16}$ Hence proved.

(Question no 27 to 33 are Short Answer Type questions of 3 marks each)

27. Prove that $\sqrt{7}$ is an irrational number.

Let us assume that $\sqrt{7}$ is rational number

such that $\sqrt{7} = a/b$ where 'a' and 'b' are co- prime numbers

$\Longrightarrow a = \sqrt{7}b$

Squaring both sides, we get

$a^2 = 7b^2$ .... (1)

$\Longrightarrow a^2$ is divisible by 7

$\Longrightarrow$ a is also divisible by 7

Let a=7c, where c is any integer

substituting values in (1), we get

$(7c)^2 = 7b^2$

$\Longrightarrow 49c^2 = 7b^2$ $\Longrightarrow 7c^2 = b^2$ $\Longrightarrow b^2 = 7c^2$

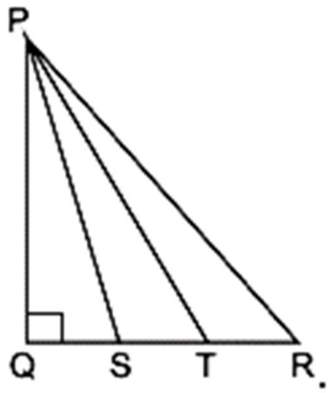
$\Longrightarrow b^2$ is divisible by 7

$\Longrightarrow$ b is also divisible by 7

that is a and b have at least one common factor 7. This is contradicting the fact that a and b have no common factor. Therefore, our assumption is wrong.

Hence, $\sqrt{7}$ is an irrational

28. In figure, S and T trisect the side QR of a right triangle PQR. Prove that $8PT^2 = 3PR^2 + 5PS^2$.



In right triangle PQS,
$PS^2 = PQ^2 + QS^2$ (By Pythagoras theorem) ...(ii)
In right triangle PQT,
$PT^2 = PQ^2 + QT^2$ (By Pythagoras theorem) ...(iii)
In right triangle PQR,
$PR^2 = PQ^2 + QR^2$ (By Pythagoras theorem) ...(iv)
Subtracting (iii) from (ii), we get

$PS^2 - PT^2 = QS^2 - QT^2 \Rightarrow PS^2 - PT^2 = \left(\frac{1}{3}QR\right)^2 - \left(\frac{2}{3}QR\right)^2$

$= \frac{1}{9}QR^2 - \frac{4}{9}QR^2$ [from (i)]

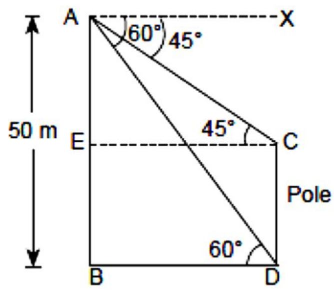
$\Rightarrow 3PS^2 - 3PT^2 = -QR^2$ ...(v)
Subtracting (iv) from (iii), we get

$PT^2 - PR^2 = QT^2 - QR^2 = \left(\frac{2}{3}QR\right)^2 - QR^2$ [from (i)]

$\Rightarrow PT^2 - PR^2 = \frac{4}{9}QR^2 - QR^2 \Rightarrow 9PT^2 - 9PR^2 = -5QR^2$ ...(vi)

Substituting for $(-QR^2)$ from (v) in (vi), we get
$\Rightarrow 9PT^2 - 9PR^2 = 5(3PS^2 - 3PT^2) \Rightarrow 9PT^2 - 9PR^2 = 15PS^2 - 15PT^2$
$\Rightarrow 24PT^2 = 15PS^2 + 9PR^2 \Rightarrow 8PT^2 = 5PS^2 + 3PR^2$

29. From the top of a tower 50 m high the angles of depression of the top and bottom of a pole are observed to be 45° and 60° respectively. Find the height of the pole.



In ΔABD, $\frac{BD}{AB} = \cot 60°$

$\Rightarrow \frac{BD}{50} = \frac{1}{\sqrt{3}} \Rightarrow BD = \frac{50}{\sqrt{3}}$ m

