(GST, BANKING)

Maximum Time : 1 Hour **Maximum Marks : 30**

Answer the following questions. **[10 × 3]**

Q. 1. **[3 + 3 + 4]**

(a) The cost of some financial services are given below, in the same city:

Cost of services: ₹ 800, ₹ 600, ₹ 700, ₹ 900.

If the rate of GST is 12%, find the amount of GST on above services.

(b) A person has a RD account in a post office for 3 years at 7.5%per annum. If he gets ₹ 80325 as maturity value. Find the monthly installment.

(c) Rina has a RD account in a bank and deposits ₹ 850 per month for 30 months. Find the interest and its maturity value if the rate of interest is 12% per annum.

Q. 2. **[3 ÷ 3 + 4]**

(a) The maturity value of a RD account is ₹ 11364. If the monthly deposit is ₹ 200 and rate of interest is 9% per annum. Find the time at which the account was kept.

(b) Ms. Swati deposits ₹ 200 for each month in a RD account. If she gets ₹ 8088 from bank after 3 years. Find the rate at which bank paid the interest.

(c) A manufacturer in a firm manufactures a machine and marks it at ₹ 1,00,000. He sells the machine to a wholesaler (in Lucknow) at a discount of 15%. The wholesaler sells the machine to a dealer (in Aligarh) at a discount of 10% on the marked price. If the rate of GST 28%, find tax paid by the wholesaler to Central Government.

Q. 3. **[3 + 3 + 4]**

(a) Let Ajay, Raj and Rohit be three dealers belonging to difference states. Dealer Ajay sells some products/services to dealer Raj for ₹ 5000 and dealer Raj sells the same products/services to dealer Rohit at a profit of ₹ 1500. Calculate the tax liability of Raj, if the rate of GST is 12%.

(b) Find the time at which account was held.

Sum of money: ₹ 1200 per month

Maturity value: ₹ 12440

Rate paid by bank: 8% per annum

(c) Gita has a RD account in a bank for 36 months and pays ₹ 200 per month at the rate 11% per annum. Find the maturity value.

(i) Market value = 100 + 20 = 120

(ii) No. of shares he bought = $\frac{36000}{120} = 300$

(iii) Dividend on each share = 15% of 100 = ₹ 15

Total dividend = 15×300 = ₹ 4500

(iv) Rate of return = $\frac{4500}{36000} \times 100 = 12.5\%$

The rate of return is 12.5%.

❑❑

(LINEAR INEQUATIONS)

Maximum Time : 1 Hour **Maximum Marks : 30**

Answer the following questions. **[10 × 3]**

Q. 1. **[3 + 3 + 4]**

(a) Find the set of values of x. $3x - 3 \leq 7x + 5$ and $5 - x \geq \frac{x}{4} - \frac{5}{4}, x \in N$.

(b) Solve the following inequation and represent the solution set on number line. $3x - 5 \leq 6x + 4 < 12, x \in I$

(c) If $10 - 5x < 5(x + 6)$, find the smallest value of x, when x belongs

(i) Integers

(ii) Whole number

(iii) Natural number.

Q. 2. **[3 + 3 + 4]**

(a) Suppose $A = \{8x - 1 > 5x + 1, x \in N\}$ and $B = \{7x + 2 > 3(x + 6), x \in N\}$. Find $A \cup B$ and $A \cap B$.

(b) Solve the inequation $2x - 3 < x + 2 \leq 3x + 5$. Represent it on number line, $x \in Z$.

(c) Solve the following inequation and write solution set.

$$-8\frac{1}{2} < -\frac{1}{2} - 4x \leq 7\frac{1}{2}, x \in Z.$$

Q. 3. **[3 + 3 + 4]**

(a) Solve the following inequation.

$$-2\frac{2}{5} \leq x + \frac{1}{5} < 3 + \frac{1}{5}, x \in R.$$

(b) Solve the inequation.

$$\frac{4x + 6}{8} - 6 < \frac{2x - 4}{6} - 4$$

(c) Find three smallest consecutive natural numbers such that the difference between one-third of the largest and one-sixth the smallest is atleast 5.

(QUADRATIC EQUATIONS IN ONE VARIABLE, RATIO AND PROPORTION, FACTORISATION OF POLYNOMIALS)

Time: 1 Hours **MM: 30**

SOLUTIONS

Sol. 1.

We have, $\frac{4a-3b}{4c-3d} = \frac{4a+3b}{4c+3d}$

Applying alternendo,

$$\frac{4a-3b}{4a+3b} = \frac{4c-3d}{4c+3d}$$

Applying components and dividends,

$$\frac{4a-3b+4a+3b}{4a-3b-4a-3b} = \frac{4c-3d+4c+3d}{4c-3d-4c-3d}$$

$$\frac{8a}{-6b} = \frac{8c}{-6d}$$

$$\frac{a}{b} = \frac{c}{d}$$ **Hence Proved.**

(b) $\frac{2x}{1} - \frac{1}{x} = 7$

$$\frac{2x^2-1}{x} = 7$$

$$2x^2 - 1 = 7x$$

$$2x^2 - 7x - 1 = 0$$

Comparing with $ax^2 + bx + c = 0$, we get

$a = 2, b = -7, c = -1$

$D = b^2 - 4ac$

$= (-7)^2 - 4 \times 2 \times -1$

$= 49 + 8$

$= 57$

Roots are

$$\Rightarrow \quad x = \frac{-b \pm \sqrt{D}}{2a}$$

$$\Rightarrow \quad x = \frac{7 \pm \sqrt{57}}{4} = \frac{7 \pm 7.5498}{4}$$

First root, $x = \frac{7+7.5498}{4} = \frac{14.5498}{4}$

$= 3.637$

$= 3.64$

Second root, $x = \frac{7-7.5498}{4} = \frac{-0.5498}{4}$

$= -0.137$

$= -0.14$

(c) Let $f(x) = 6x^3 + 25x^2 - 32x - 12$

Let $(x - 2)$ is a factor of $f(x)$, then

$f(2) = 6(2)^3 - 25(2)^2 + 32(2) - 12$

$= 48 - 100 + 64 - 12$

$= 112 - 112 = 0$

So, it is clearly that $x - 2$ is a factor of $f(x)$

$$x-2\ \overline{)\ 6x^3 - 25x^2 + 32x - 12\ (\ 6x^2 - 13x + 6}$$

$6x^3 - 12x^2$

$- \quad +$

$-13x^2 + 32x$

$-13x^2 + 26x$

$+ \quad -$

$6x - 12$

$6x - 12$

$- \quad +$

0

Now, factor of $6x^2 - 13x + 6 = 6x^2 - 9x - 4x + 6$

$= 3x(2x - 3) - 2(2x - 3)$

$= (2x - 3)(3x - 2)$

Hence,

$6x^3 - 25x^2 + 32x - 12 = (x - 1)(2x - 3)(3x - 2)$

Sol. 2. (a) Given, $\frac{a}{b} = \frac{c}{d}$

Now multiply by $\frac{3}{5}$ both the sides

$$\frac{3a}{5b} = \frac{3c}{5d}$$

Apply componendo and dividendo

$$\frac{3a+5b}{3a-5b} = \frac{3c+5d}{3c-5d}$$

Now, apply Invertendo,

$$\frac{3a-5b}{3a+5b} = \frac{3c-5d}{3c+5d}$$ **Hence Proved.**

(b) Let $f(x) = x^3 - 7x^2 + 6x + 4$

$$x-6\ \overline{)\ x^3 + 7x^2 + 6x + 4\ (\ x^2 - x}$$

$x^3 - 6x^2$

$(-)\ (+)$

$-x^2 + 6x$

$-x^2 + 6x$

$(+)\ (-)$

4

Hence, on dividing $x^3 - 7x^2 + 6x + 4$ by $x - 6$, then remainder is 4.

(c) $x^2 - 10x + 6 = 0$

Comparing with $ax^2 + bx + c = 0$, we get

$a = 1, b = -10, c = 6$

$D = b^2 - 4ac$

$= (-10)^2 - 4 \times 1 \times 6$

(MATRICS, ARITHMETIC PROGRESSIONS, GEOMETRIC PROGRESSIONS)

Maximum Time : 1 Hour **Maximum Marks : 30**

Section A **20 marks**

Attempt all questions from this section.

Q. 1. (a) How many two digit numbers are divisible by 7 ? [3]

(b) The first term of a G.P. is 50 and the fourth term is 1350. Find its fifth term. [3]

(c) Given, $A = \begin{bmatrix} 1 & 1 \\ 8 & 3 \end{bmatrix}$, evaluate $A^2 - 4A$. [4]

Q. 2. (a) The 16^{th} term of an A.P. is five times its third term. If its 10^{th} term is 41, then find the sum of its first fifteen terms. [3]

(b) The sum of three numbers of a G.P. is 26. Their product is 216. Find the numbers. [4]

(c) Given, $A = \begin{bmatrix} 2 & -1 \\ 2 & 0 \end{bmatrix}$, $B = \begin{bmatrix} -3 & 2 \\ 4 & 0 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$, find the matrix X such that $A + X = 2B + C$. [3]

Section B **10 marks**

Q. 3. (a) If the numbers $x + 3$, $2x + 1$ and $x - 7$ are in A.P., find the value of x. [3]

(b) A person saved every year half as much he saved the previous year. If he totally saved ₹ 19,375 in 5 years, how much did he save the first year ? [4]

(c) Find x and y if $\begin{bmatrix} 3 & -2 \\ -1 & 4 \end{bmatrix}\begin{bmatrix} 2x \\ 1 \end{bmatrix} + 2\begin{bmatrix} -4 \\ 5 \end{bmatrix} = 4\begin{bmatrix} 2 \\ y \end{bmatrix}$. [3]

SOLUTIONS

Time : 1 Hour **Max. Marks : 30**

Sol. 1. (a) Two digit numbers which are divisible by 7 are 14, 21, 28, ...98.