$BD = EC \Rightarrow EC = \frac{50}{\sqrt{3}}$ m

In ΔAEC, $\frac{AE}{EC} = \tan 45°$

$\Rightarrow AE = EC \Rightarrow AE = \frac{50}{\sqrt{3}}$ m

Now $BE = AB - AE = 50 - \frac{50}{\sqrt{3}}$

$= \frac{50\sqrt{3} - 50}{\sqrt{3}} = \frac{50(\sqrt{3} - 1)}{\sqrt{3}}$ m

$DC = BE = \frac{50(\sqrt{3} - 1)}{\sqrt{3}}$ m

30. Using quadratic formula, solve the following quadratic equation for x:
$p^2x^2 + (p^2 - q^2)x - q^2 = 0$.

$p^2x^2 + (p^2 - q^2)x - q^2 = 0$

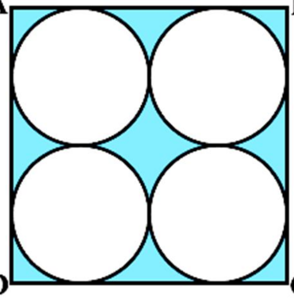
Here $a = p^2$, $b = (p^2 - q^2)$, $c = -q^2$,

$D = b^2 - 4ac = (p^2 - q^2)^2 - 4 \times p^2 \times (-q^2) = (p^2 + q^2)^2$

Now $x = \frac{-b+\sqrt{D}}{2a}, \frac{-b-\sqrt{D}}{2a}$

$\Rightarrow x = \frac{-(p^2-q^2)+\sqrt{(p^2+q^2)^2}}{2\times p^2}$; $x = \frac{-(p^2-q^2)-\sqrt{(p^2+q^2)^2}}{2\times p^2}$ $\Rightarrow x = \frac{q^2}{p^2}, -1$

31. Find the area of the shaded region in the fig., where ABCD is a square of side 14 cm.



Diameter of 2 circles = 14 cm

$\therefore$ Diameter of one circle = 7 cm

$\Rightarrow$ Radius of one circle = $\frac{7}{2}$ cm

Area of one circle = $\pi \times \left(\frac{7}{2}\right)^2 = \frac{49}{4}\pi \text{ cm}^2$

$\therefore$ Area of 4 circles = $4 \times \frac{49}{4}\pi = 49\pi \text{ cm}^2 = 154 \text{ cm}^2$

Area of square ABCD = 14 × 14 = 196 cm^2.

$\therefore$ Area of shaded region = Area of square – Area of 4 circles = (196 – 154) cm^2 = 42 cm^2

32. If the median of the distribution given below is 28.5, find the values of x and y.

Class	0-10	10-20	20-30	30-40	40-50	50-60	Total
Frequency	5	x	20	15	y	5	60

Class interval	*Frequency (f)*	*c.f.*	*New c.f.*
0 – 10	5	5	5
10 – 20	x	$5 + x$	$5 + x$
20 – 30	20	$25 + x$	$25 + x$
30 – 40	15	$40 + x$	$40 + x$
40 – 50	y	$40 + x + y$	55
50 – 60	5	$45 + x + y$	60
Total	$\Sigma f = 45 + x + y$		

Given: $\Sigma f = 60 \Rightarrow 45 + x + y = 60 \Rightarrow x + y = 15.$

Since, median = 28.5, which lies in class 20 – 30. Thus, $l = 20$, $h = 10$, $\frac{N}{2} = \frac{60}{2} = 30$, $C = 5 + x$ and $f = 20$

$\therefore$ Median $= l + \frac{\frac{N}{2} - C}{f} \times h \Rightarrow 28.5 = 20 + \frac{30-(5+x)}{20} \times 10 \Rightarrow 8.5 = \frac{25-x}{2}$

$\Rightarrow 17 = 25 - x. \Rightarrow x = 25 - 17 = 8$

and $y = 15 - 8 = 7$. Hence, $x = 8$ and $y = 7$.

33. In a single throw of a pair of different dice, what is the probability of getting (i) a prime number on each dice (ii) a total of 9 or 11?

Total possible cases when two dice are thrown together = 6 x 6 = 36

(i) Favourable cases when both numbers are prime are (2, 2), (2, 3), (2, 5), (3, 2), (3, 3),(3, 5), (5, 2), (5, 3), (5,5), i.e. 9 outcomes

$$P(\text{a prime number on each dice}) = \frac{\text{Favourable cases}}{\text{Total cases}} = \frac{9}{36} = \frac{1}{4}$$

(ii) Favourable cases when sum of numbers are 9 or 11 are (3, 6), (4, 5), (5, 4), (5, 6),(6, 3), (6,5), i.e. 6 outcomes

$$P(\text{a total of 9 or 11}) = \frac{\text{Favourable outcomes}}{\text{Total possible outcomes}} = \frac{6}{36} = \frac{1}{6}$$

(Question no 34 to 36 are Long Answer Type questions of 5 marks each.)