It forms an *A.P.*

$$a = 14, d = 7, a_n = 98$$
$$a_n = a + (n-1)d$$
$$98 = 14 + (n-1)7$$
$$98 - 14 = 7n - 7$$
$$84 + 7 = 7n$$
$$\Rightarrow \quad 7n = 91$$
$$\Rightarrow \quad n = 13.$$

(b) Given, $a = 50, T_4 = 1350, T_5 = ?$

Since, $T_n = ar^{n-1}$

$$\therefore \quad T_4 = ar^{4-1}$$
$$1350 = 50r^{3S}$$
$$r^3 = \frac{1350}{50} = 27 = 3^3$$
$$r^3 = 3^3 \Rightarrow r = 3$$
$$T_5 = T_4 \times r$$
$$= 1350 \times 3$$
$$T_5 = 4050$$

(c)
$$A^2 = \begin{bmatrix} 1 & 1 \\ 8 & 3 \end{bmatrix}\begin{bmatrix} 1 & 1 \\ 8 & 3 \end{bmatrix}$$
$$\Rightarrow \begin{bmatrix} 1\times1+1\times8 & 1\times1+1\times3 \\ 8\times1+3\times8 & 8\times1+3\times3 \end{bmatrix}$$
$$\Rightarrow \quad \begin{bmatrix} 1+8 & 1+3 \\ 8+24 & 8+9 \end{bmatrix} = \begin{bmatrix} 9 & 4 \\ 32 & 17 \end{bmatrix}$$
$$\Rightarrow \quad 4A = 4\begin{bmatrix} 1 & 1 \\ 8 & 3 \end{bmatrix} = \begin{bmatrix} 4 & 4 \\ 32 & 12 \end{bmatrix}$$
$$\therefore \quad A^2 - 4A = \begin{bmatrix} 9 & 4 \\ 32 & 17 \end{bmatrix} - \begin{bmatrix} 4 & 4 \\ 32 & 12 \end{bmatrix}$$
$$\therefore \begin{bmatrix} 9-4 & 4-4 \\ 32-32 & 17-12 \end{bmatrix} = \begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix}$$

Sol. 2. (a) Here, $a_{16} = 5a_3$

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

$$\Rightarrow \quad a + 15d = 5(a + 2d)$$
$$\Rightarrow \quad 4a = 5d \qquad \text{...(i)}$$
$$a_{10} = 41$$
$$\Rightarrow \quad a + 9d = 41 \qquad \text{...(ii)}$$

Solving (i) and (ii), we get

$$a = 5, d = 4$$
$$S_{15} = \frac{15}{2}[2\times5 + (15-1)\times4]$$
$$= \frac{15}{2}[10 + 56]$$
$$= \frac{15}{2}\times66 = 15 \times 33$$
$$= 495.$$

(b) Let three numbers of a *G.P.* be $\frac{a}{r}$, a and ar.

$$\therefore \quad \frac{a}{r}\times a \times ar = 216$$
$$a^3 = 216 = 6^3$$
$$\therefore \quad a = 6$$

And
$$\frac{a}{r} + a + ar = 26$$
$$a\left(\frac{1}{r} + 1 + r\right) = 26$$
$$\left(\frac{1}{r} + 1 + r\right) = \frac{26}{a}$$
$$\frac{1}{r} + 1 + r = \frac{26}{6}$$
$$r + \frac{1}{r} = \frac{13}{3} - 1$$
$$= \frac{10}{3}$$
$$\Rightarrow \quad 3r^2 - 10r + 3 = 0$$
$$3r^2 - 9r - r + 3 = 0$$
$$3r(r-3) - 1(r-3) = 0$$
$$(r-3)(3r-1) = 0$$
$$r = 3, r = \frac{1}{3}$$

Thus, numbers are :

$\frac{a}{r} = \frac{6}{3} = 2, a = 6$ and $ar = 6 \times 3 = 18$.

(c)
$$2B = \begin{bmatrix} -6 & 4 \\ 8 & 0 \end{bmatrix}$$
$$2B + C = \begin{bmatrix} -5 & 4 \\ 8 & 2 \end{bmatrix}$$
$$X = \begin{bmatrix} -5 & 4 \\ 8 & 2 \end{bmatrix} - \begin{bmatrix} 2 & -1 \\ 2 & 0 \end{bmatrix}$$
$$X = \begin{bmatrix} -7 & 5 \\ 6 & 2 \end{bmatrix}.$$

Sol. 3. (a) $2x + 1 - x - 3 = x - 7 - 2x - 1$

$$x - 2 = -x - 8$$

(CO-ORDINATE GEOMETRY, SECTION AND MIS-POINT FORMULA, EQUATION OF LINE)

(c) Use the graph paper for the question $A(1, 1)$, $B(5, 1)$, $C(4, 2)$ and $D(2, 2)$ are the vertices of a quadrilateral. Name the quadrilateral $ABCD$. A, B, C and D are reflected in the origin onto A', B' C' and D' respectively. Locate A', B', C' and D' on the graph sheet and write their coordinates. Are D, A, A' and D' collinear ? [3]

(CO-ORDINATE GEOMETRY, SECTION AND MIS-POINT FORMULA, EQUATION OF LINE)

Sol. 2. (a) $(x_1, y_1) = (-2, 3)$

Equation of line passing through the point $(-2, 3)$ and the point that having the x-intercept 8 unit means $(8, 0)$.

Here, $(x_1, y_1) = (-2, 3)$ and $(x_2, y_2) = (8\ 0)$

Equation of line :

$$\frac{y-y_1}{x-x_1} = \frac{y_2-y_1}{x_2-x_1}$$

$$\frac{y-(3)}{x-(-2)} = \frac{0-(3)}{8-(-2)}$$

$$\frac{y-3}{x+2} = \frac{-3}{10}$$

$$\frac{y-3}{x+2} = \frac{-3}{10}$$

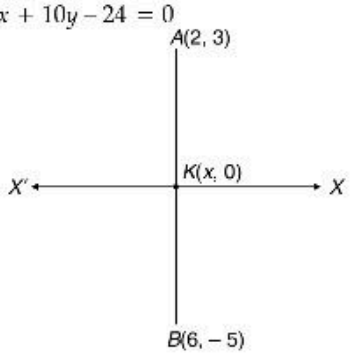
$$10(y-3) = -3(x+2)$$

$$10y-30 = -3x-6$$

$$3x+10y-30+6 = 0$$

$$3x+10y-24 = 0$$

(b)



Let the ratio be $k : 1$, then

$$y = \frac{m_2y_1 - m_1y_2}{m_1+m_2}$$

$$0 = \frac{1\times3 + k\times-5}{k+1}$$

$$0 = 3-5k$$

$$5k = 3$$

$$k = \frac{3}{5}$$

Now,

$$x = \frac{m_2x_1 + m_1x_1}{m_1+m_2}$$

$$= \frac{5\times2+3\times6}{3+5}$$

$$= \frac{10+18}{8}$$

$$= \frac{28}{8}$$

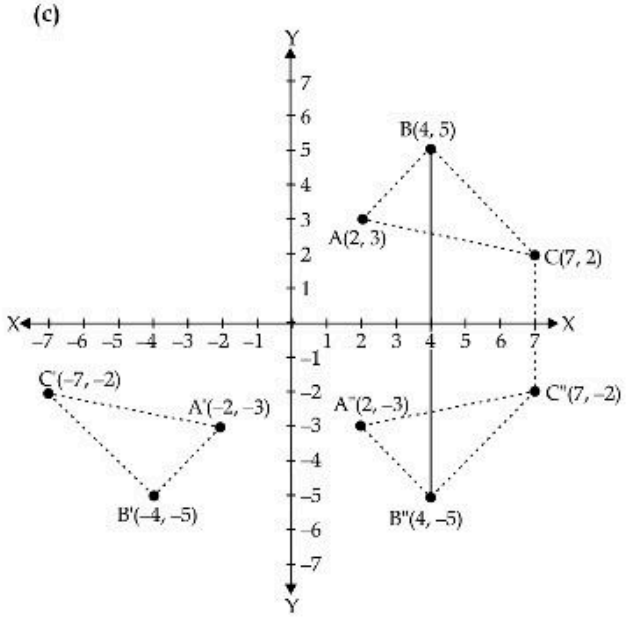
$$= \frac{7}{2}$$

Hence,

Coordinates of the point K are $\left(\frac{7}{2}, 0\right)$. Also,

K divide AB in ratio 3 : 5

(c)



(i) The reflected image at A, B and C in the origin are $A'(-2, -3)$, $B'(-4, -5)$ and $C'(-7, -2)$.

(ii) The reflected image of A, B and C in the X-axis are $A''(2, -3)$, $B''(4, -5)$ and $C''(7, -2)$.

(iii) Quadrilateral $BCC''B''$ is isosceles trapezium.

$$\text{Area} = \frac{1}{2} \times (BB'' + CC'') \times \text{height}$$

$$= \frac{1}{2} \times (10+4) \times 3$$

$$= 7 \times 3$$

$$= 21 \text{ sq. units}$$

Sol. 3. (a) $y = 3x + 7$

Comparing with $y = m_1x + c$,

$$m_1 = 3$$

and $2y + px = 3$

$$2y = 3 - px$$

$$y = \frac{3}{2} - \frac{p}{2}x$$

Comparing with $y = m_2x + c$,

$$m_2 = -\frac{p}{2}$$

$$m_1 \times m_2 = -1$$

$$3\times\left(-\frac{p}{2}\right) = -1 \quad [\because \text{Lines are given perpendicular}]$$

$$-\frac{3p}{2} = -1$$

$$p = \frac{-2}{-3}$$

$$p = \frac{2}{3}$$

$\therefore$ Value of p is $\frac{2}{3}$.

(b) (i) Co-ordinates of $A = (2, 3)$

Co-ordinates of $B = (-1, 2)$

Co-ordinates of $C = (3, 0)$

(CO-ORDINATE GEOMETRY, SECTION AND MIS-POINT FORMULA, EQUATION OF LINE)

Time: 1 Hours **MM: 30**

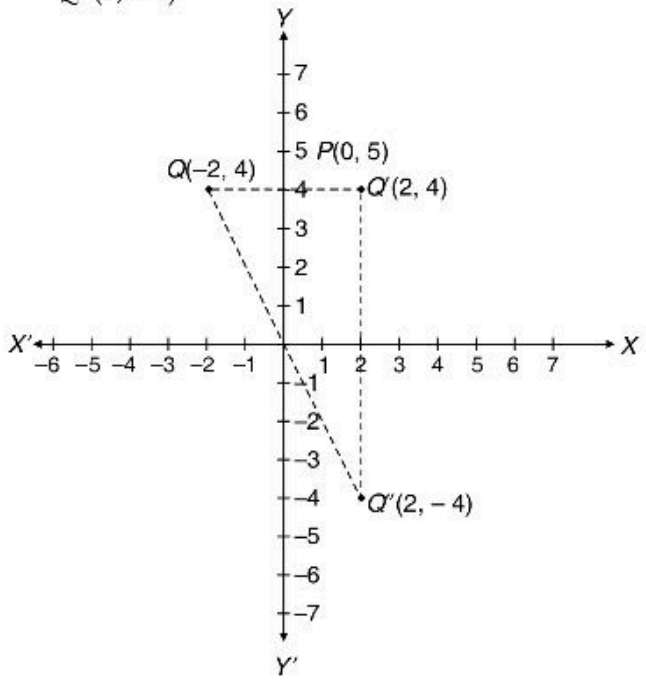
SOLUTIONS

Sol. 1. (a) (i) y-axis

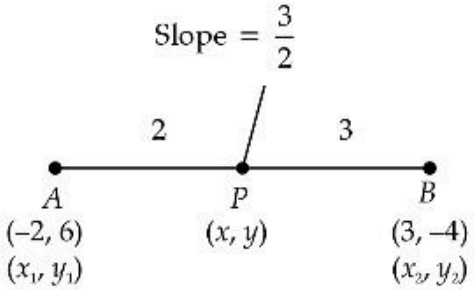
(ii) The image of Q on reflection in y-axis is $Q'(2, 4)$

(iii) $k = 0$

(iv) The image of Q on reflection in the origin is $Q''(2, -4)$



(b) Given :



$$x = \frac{m_1x_2 + m_2x_1}{m_1 + m_2}$$

$$x = \frac{2\times3 + 3\times(-2)}{2+3}$$

$$x = \frac{6-6}{5}$$

$$x = \frac{0}{5}$$

$$x = 0$$

$$y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2}$$

$$y = \frac{2\times(-4) + 3\times6}{2+3}$$

$$y = \frac{-8+18}{5}$$

$$y = \frac{10}{5}$$

$$y = 2$$

$$(x, y) = (0, 2)$$

Equation of line, whose gradient is $\frac{3}{2}$ and passing through $P(0, 2)$ is

$$y - y_1 = m(x - x_1)$$

$$y - 2 = \frac{3}{2}(x - 0)$$

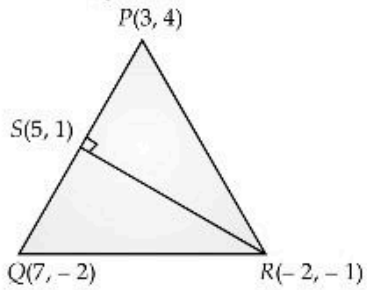
$$y - 2 = \frac{3}{2}x$$

$$2y - 4 = 3x$$

$$2y - 3x = 4$$

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

(c) Mid-point of PQ



$$x = \frac{x_1 + x_2}{2}$$

$$x = \frac{7+3}{2}$$

$$x = 5$$

$$y = \frac{y_1 + y_2}{2}$$

$$y = \frac{-2+4}{2}$$

$$y = 1$$

So, mid-point of $PQ = (5, 1)$

Equation of median through R,

$$y - y_1 = \left(\frac{y_2 - y_1}{x_2 - x_1}\right)(x - x_1)$$

or

$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\frac{y+1}{x+2} = \frac{1+1}{5+2}$$

$$\frac{y+1}{x+2} = \frac{2}{7}$$

$$7(y + 1) = 2(x + 2)$$

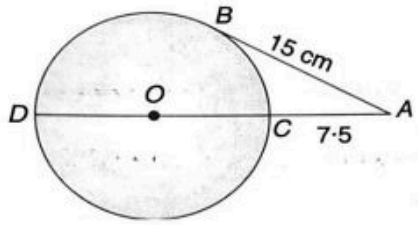
$$7y + 7 = 2x + 4$$

$$2x - 7y = 3$$

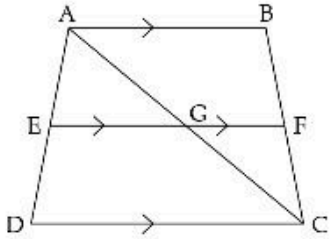
$$2x - 7y - 3 = 0$$

(b) Draw a regular hexagon of side 2.4 cm. Circumscribe a circle to it. **[3]**

(c) In the given figure, O is the centre of the circle and AB is a tangent at B. If $AB = 15$ cm and $AC = 7.5$ cm. Calculate the radius of the circle. **[3]**



(b) Draw AC intersecting EF at G.



In $\Delta ACAB$, $GF \parallel AB$

or, $\dfrac{AG}{CG} = \dfrac{BF}{FC}$ (By BPT) ...(i)

In ΔADC, $EG \parallel DC$

or, $\dfrac{AE}{ED} = \dfrac{AG}{CG}$ (By BPT) ...(ii)

From equation (i) and (ii),

$\dfrac{AE}{ED} = \dfrac{BF}{FC}$ **Hence Proved.**

(c) Steps of Construction:

(i) Draw $BC = 6$ cm.

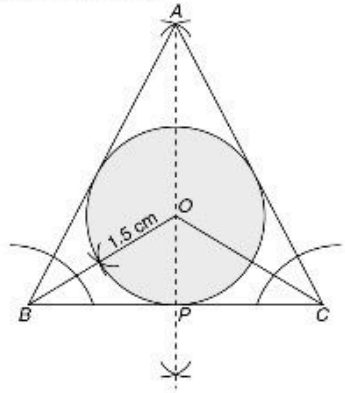
(ii) Draw a right bisector of BC at P and cut $PA = 4$ cm.

(iii) Join AB and AC.

(iv) Draw the bisectors of $\angle B$ and $\angle C$ to meet each other at O.

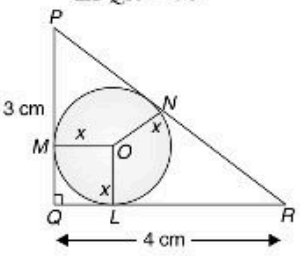
(v) Draw an incircle with centre O and radius OP.

(vi) Radius $OP = 1.5$ cm.



Sol. 3. (a) Given $PQ = 3$ cm, $QR = 4$ cm

$\angle PQR = 90°$



In right angle ΔPQR,

$PR^2 = PQ^2 + QR^2$

$PR^2 = (3)^2 + (4)^2$

$PR^2 = 9 + 16$

$PR^2 = 25$

$PR = \sqrt{25} = 5$ cm

Here PQ, QR and PR are the tangents of inscribed circle.

We know that tangent at any point of a circle is perpendicular to the radius through the point of contact.

$\angle OMQ = \angle OLQ = \angle ONR = 90°$

So, $OLQM$ is a square

$QL = QM = x$

$LR = QR - QL = 4 - x = RN$

($\because$ tangents drawn from an external point are equal in length)

and $MP = PQ - QM$

$= 3 - x = PN$

$PR = PN + NR$

$5 = 4 - x + 3 - x$

$5 = 7 - 2x$

$2x = 7 - 5$

$2x = 2$

$x = 1$ cm

(b) Steps of Construction:

(i) Draw $AB = 2.4$ cm.

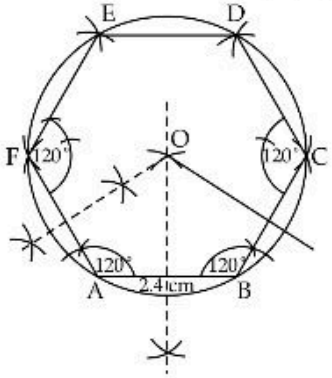
(ii) Draw $\angle A = \angle B = 120°$ and make $BC = AF = 2.4$.

(iii) Draw F and C both equal to $120°$ and make $FE = CD = 2.4$ cm.

(iv) Join DE to form a regular hexagon $ABCDEF$.

(v) Draw the right bisector of AB and AF to meet each other at O.

(vi) Join OB and with O as centre and OB as radius draw a circumscribed circle through A, B, C, D, E and F.



(c) Given $AB = 15$ cm, $AC = 7.5$ cm

Here, DCA is secant and AB is a tangent of a circle.

$AC \times AD = AB^2$

$7.5 \times AD = (15)^2$

$AD = \dfrac{225}{7.5}$

$AD = 30$ cm

$CD = AD - AC$

$= 30 - 7.5$

$= 22.5$

Radius, $OD = \dfrac{CD}{2} = \dfrac{22.5}{2}$

$= 11.25$ cm

(MENSURATION)

Maximum Time : 1 Hour **Maximum Marks : 30**

Attempt all questions from sections A and B.

Section A **20 marks**

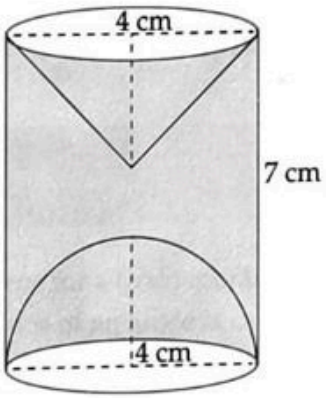
Q. 1. (a) A hollow sphere of internal and external diameters 4 cm and 8 cm respectively, is melted into a cone of base diameter 8 cm. Find the height of the cone. **[3]**

(b) A solid sphere of radius 15 cm is melted and recast into a solid right circular cones of radius 1.5 cm and height 8 cm. Calculate the number of cones recast. **[3]**

(c) A hemispherical and a conical hole is scooped out of a slid wooden cylinder. Find the volume of the remaining solid where the measurements are as follows: **[4]**

The height of the solid cylinder is 7 cm, radius of each of hemisphere, cone and cylinder is 4 cm. Height of cone is 4 cm.

Give your answer correct the nearest whole number. $\left[\text{Take } \pi = \frac{22}{7}\right]$



Q. 2. (a) A metallic sphere of radius 10.5 cm is melted and then recast into small cones, each of radius 3.5 cm and height 3 cm. Find the number of cones thus obtained. **[3]**

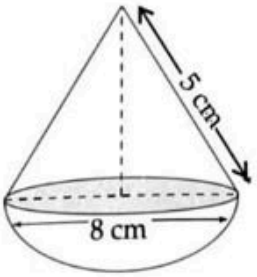
(b) A solid spherical ball of radius 6 cm is melted and recast into 125 identical spherical marbles. Find the radius of each marble. **[3]**

(c) The given figure represents a hemisphere surmounted by a conical block of wood. The diameter of their bases is 8 cm each and the slant height of the cone is 5 cm. **[4]**

Calculate:

(i) the height of the cone.