34. Solve the following equations:

$$\frac{6}{x+2y}+\frac{5}{x-2y}=-3; \frac{3}{x+2y}+\frac{7}{x-2y}=-6; x+2y\neq 0, x-2y\neq 0.$$

Given equations are

$\frac{6}{x+2y}+\frac{5}{x-2y}=3$ ...(i)

$\frac{3}{x+2y}+\frac{7}{x-2y}=-6$

Putting $\frac{1}{x+2y}$ = A and $\frac{1}{x-2y}$ = B

eq. (i) and (ii) become

6A + 5B = –3 ...(iii)

and 3A + 7B = –6 ...(iv)

Multiply eq. (iv) with 2 we get

6A + 14B = –12 ...(v)

Subtracting eq. (v) from (iii), we get

$$\begin{array}{r} 6A + 5B = -3 \\ 6A + 14B = -12 \\ - \quad - \quad\quad + \\ \hline -9B = 9 \Rightarrow B = -1 \end{array}$$

when B = –1, eq. (iii) becomes

6A + 5 × –1 = –3

$\Rightarrow$ 6A = 2 $\Rightarrow$ A = $\frac{1}{3}$

When A = $\frac{1}{3}$

$\Rightarrow \frac{1}{x+2y} = \frac{1}{3} \Rightarrow x + 2y = 3$ ...(vi)

when B = –1 $\Rightarrow \frac{1}{x-2y} = -1$

$\Rightarrow x - 2y = -1$ ...(vii)

adding (vi) and (vii), we get

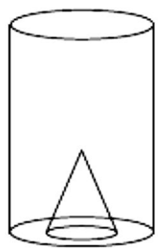
$$\begin{array}{lr} & x + 2y = 3 \\ \text{adding} & x - 2y = -1 \\ \hline & 2x = 2 \Rightarrow x = 1 \end{array}$$

when x = 1 eq. (vi) becomes

1 + 2y = 3 $\Rightarrow y$ = 1

$\therefore$ x = 1, y = 1

35. A cylindrical vessel with internal diameter 10 cm and height 10.5 cm is full of water. A solid cone of base diameter 7 cm and height 6 cm is completely immersed in water. Find the volume of (i) water displaced out of the cylindrical vessel. (ii) water left in the cylindrical vessel.



Height of cylinder = 10.5 cm ; Radius of cylinder = 5 cm

$\therefore$ Volume of cylinder = $\pi r^2 h$

= $\frac{22}{7}$ × 5 × 5 × 10.5 cm^3 = 825 cm^3

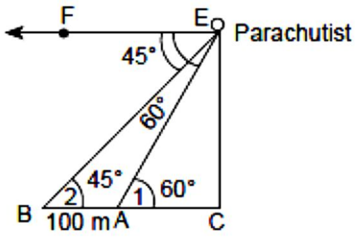
Radius of base of cone = $\frac{7}{2}$ cm; height of cone = 6 cm

$\therefore$ Volume of cone = $\frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 6 = 77 \text{ cm}^3$

(i) Volume of water displaced = volume of cone = 77 cm^3

(ii) Water left in cylindrical vessel = 825 cm^3 – 77 cm^3 = 748 cm^3

36. A parachutist is descending vertically and makes angles of depression of 45° and 60° at two observation points 100 m apart from each other on the left side of himself. Find, in metres, the approximate height from which he falls and also find, in metres the approximate distance of the point where he falls on the ground from the first observation point.



$\angle FEB = 45°$, $\angle FEA = 60°$

To find: EC and BC

Solution: In right ΔECB

$\because$ EF || BC [Given]

$\Rightarrow \angle 2 = 45°$ [Alternate angles]

$\frac{EC}{BC} = \tan 45°$

$\Rightarrow$ EC = BC ...(i)

In right ΔECA, $\angle 1 = \angle FEA = 60°$

$\frac{EC}{AC} = \tan 60°$

$\Rightarrow EC = \sqrt{3}\,AC$

$\Rightarrow BC = \sqrt{3}\,(BC - AB)$ [$\because$ AC = BC – AB]

$\Rightarrow BC = \sqrt{3}\,BC - \sqrt{3} \times 100$

$\Rightarrow \sqrt{3} \times 100 = \sqrt{3}\,BC - BC$

$\sqrt{3} \times 100 = (\sqrt{3} - 1)BC$

$\Rightarrow \frac{\sqrt{3} \times 100}{(\sqrt{3} - 1)} = BC$

$\Rightarrow BC = \frac{\sqrt{3} \times 100(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)} = \frac{100(3+\sqrt{3})}{2}$

= 50 (3 + 1.732)

= 50 × 4.732 m = 236.6 m

From (i) EC = 236.6 m