(ii) the volume of the solid.



Section B **10 marks**

Q. 3. (a) A vessel is in the form of an inverted cone. Its height is 11 cm and the radius of its top which is open; is 2.5 cm. It is filled with water upto the rim or brim. When lead shots, each of which is a sphere of radius 0.25 cm are dropped into the vessel, 2/5 of the water flows out. Find the number of lead shots dropped into the vessel. **[3]**

(b) A conical tent is to accommodate 66 person. Each person must have 16 m^3 of air to breathe. Given the radius of the tent as 6 m find the height of the tent and also its curved surface area. **[3]**

(c) The surface area of a solid metallic sphere is 5544 cm^2. It is melted and recast into solid right circular cones of radius 3.5 cm and height 7 cm. Calculate **[4]**

(i) the radius of the sphere.

(ii) the number of cones recast. $\left[\text{Take } \pi = \frac{22}{7}\right]$

(b) The daily wages of 160 workers in a building project are given below:

Wages (in ₹)	Number of Workers
0 - 10	12
10 - 20	20
20 - 30	30
30 - 40	38
40 - 50	24
50 - 60	16
60 - 70	12
70 - 80	8

Using a graph paper, draw an ogive for the above distribution.

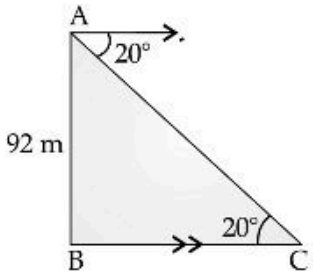
Use your ogive to estimate

(i) The median wage of the workers.

(ii) The upper quartile wage of the workers.

(iii) The lower quartile wage of the workers.

(iv) The percentage of workers, who earn more than ₹ 45 a day. **[6]**



In ΔABC, $\tan 20° = \frac{AB}{BC}$

$$BC = \frac{92}{\tan 20°}$$

$\because$ $\tan 20° = 0.363$ (given)

$$BC = \frac{92}{0.363}$$

$$BC = 253.44$$

i.e., The distance of the boy from the foot of the cliff is approx. 253 m.

Sol. 3. (a) Given: $\cos\theta + \sin\theta = p$ and $\sec\theta + \text{cosec}\,\theta = q$

LHS $= q(p^2 - 1)$

$= (\sec\theta + \text{cosec}\,\theta)\,[(\cos\theta + \sin\theta)]$

$= (\sec\theta + \text{cosec}\,\theta)\,[1 + 2\sin\theta\cos\theta - 1]$

$$= \left(\frac{1}{\cos\theta} + \frac{1}{\sin\theta}\right)(2\sin\theta\cos\theta)$$

$$= \frac{\sin\theta + \cos\theta}{\cos\theta\sin\theta} \times 2\sin\theta\cos\theta$$

$= 2(\sin\theta + \cos\theta)$

$= 2p$

= RHS **Hence Proved**

$$\therefore \quad \frac{AC}{50}$$

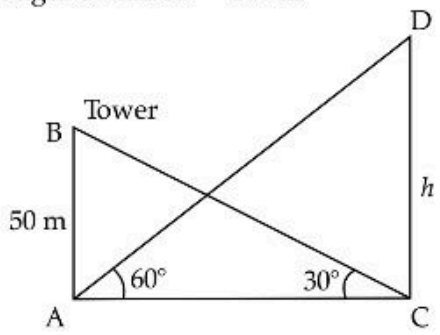
$\Rightarrow$ $AC = 50\sqrt{3}$ $[\because \cot 30° = \sqrt{3}\,]$

In right ΔACD, $\tan 60° = \frac{CD}{AC}$

$\Rightarrow$ $\sqrt{3} = \frac{CD}{50\sqrt{3}}$

$\Rightarrow$ $CD = 50\sqrt{3} \times \sqrt{3}$

So, height of hill CD = 150 m



(c) Given that, $a\sin\theta + b\cos\theta = c$

On squaring both sides, we get

$(a\sin\theta + b\cos\theta)^2 = c^2$

$\Rightarrow a^2\sin^2\theta + b^2\cos^2\theta + 2ab\sin\theta\cos\theta = c^2$

$[\because (a+b)^2 = a^2 + 2ab + b^2\,]$

$\Rightarrow a^2(1 - \cos^2\theta) + b^2(1 - \sin^2\theta) + 2ab\sin\theta\cos\theta = c^2$

$[\because \sin^2\theta + \cos^2\theta = 1\,]$

$\Rightarrow a^2 + b^2 - c^2 = a^2\cos^2\theta + b^2\sin^2\theta - 2ab\sin\theta\cos\theta$

$\Rightarrow a^2 + b^2 - c^2 = (a\cos\theta - b\sin\theta)^2$

$[\because x^2 - 2xy + y^2 = (x-y)^2]$

$\Rightarrow a\cos\theta - b\sin\theta = \sqrt{a^2 + b^2 - c^2}$

Hence Proved

❑❑

Sol. 1. (a) LHS $= (1+\tan A)^2 + (1-\tan A)^2$

$= 1 + \tan^2 A + 2\tan A + 1 + \tan^2 A - 2\tan A$

$= 2 + 2\tan^2 A$

$= 2(1 + \tan^2 A)$

$= 2\sec^2 A$

$=$ RHS **Hence Proved.**

(b) We have,

$$2\sin^2\theta - \cos^2\theta = 2$$

$$\Rightarrow \quad 2\sin^2\theta - (1-\sin^2\theta) = 2 \quad [\because \sin^2\theta + \cos^2\theta = 1]$$

$$\Rightarrow \quad 2\sin^2\theta - 1 + \sin^2\theta = 2$$

$$\Rightarrow \quad 3\sin^2\theta = 2 + 1$$

$$\Rightarrow \quad \sin^2\theta = 1$$

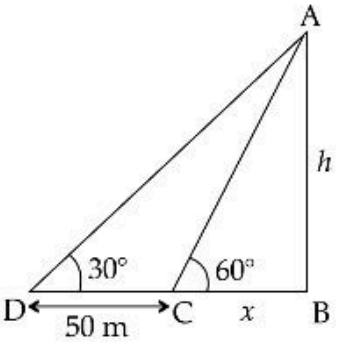
$$\Rightarrow \quad \sin\theta = 1$$

$$\Rightarrow \quad \sin\theta = \sin 90^\circ$$

$$\Rightarrow \quad \theta = 90^\circ$$

(c) Let the height of the tree be AB $= h$ m and BC $= x$ m be the width of river.

In ΔABC, $\tan 60^\circ = \dfrac{AB}{BC}$



$$\sqrt{3} = \frac{h}{x}$$

$$h = \sqrt{3}x \qquad \ldots(i)$$

In ΔADB, $\tan 30^\circ = \dfrac{AB}{BD}$

$$\frac{1}{\sqrt{3}} = \frac{h}{x+50}$$

$$x + 50 = \sqrt{3}h$$

$$x + 50 = \sqrt{3}\times\sqrt{3}x \qquad [\text{from (i)}]$$

$$x + 50 = 3x$$

$$2x = 50 \text{ or } x = 25 \text{ m}$$

(i) The width of the river $= 25$ m.

(ii) $\therefore h = \sqrt{3}\times 25 = 1.732 \times 25 = 43.3$ m

Sol. 2. (a)

$$\text{LHS} = \frac{\sin\theta\tan\theta}{1-\cos\theta}$$

$$= \frac{\sin\theta \times \dfrac{\sin\theta}{\cos\theta}}{1-\cos\theta}$$

$$= \frac{\dfrac{\sin^2\theta}{\cos\theta}}{1-\cos\theta}$$

$$= \frac{\sin^2\theta}{\cos\theta(1-\cos\theta)}$$

$$= \frac{1-\cos^2\theta}{\cos\theta(1-\cos\theta)}$$

$$= \frac{(1-\cos\theta)(1+\cos\theta)}{\cos\theta(1-\cos\theta)}$$

[Using, $(a+b)(a-b) = a^2 - b^2$]

$$= \frac{1+\cos\theta}{\cos\theta}$$

$$= \frac{1}{\cos\theta} + \frac{\cos\theta}{\cos\theta}$$

$$[\because \frac{1}{\cos\theta} = \sec\theta]$$

$$= \sec\theta + 1 = \text{RHS}$$

Hence Proved

(b) $$\text{LHS} = \sqrt{\sec^2\theta + \text{cosec}^2\theta}$$

$$= \sqrt{1+\tan^2\theta+1+\cot^2\theta}$$

$[\because \sec^2\theta = 1 + \tan^2\theta \text{ and } \text{cosec}^2\theta = 1 + \cot^2\theta]$

$$= \sqrt{2+\tan^2\theta+\cot^2\theta}$$

$$= \sqrt{\tan^2\theta+\cot^2\theta+2\tan\theta\cot\theta}$$

$$(\because \text{As } \tan\theta \times \cot\theta = 1)$$

$$= \sqrt{(\tan\theta+\cot\theta)^2}$$

$= \tan\theta + \cot\theta = \text{RHS}$ **Hence Proved**

(c) Let the height of the cliff be $AB = 92$ m and C be the position of boy.

Here, $\angle PAC = \angle ACB$ (Alternate angle)

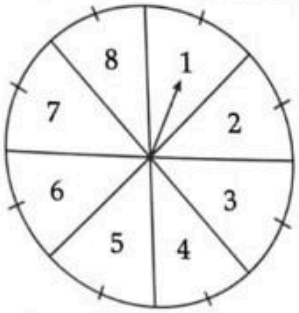
(PROBABILITY)

Maximum Time : 1 Hour **Maximum Marks : 30**

Answer the following questions.

Q. 1. **[10 × 3]**

(a) A game of chance consists of spring of an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8 (see figure) and these are equally likely outcomes. What is the probability that it will point at: **[3 + 3 + 4]**



(i) 8? (ii) an odd number? (iii) a number greater than 3?

(b) Teacher and students are selected at random to make two teams of 20 members each on sports day to participate in even of "Tug of War". The numbers of volunteers are as follows:

Teachers		Students	
Male	Female	Male	Female
12	18	20	10

Find the probability that the person chosen at random

(i) is a male (ii) is a female student.

(c) A piggy bank contains hundred 50p coin, fifty ₹ 1 coins, twenty ₹ 2 coins and ten ₹ 5 coins. If it is equally likely that one of the cons will fall out when the bank is turned upside down, what is the probability that the coin:

(i) will be 50p coin? (ii) will not be a ₹ 5 coin?

Q. 2.

(a) A jar contains 24 balls, some green and other blue if a ball is drawn at random from the jar, the probability that it is green is $\frac{2}{3}$. Find the number of blue balls in the jar. **[3 + 3 + 4]**

(b) Five cards the ten, jack, queen, king and ace of diamonds are well shuffled with their face downwards. One card is then picked up at random.

(i) What is the probability that the card is the queen ?

(ii) If the queen is drawn and put aside, what is the probability that the second card picked up is:

(a) an ace ? (b) a queen ?

(c) (i) A lot of 20 bulbs contains 4 defective ones. One bulb is drawn at random from the lot. What is the probability that this bulb is defective ?

(ii) Suppose the bulb drawn in (i) is not defective and is not replaced. Now one bulb is drawn at random from rest. What is the probability that bulb is not defective ?

Q. 3.

(a) A dice is rolled one. Find the probability of getting: **[3 + 3 + 4]**

(i) an even number (ii) an odd number

(iii) a number < 2 (iv) a prime number

(b) A lot consists of 144 balls pen of which 20 are defective and the others good. Nuri will buy a pen if it is good, but will not buy if it is defective. The shopkeeper draws one pen at random and gives it to her. What is the probability that:

(i) she will buy it ? (ii) she will not buy it?

Sol. 1. (a) Since out of 8 numbers, an arrow can point any of the numbers in 8 ways.

Therefore total number of possible outcomes = 8

(i) Favourable no. of outcomes = 1

Hence P(arrow points at 8) = $\frac{1}{8}$

(ii) Favourable no. of outcomes = 4{1, 3, 5, 7}

Hence P(arrow points at an odd number) = $\frac{4}{8} = \frac{1}{2}$

(iii) Favourable no. of outcomes = 5{4, 5, 6, 7, 8}

Hence, P(arrow points a number greater than 3) = $\frac{5}{8}$

(b)

Teachers		Students	
Male	Female	Male	Female
12	18	20	10

Total number of volunteers

= 12 + 18 + 20 + 10

= 60

(i) Total number of males = 12 + 20 = 32

P(person is male) = $\frac{32}{60} = \frac{8}{15}$

(ii) No. of female students = 10

P(person is female student)

= $\frac{10}{60} = \frac{1}{6}$

(c) Since, total no. of coins in a piggy bank

= 100 + 50 + 20 + 10 = 180

Total no. of events = 180

(i) There are one hundred 50p coins in the piggy bank.

favourable no. of events = 100

P(falling out of a 50p coin) = $\frac{100}{180} = \frac{5}{9}$

(ii) There are 100 + 50 + 20 = 170 coins other that ₹ 5 coins.

favourable no. of events = 170

P(falling out of a coin other than ₹ 5) = $\frac{170}{180}$

= $\frac{17}{18}$

Sol. 2. (a) Total number of balls = 24

Let the number of green balls be x. Then the number of blue balls will be $(24 - x)$.

$\therefore$ P(a green ball) = $\frac{x}{24}$

Equating it to $\frac{2}{3}$, we get

$\frac{x}{24} = \frac{2}{3}$

$\Rightarrow$ $x = 16$

Hence, there are 16 green and (24 – 16) = 8 blue balls in the jar.

(b) Since total number of possible outcomes = 5

(i) There is only one queen. Therefore, favourable outcome = 1

Hence, P(the queen) = $\frac{1}{5}$

(ii) In this situation, total number of outcomes = 4

(a) favourable outcome = 1

Hence, P(an ace) = $\frac{1}{4}$

(b) There is no queen card in the remaining cards.

$\therefore$ favourable outcome = 0

Hence, P(a queen) = $\frac{0}{4} = 0$

(c) (i) Total no. of possible outcomes = 20

No. of favourable outcomes = 4

Hence, P(getting a defective bulb) = $\frac{4}{20} = \frac{1}{5}$

(i) Now, total no. of possible outcomes = 20 – 1 = 19

No. of favourable outcomes = 19 – 4 = 15

Hence, P(getting a non-defective bulb) = $\frac{15}{19}$

Sol. 3. (a) Sample space is (1, 2, 3, 4, 5, 6)

Total number of possible outcomes, $n(S) = 6$

(i) Even numbers = 2, 4 and 6

Favourable outcomes; $n(E_1) = 3$

P(even number) = $\frac{n(E_1)}{n(S)} = \frac{3}{6} = \frac{1}{2}$

(ii) Odd numbers = 1, 3 and 5

Favourable outcomes, $n(E_2) = 3$

P(odd number) = $\frac{n(E_2)}{n(S)} = \frac{3}{6} = \frac{1}{2}$

(iii) Numbers greater than 2 are 3, 4, 5 and 6

Favourable outcomes, $n(E_3) = 4$

P(number < 2) = $\frac{n(E_3)}{n(S)} = \frac{4}{6} = \frac{2}{3}$

(iv) 2, 3 and 5 are prime numbers in the sample space.

i.e., favourable outcomes, $n(E_4) = 3$

$$P(\text{a prime number}) = \frac{n(E_4)}{n(S)} = \frac{3}{6} = \frac{1}{2}$$

(b) Since, total no. of possible outcomes = 144

and, no. of defective pens = 20

(i) No. of non-defective pens = 144 – 20 = 124

Hence, P(she will buy) = P(a non-defective pen)

$$= \frac{124}{144} = \frac{31}{36}$$

(ii) No. of favourable outcomes = 20

Hence P(she will not buy) = P(a defective pen)

$$= \frac{20}{144} = \frac{5}{36}$$

(c) Since, total favourable outcomes associated to the random experiment of visiting a particular shop in the same week (Tuesday to Saturday) by two customers Shyam and Ekta are:

(T, T), (T, W), (T, Th), (T, F), (T, S)

(W, T), (W, W), (W, Th), (W, F), (W, S)

(Th, T), (Th, W), (Th, Th), (Th, F), (Th, S)

(F, T), (F, W), (F, Th), (F, F), (F, S)

(S, T), (S, W), (S, Th), (S, F), (S, S)

Where, T = Tuesday, W = Wednesday, Th = Thursday, F = Friday, S = Saturday

Total number of favourable outcomes = $5 \times 5 = 25$

(i) The favourable outcomes of visiting on the same day are (T, T) (W, W), (Th, Th), (F, F) and (S, S).

No. of favourable outcomes = 5

Hence, required probability = $\frac{5}{25} = \frac{1}{5}$

(ii) The favourable outcomes of visiting on consecutive days are (T, W), (W, T), (W, Th), (Th, W), (Th, F), (F, Th), (S, F) and (F, S)

Number of favourable outcomes = 8

Hence, required probability = $\frac{8}{25}$

(iii) Number of favourable outcomes of visiting on different day = 25 – 5 = 20

Hence, required probability = $\frac{20}{25} = \frac{4}{5}$

(c) Two customers shyam and Ekta are visiting a particular shop in the same week (Tuesday to saturday). Each is equally likely to visit the shop on any day as on another day. What is the probability that both will visit the shop on:

(i) the same day? (ii) consecutive days? (iii) different days?

(STATISTICS)

Maximum Time : 1 Hour **Maximum Marks : 30**

Attempt all questions from sections A and B.

Section A **20 marks**

Q. 1. (a) For the following set of numbers, find the median: 10, 75, 3, 81, 17, 27, 4, 48, 12, 47, 9, 15 **[3]**

(b) Calculate the mean and mode for the following distribution:

Weight (in kg)	35	47	52	56	60
No. of students	4	3	5	3	2

(c) Draw a histogram and hence estimate the mode for the following frequency distribution. **[4]**

Class	Frequency
0 – 10	2
10 – 20	8
20 – 30	10
30 – 40	5
40 – 50	4
50 – 60	3

Q. 2. (a) If the mean of the following distribution is 20, find the value of '*a*'. **[3]**

Marks	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50
Number of students	7	*a*	8	10	5

(b) If the mean of the following distribution is 7.5, find the missing frequency *f*. **[3]**

Variables	5	6	7	8	9	10	11	12
Frequency	20	17	*f*	10	8	6	7	6

(c) Using the data given below construct the cumulative frequency table and draw the ogive. **[3]**

Marks	Number of students
0 - 10	3
10 - 20	8
20 - 30	12
30 - 40	14
40 - 50	10
50 - 60	6
60 - 70	5
70 - 80	2

From the ogive, determine the median.

Section B **[4]**

Q. 3. In a retail market, fruit vendors were selling mangoes kept in packing boxes. These box contained varying number of mangoes. The following table was the distribution of mangoes according to the number boxes.

No. of mangoes	50 - 52	53 - 55	56 - 58	59 - 61	62 - 64
No. of boxes	15	110	135	115	25

Find the mean number of mangoes (using step deviation method) kept in a packing box.

(TRIGONOMETRIC IDENTITIES, HEIGHTS AND DISTANCES)

Maximum Time : 1 Hour **Maximum Marks : 30**

Answer the following questions.

Q. 1. **[3 + 3 + 4]**

(a) Prove that: $(1 + \tan A)^2 + (1 - \tan A)^2 = 2\sec^2 A$

(b) Prove the following identify:

If $2\sin^2\theta - \cos^2\theta = 2$, then find the value of θ.

(c) A man standing on the bank of a river observes that the angle of elevation of a tree on the opposite bank is 60°. When he moves 50 m away from the bank, then he find the angle of elevation to be 30°. Calculate:

(i) the width of the river.

(ii) the height of the tree.

Q. 2. **[3 + 3 + 4]**

(a) Prove that: $\frac{\sin\theta\tan\theta}{1-\cos\theta} = 1 + \sec\theta$.

(b) Prove that: $\sqrt{\sec^2\theta + \text{cosec}^2\theta} = \tan\theta + \cot\theta$.

(c) From the top of a cliff 92 m high, the angle of depression of a boy is 20°. Calculate to the nearest metre, the distance of the boy from the foot of the cliff. [Given $\tan 20° = 0.363$]

Q. 3. **[3 + 3 + 4]**

(a) If $\cos\theta + \sin\theta = p$ and $\sec\theta + \text{cosec}\,\theta = q$, prove that $q(p^2 - 1) = 2p$.

(b) The angle of elevation of the top of a hill at the foot of a tower is 60° and angle of elevation of the top of the tower from the foot of the hill is 30°. If the tower is 50 m high, find the height of the hill.

(c) If $a\sin\theta + b\cos\theta = c$, then

Prove that: $a\cos\theta - b\sin\theta = \sqrt{a^2 + b^2 - c^2}$.

Sol. 1. (a) Internal radius of hollow sphere (r) = 2 cm
External radius of hollow sphere (R) = 4 cm
Volume of hollow sphere

$$= \frac{4}{3}\pi(R^3 - r^3)$$

$$= \frac{4}{3}\pi(4^3 - 2^3)$$

$$= \frac{4}{3}\pi(64 - 8)$$

$$= \frac{4}{3}\pi(56) \quad \text{...(i)}$$

$$\text{Volume of cone} = \frac{1}{3} \times \pi \times r^2 \times h$$

$$= \frac{1}{3} \times \pi \times (4)^2 \times h$$

$$\left[\because r = \frac{\text{diameter}}{2} = \frac{8}{2} = 4 \text{ cm}\right]$$

$$= \frac{1}{3} \times \pi \times 16h \quad \text{...(ii)}$$

On comparing (i) and (ii)

$$\frac{4}{3}\pi(56) = \frac{1}{3} \times \pi \times 16 \times h$$

$$224 = 16h$$

$$h = \frac{224}{16}$$

$$h = 14 \text{ cm}$$

(b) Given: Radius of cone, r = 1.5 cm and h = 8 cm
radius of sphere, R = 15 cm

$$\text{Volume of sphere} = \frac{4}{3}\pi R^3$$

$$= \frac{4}{3} \times \pi \times (15)^3$$

$$\text{Volume of cone} = \frac{1}{3} \times \pi \times r^2 \times h$$

$$= \frac{1}{3} \times \pi \times (1.5)^2 \times 8$$

$$\text{No. of cones} = \frac{\text{Volume of sphere}}{\text{Volume of cone}}$$

$$= \frac{\frac{4}{3} \times \pi \times (15)^3}{\frac{1}{3} \times \pi \times (1.5)^2 \times 8}$$

$$= \frac{15 \times 15 \times 15}{1.5 \times 1.5 \times 2} = 750$$

(c) Remaining volume = Volume of Cylinder – (Volume of cone + Volume of hemisphere)

$$= \pi r^2 h - \left(\frac{1}{3}\pi r^2 h_1 + \frac{2}{3}\pi r^3\right)$$

$$= \frac{22}{7} \times 4^2 \times 7 - \left(\frac{1}{3} \times \frac{22}{7} \times 4^2 \times 4 + \frac{2}{3} \times \frac{22}{7} \times 4^3\right)$$

$$= \frac{22}{7} \times 4^2 \left[7 - \left(\frac{4}{3} + \frac{8}{3}\right)\right]$$

$$= \frac{22}{7} \times 4^2 \times 3 = \frac{1056}{7}$$

$$= 150.85 = 151 \text{ cm}^3 \text{(Approx.)}$$

Sol. 2. (a) Radius of sphere (R) = 10.5 cm
Radius of cone (r) = 3.5 cm and
height of cone h = 3 cm

$$\text{Volume of sphere} = \frac{4}{3} \times \pi \times R^3$$

$$= \frac{4}{3} \times \pi \times (10.5)^3 \text{ cm}^3$$

$$\text{Volume of cone} = \frac{1}{3} \times \pi \times r^2 \times h$$

$$= \frac{1}{3} \times \pi \times (3.5)^2 \times 3 \text{ cm}^3$$

$$\text{No. of cones formed} = \frac{\text{Volume of sphere}}{\text{Volume of cone}}$$

$$= \frac{\frac{4}{3} \times \pi \times (10.5)^3}{\frac{1}{3} \times \pi \times (3.5)^2 \times 3}$$

$$= \frac{10.5 \times 10.5 \times 4 \times 10.5}{3.5 \times 3.5 \times 3}$$

$$n = 12 \times 10.5 = 126$$

No. of cones formed = 126

(b) Volume of solid spherical ball = $\frac{4}{3}\pi r^3$

$$= \frac{4}{3}\pi(6)^3,$$

where radius (r) of solid ball = 6 cm (given)

$$= \frac{4}{3}\pi \times 216$$

$$= \frac{216 \times 4}{3}\pi \text{ cm}^3$$

Let the radius of spherical marble be R cm.

(SIMILARITY, LOCI, CIRCLES, TANGENT AND SECANT PROPERTIES, CONSTRUCTIONS)

Time: 1 Hours **MM: 30**

SOLUTIONS

Sol. 1. (a) (i) To prove: $\Delta EGD \sim \Delta CGB$.

Proof: In ΔEGD and ΔCGB

$\angle EGD = \angle CGB$ [Vertically opposite angles]

$\angle GED = \angle GCB$ $(ED \| BC)$ [Alternate interior angles]

Thus, $\Delta EGD \sim \Delta CGB$ (by AA rule of similarity)

(ii) D is mid-point of AC, so $AD = DC$

E is mid-point of AB, so $AE = BE$

$\therefore$ E and D are mid-point, then $ED \| BC$

$$ED = \frac{1}{2}BC \quad \text{(mid point theorem) ...(i)}$$

i.e., $BC = 2ED$

Since, $\Delta GDE \sim \Delta GBC$ (proved above)

$$\frac{GD}{GB} = \frac{ED}{CB} \quad \text{...(ii)}$$

From eqn. (i), put value of BC in eqn. (ii)

$$\frac{GD}{GB} = \frac{ED}{2ED}$$

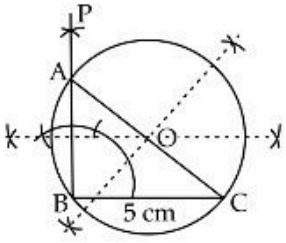
$2GD = BG$ **Hence Proved.**

(b) Steps of construction:

(i) Draw $BC = 5$ cm.

(ii) Draw $\angle PBC = 90°$.

(iii) Taking centre B and radius 4 cm draw an arc which intersect BP at the point A.



(iv) Join AC, ΔABC is required triangle $\angle B = 90°$.

$\therefore$ AC is the diameter of circle.

So find out mid point of AC

(v) Draw perpendicular bisectors of AC and AB, which intersect at O.

(vi) Taking centre O and radius equal to BO draw a circle which passes through vertex A, B and C.

Radius of circumscribe circle = 3.2 cm.

Examiner's Comment

- Some candidates did not show the necessary traces of construction. Some candidates followed some other incorrect methods for construction.

Answering Tip

- Instruct students to show all necessary traces of construction clearly.

(c) $\angle RSQ = \angle PRQ = y°$ [Alternate segment Theorem]

$\angle QRS = 90°$ [Angle in a semi-circle is 90°]

In ΔPRS,

$\angle SPR + \angle PRS + \angle RSP = 180°$ [Angle sum property of Δ]

$\angle SPR + (\angle PRQ + \angle QRS) + \angle RSP = 180°$

$x° + (y° + 90°) + y° = 180°$

$x° + 2y° = 90°$

Hence Proved.

Sol. 2. (a) (i) $\angle CAB = 34°$

$\angle ACB = 90°$ (Angle in a semi-circle is 90°)

In ΔACB,

$\angle CAB + \angle ACB + \angle ABC = 180°$ (Angle sum property of a Δ)

$34° + 90° + \angle ABC = 180°$

$124° + \angle ABC = 180°$

$\angle ABC = 180° - 124°$

$\angle ABC = 56°$

(ii) Since, CQ is a tangent to the circle

$\angle BCQ = \angle BAC = 34°$ [Alternate segment Theorem]

Since, AQ is a straight line

$\angle ABC + \angle CBQ = 180°$

$56° + \angle CBQ = 180°$

$\angle CBQ = 180° - 56°$

$\angle CBQ = 124°$

In ΔCBQ

$\angle CBQ + \angle CQB + \angle BCQ = 180°$ (Angle sum property of a Δ)

$124° + \angle CQB + 34° = 180°$

$\angle CQB = \angle CQA = 22°$

(SIMILARITY, LOCI, CIRCLES, TANGENTS AND SECANT PROPERTIES, CONSTRUCTIONS)

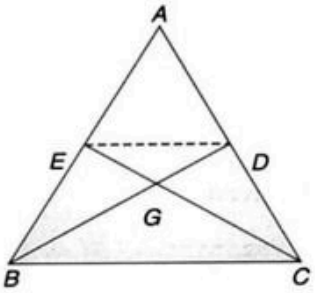
Maximum Time : 1 Hour **Maximum Marks : 30**

Attempt all questions from both sections.

Q. 1. (a) In the adjoining figure, the medians BD and CE of a ΔABC meet at the point G. Prove that

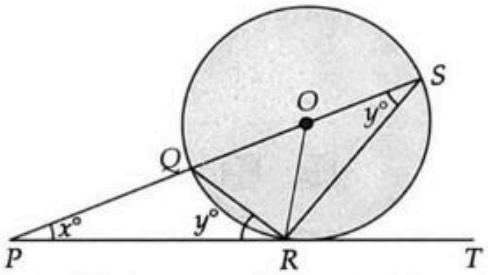
(i) $\Delta EGD \sim \Delta CGB$.

(ii) $BG = 2\,GD$. **[3]**



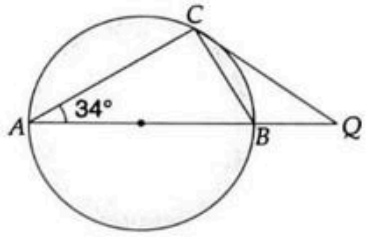
(b) Using ruler and compass construct a triangle ABC where AB = 4 cm, BC = 5 cm and angle ABC = 90°. Hence construct a circle circumscribing triangle ABC. Measure and write down the radius of the circle. **[4]**

(c) In the given figure, PT touches the circle, whose centre is O, at R. Diameter SQ, when produced meets PT at P. If $\angle SPR = x°$ and $\angle QRP = y°$.
Show that $x° + 2y° = 90°$. **[3]**

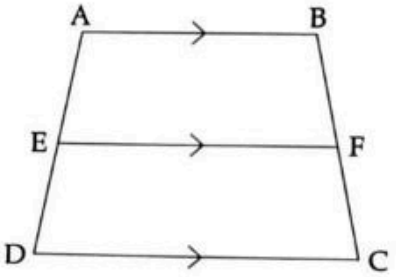


Q. 2. (a) In the given figure, AB is a diameter. The tangent at C meets AB produced at Q, $\angle CAB = 34°$. Find

(i) $\angle ABC$ **(ii)** $\angle CQA$



(b) In the given figure, if $ABCD$ is trapezium in which $AB \parallel CD \parallel EF$, then prove that $\frac{AE}{ED} = \frac{BF}{FC}$.



[3]

(c) Draw an isosceles ΔABC in which base $BC = 6$ cm and the altitude from vertex to the base is 4 cm. Draw its inscribed circle. **[3]**

Q. 3. (a) PQR is a right angled triangle with $PQ = 3$ cm and $QR = 4$ cm. A circle which touches all the sides of the triangle is inscribed in the triangle. Calculate the radius of the circle. **[4]**

(ii) Mid-points of BC

$$x = \frac{x_1 + x_2}{2} \qquad y = \frac{y_1 + y_2}{2}$$

$$x = \frac{3-1}{2} \qquad y = \frac{0+2}{2}$$

$$x = \frac{2}{2} \qquad y = \frac{2}{2}$$

$$x = 1 \qquad y = 1$$

The slope of BC,

$$\left[\text{Using slope formula } m_1 = \frac{y_2 - y_1}{x_2 - x_1}\right]$$

$$m_1 = \frac{0-2}{3+1}$$

$$m_1 = -\frac{2}{4}$$

$$= -\frac{1}{2}$$

For condition of perpendicular:

$$m_1 m_2 = -1$$

$$-\frac{1}{2} \times m_2 = -1$$

$$m_2 = 2 \quad \text{(Slope of required line)}$$

Equation of line through A,

$$y - y_1 = m_2(x - x_1)$$

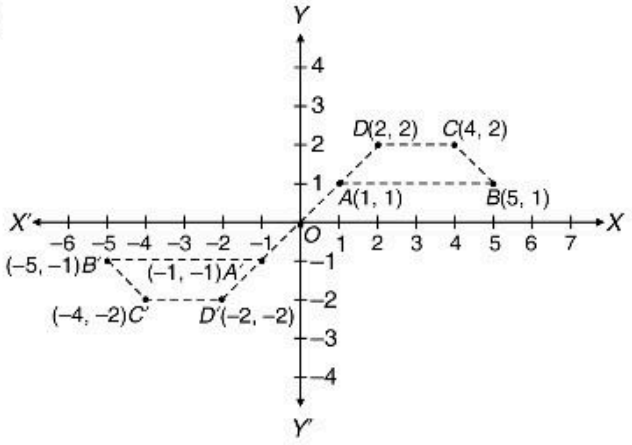
$$y - 3 = 2(x - 2)$$

$$y - 3 = 2x - 4$$

$$y - 2x = -1$$

$$2x - y - 1 = 0$$

(c)



Here, the quadrilateral $ABCD$ is trapezium.

The reflected image at A, B, C and D in the origin are $A'(-1,-1)$, $B'(-5,-1)$, $C'(-4,-2)$ and $D'(-2,-2)$ respectively.

On joining points D and D', we find that the points A and A' lie on it , Hence, the points D, A, A' and D' are collinear.

❑❑

(CO-ORDINATE GEOMETRY, SECTION AND MID-POINT FORMULA, EQUATION OF STRAIGHT LINE)

Maximum Time : 1 Hour **Maximum Marks : 30**

Answer of the following questions

Q. 1. **(a)** Use a graph paper for this question (take 10 small divisions = 1 unit on both the axes).

P and Q have coordinates $(0, 5)$ and $(-2, 4)$.

(i) P is invariant, when reflected in an axis. Name the axis.

(ii) Find the image of Q on reflection in the axis found in (i).

(iii) $(0, k)$ on reflection in the origin is invariant. Write the value of k.

(iv) Write the coordinates of the image of Q, obtained by reflecting it in the origin followed by reflection in X-axis. **[3]**

(b) Write down the equation of the line, whose gradient is 3/2 and which passes through P, where P divides the line segment joining $A(-2, 6)$ and $B(3, -4)$ in the ratio of 2 : 3. **[3]**

(c) $P(3, 4)$, $Q(7, -2)$ and $R(-2, -1)$ are the vertices of ΔPQR. Write down the equation of the median of the triangle through R. **[4]**

Q. 2. **(a)** Find the equation of a line passing through the point $(-2, 3)$ and having the x-intercept 8 units. **[3]**

(b) The line segment joining $A(2, 3)$ and $B(6, -5)$ is intersected by the X-axis at the point K. Write the coordinates of the point K. Hence, find the ratio in which K divides AB. **[3]**

(c) Use graph paper for the question. The points $A(2, 3)$ $B(4, 5)$ and $C(7, 2)$ are the vertices of ΔABC.

(i) Write down the coordinates of A', B', C', if A' B' C' are the image of ΔABC, when reflected in the origin.

(ii) Write down the coordinates of A'', B'', C'', if A'' B'' C'' are the image of ΔABC when reflected in the X-axis.

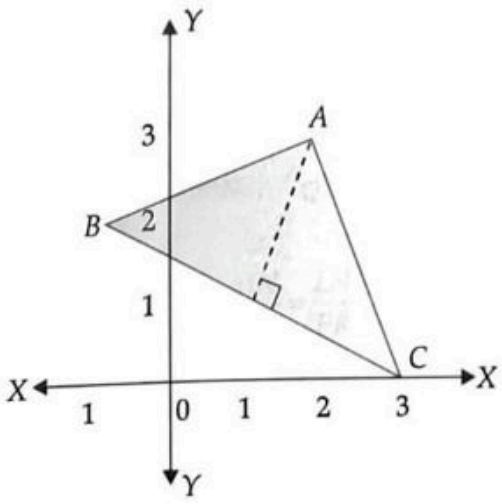
(iii) Mention the special name of the quadrilateral BCC'' B'' and find its area. **[4]**

Q. 3. **(a)** If the lines $y = 3x + 7$ and $2y + px = 3$ are perpendicular to each other, then find the value of p. **[3]**

(b) In the adjoining figure, write

(i) the coordinates of A, B and C.

(ii) the equation of the line through A and perpendicular bisector of BC.



$$2x = -6$$
$$x = -3.$$

(b) Let the first term of G.P. be a, common ratio be r and number of terms be n

$a_4 = 10$, $a_6 = 40$ and $a_n = 640$ (given)

$$a_4 = 10$$
$$ar^3 = 10 \quad \text{...(i)}$$

Again, $a_6 = 40$

$$ar^5 = 40 \quad \text{...(ii)}$$

From (i) & (ii),

$$\frac{ar^5}{ar^3} = \frac{40}{10}$$

$\Rightarrow r^2 = 4$

$\therefore r = \pm 2$ As $(r > 0)$

$\therefore r = 2$

From equ. (i),

$$ar^3 = 10$$
$$a(2)^3 = 10$$
$$a = \frac{10}{8} = \frac{5}{4}$$

Again, $a_n = 640$

$$ar^{n-1} = 640$$
$$\frac{5}{4}(2)^{n-1} = 640$$
$$2^{n-1} = \frac{640 \times 4}{5}$$
$$2^{n-1} = 128 \times 4 = 2^9$$

Comparing the powers

$$n - 1 = 9 \Rightarrow n = 10$$

$\therefore$ First term of G.P. $= \frac{5}{4}$, common ratio $= 2$ and number of terms $= 10$.

(c)
$$\begin{bmatrix} 3 \times 2x + (-2) \times 1 \\ -1 \times 2x + 4 \times 1 \end{bmatrix} + \begin{bmatrix} -8 \\ 10 \end{bmatrix} = \begin{bmatrix} 8 \\ 4y \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 6x - 2 \\ -2x + 4 \end{bmatrix} + \begin{bmatrix} -8 \\ 10 \end{bmatrix} = \begin{bmatrix} 8 \\ 4y \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 6x - 2 - 8 \\ -2x + 4 + 10 \end{bmatrix} = \begin{bmatrix} 8 \\ 4y \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 6x - 10 \\ -2x + 14 \end{bmatrix} = \begin{bmatrix} 8 \\ 4y \end{bmatrix}$$

As, corresponding parts of equal matrices are also equal.

$$6x - 10 = 8$$
$$6x = 8 + 10$$
$$6x = 18$$
$$x = \frac{18}{6}$$
$$x = 3.$$

Similarly, $-2x + 14 = 4y$

Putting value of x in above equation

$$-2(3) + 14 = 4y$$
$$-6 + 14 = 4y$$
$$8 = 4y$$
$$y = \frac{8}{4}$$
$$y = 2$$
$$x = 3, y = 2.$$

$= 100 - 24$
$= 76$

Roots are

$\Rightarrow \quad x = \dfrac{-b \pm \sqrt{D}}{2a}$

$\Rightarrow \quad x = \dfrac{10 \pm \sqrt{76}}{2}$

$\Rightarrow \quad x = \dfrac{10 \pm 8.7177}{2}$

Taking (+) sign, for 1st root,

$\Rightarrow \quad x = \dfrac{10 + 8.7177}{2}$

$\Rightarrow \quad x = \dfrac{18.7177}{2}$

$\Rightarrow \quad x = 9.36$

Taking (–) sign for second root,

$\Rightarrow \quad x = \dfrac{10 - 8.7177}{2}$

$\Rightarrow \quad x = \dfrac{1.2823}{2}$

$\Rightarrow \quad x = 0.64$

Sol. 3 (a) Monthly pocket money

Ravi		Sanjeev
$5x$	:	$7x$

Expenditures :

Ravi		Sanjeev
$3y$	:	$5y$

Pocket money – Saving money = Expenditure

$\therefore$ Expenditure of Ravi $= 5x - 80$

Expenditure of Sanjeev $= 7x - 80$

As per the question,

Expenditures are in the ratio 3 : 5

$$\frac{(5x-80)}{(7x-80)} = \frac{3y}{5y}$$

$$5(5x-80) = 3(7x-80)$$
$$25x - 400 = 21x - 240$$
$$25x - 21x = -240 + 400$$
$$4x = 160$$
$$x = \frac{160}{4}$$
$$x = 40$$

Pocket money of Ravi $= 5 \times 40$
$= ₹200$

Pocket money of Sanjeev $= 7 \times 40$
$= ₹280$

(b) As we know, $(x-3)$ is a factor of given polynomial, then remainder is 0.

Then, $x - 3 \overline{)x^3 - 2x^2 + 3x - 18} \; x^2 + x + 6$

$x^3 - 3x^2$
(–) (+)
$x^2 + 3x - 18$
$x^2 - 3x$
(–) (+)
$6x - 18$
$6x - 18$
(–) (+)
0

Hence, the remainder is 0. therefore $(x - 3)$ is a factor of given polynomial.

Alternate Solution : Remainder $= p(3)$

$(3)^3 - 2(3)^2 + 3(3) - 18$
$27 - 18 + 9 - 18$
$36 - 36 = 0$

(c) $3x^2 - x - 7 = 0$

Comparing with $ax^2 + bx + c = 0$, we get

$a = 3, b = -1, c = -7$
$D = b^2 - 4ac$
$= (-1)^2 - 4 \times 3 \times -7$
$= 1 + 84$
$= 85$

Roots are

$\Rightarrow \quad x = \dfrac{-b \pm \sqrt{D}}{2a}$

$\Rightarrow \quad x = \dfrac{1 \pm \sqrt{85}}{6}$

$\Rightarrow \quad x = \dfrac{1 \pm 9.2195}{6}$

Taking (+) sign for 1st root,

$\Rightarrow \quad x = \dfrac{1 + 9.2195}{6}$

$\Rightarrow \quad x = \dfrac{10.2195}{6}$

$\Rightarrow \quad x = 1.703 \Rightarrow x = 1.70$

Taking (–) sign for 2nd root,

$x = \dfrac{1 - 9.2195}{6}$

$x = -\dfrac{8.2195}{6}$

$x = -1.369 \Rightarrow x = -1.37$

Hence, roots are $x = 1.70$ and -1.37

$\Rightarrow -\frac{18}{2} < -3x$

$\Rightarrow -9 < -3x$

$\Rightarrow 3 > x$

and

$-\frac{1}{2} - 3x \le 8\frac{1}{2}$

$\Rightarrow -\frac{1}{2} - 3x \le \frac{17}{2}$

$\Rightarrow -3x \le \frac{17}{2} + \frac{1}{2}$

$\Rightarrow -3x \le 9$

$\Rightarrow x \ge -3$

Solution set : $\{x : -3 \le x < 3, x \in Z\}$
or $\{-3, -2, -1, 0, 1, 2\}$

Sol. 3. (a) Given, $-2\frac{2}{5} \le x + \frac{1}{5} < 3 + \frac{1}{5}, x \in R$

Now,

$-2\frac{2}{5} \le x + \frac{1}{5}$

$\Rightarrow -\frac{12}{5} \le x + \frac{1}{5}$

$\Rightarrow -\frac{12}{5} - \frac{1}{5} \le x$

$\Rightarrow -\frac{13}{5} \le x$

$\Rightarrow -2.6 \le x$

and,

$x + \frac{1}{5} < 3 + \frac{1}{5}$

$\Rightarrow x < 3$

Solution set: $\{x : -2.6 \le x < 3, x \in R\}$

(b) We have,

$$\frac{4x+6}{8} - 6 < \frac{2x-4}{6} - 4$$

$$\Rightarrow \quad \frac{4x-42}{8} < \frac{2x-28}{6}$$

$$\Rightarrow \quad \frac{x}{2} - \frac{21}{4} < \frac{x}{3} - \frac{14}{3}$$

$$\Rightarrow \quad \frac{x}{2} - \frac{x}{3} < -\frac{14}{3} + \frac{21}{4}$$

[Transposing $\frac{x}{3}$ to LHS and $\frac{21}{4}$ to RHS]

$$\Rightarrow \quad \frac{x}{6} < \frac{7}{12}$$

$$\Rightarrow \quad x < \frac{7}{2}$$

$\square\ x \in \left(-\infty, \frac{7}{2}\right)$

(c) Let the three consecutive integers are $x, x + 1, x + 2$
According to question,

$\frac{x+2}{3} - \frac{x}{6} \ge 5$

$\Rightarrow 2x + 4 - x \ge 30$

$\Rightarrow x + 4 \ge 30$

$\Rightarrow x \ge 26$

The smallest number is 26 and the three numbers are 26, 27 and 28.

(QUADRATIC EQUATIONS IN ONE VARIABLE, RATIO AND PROPORTION, FACTORISATION OF POLYNOMIALS)

Maximum Time : 1 Hour **Maximum Marks : 30**

Answer of the following questions

Q. 1. (a) If $\frac{4a-3b}{4c-3d}=\frac{4a+3b}{4c+3d}$, then prove that $\frac{a}{b}=\frac{c}{d}$. **[3]**

(b) Solve the quadratic equation $2x-\frac{1}{x}=7$. Write answer correct to two decimal places. **[3]**

(c) Using the Remainder theorem, factorise the following polynomial.
$6x^3-25x^2-32x+12$ **[4]**

Q. 2. (a) Given, $\frac{a}{b}=\frac{c}{d}$, prove that $\frac{3a-5b}{3a+5b}=\frac{3c-5d}{3c+5d}$. **[3]**

(b) Using remainder theorem, find the remainder when: x^3-7x^2+6x+4 is divided by $(x-6)$ **[3]**

(c) Solve the quadratic equation $x^2-10x+6=0$ for x and give you answer correct to two decimal places. **[4]**

Q. 3. (a) The monthly pocket money of Ravi and Sanjeev are in the ratio 5 : 7. Their expenditures are in the ratio 3 : 5. If each saves ₹ 80 every month, then find their monthly pocket money. **[3]**

(b) Verify that whether $(x-3)$ is a factor of polynomial $x^3-2x^2+3x-18$. **[3]**

(c) Solve the equation $3x^2-x-7=0$ and give your answer correct to two decimal places. **[4]**

(LINEAR INEQUATIONS)

Time: 1 Hours **MM: 30**

SOLUTIONS

Sol. 1. (a) Given,

$3x - 3 \le 7x + 5$

$= -3 - 5 \le 7x - 3x$

$= -8 \le 4x$

$= -2 \le x$

and

$5 - x \ge \frac{x}{4} - \frac{5}{4}$

$= 5 - x \ge \frac{x-5}{4}$

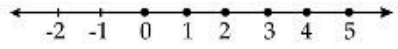
$= 20 - 4x \ge x - 5$

$= 20 + 5 \ge 5x$

$= 25 \ge 5x$

$= 5 \ge x$

Solution set: $\{x : -2 \le x \le 5, x \in N\}$



(b) Given, $3x - 5 \le 6x + 4 < 12, x \in Z.$

$3x - 5 \le 6x + 4$

$= 3x - 6x \le 4 + 5$

$= -3x \le 9$

$= x \ge -3$

and

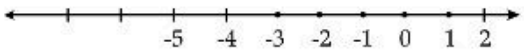
$6x + 4 < 12$

$= 5x < 8$

$= x < 8/5$

$= x < 1.3$

Solution set:- $\{x : -3 \le x < 1.3, x \in Z\}$



(c) Given,

$10 - 5x < 5(x + 6)$

$= 10 - 5x < 5x + 30$

$= -5x - 5x < 30 - 10$

$= -10x < 20$

$= x > -2$

And, the smallest value of x

(i) When x belongs Z, $x = -1$

(ii) When x belongs W, $x = 0$

(iii) When x belongs N, $x = 1$

Sol. 2. (a) Given,

$A = \{8x - 1 > 5x + 1, x \in N\}$

$B = \{7x + 2 > 3(x + 6), x \in N\}$

Now,

$A = \{8x - 1 > 5x + 1, x \in N\}$

$\Rightarrow 8x - 1 > 5x + 1$

$\Rightarrow 8x - 5x > 1 + 1$

$\Rightarrow 3x > 2$

$\Rightarrow x > \frac{2}{3}$

Again,

$B = \{7x + 2 > 3x + 18, x \in N\}$

$\Rightarrow 7x + 2 > 3x + 18$

$\Rightarrow 7x - 3x > 18 - 2$

$\Rightarrow 4x > 16$

$\Rightarrow x > 4$

Solution set of $A = \{1, 2, 3, ...\}$

Solution set of $B = \{5, 6, 7, ...\}$

Now, $A \cup B = \{1, 2, 3, 4, ...\}$ and $A \cap B = \{5, 6, 7, ...\}$.

(b) Given, $2x - 3 < x + 2 \le 3x + 5$

$2x - 3 < x + 2$

$= 2x - x < 2 + 3$

$= x < 5$

and

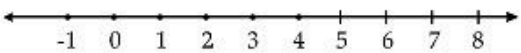
$x + 2 \le 3x + 5$

$= x - 3x \le 5 - 2$

$= -2x \le 3$

$= x \ge -\frac{3}{2}$

Solution set: $\{x : -\frac{3}{2} \le x < 5, x \in Z\}$



(c) Given, $-9\frac{1}{2} < -\frac{1}{2} - 3x \le 7\frac{1}{2}, x \in Z$

Now,

$-9\frac{1}{2} < -\frac{1}{2} - 3x$

$\Rightarrow -\frac{19}{2} + \frac{1}{2} < -3x$

SOLUTIONS

Sol. 1. (a) Case : 1

Profit % on ₹ 160=15% of on ₹ 150

$$\Rightarrow \frac{P}{100}\times 160 = \frac{15}{100}\times 150$$

$$\Rightarrow \quad \text{Profit} = 14.06\%$$

Case : 2

Profit % on ₹ 110=10% of on ₹ 120

$$\Rightarrow \frac{P}{100}\times 110 = \frac{10}{100}\times 120$$

$$\Rightarrow \quad \text{Profit} = 10.90\%$$

Therefore, the first investment is better.

(b) Dividend on each share=12% of 100 = ₹ 12

$$\text{No. of share he bought} = \frac{\text{total dividend}}{\text{dividend on each share}}$$

$$= \frac{1140}{12} = 95 \text{ shares}$$

Market value of each share = ₹ 80

Total investment= ₹ 80 × 95 = ₹ 7600

Therefore, he invested ₹ 7600 in the share market.

(c) The profit for each share = 15% of 100

$$= \frac{15}{100}\times 100 = ₹\ 15$$

If the man buys share for ₹ x.

$$\text{Profit} = 10\% \text{ of } x = \frac{x}{10}$$

According to question,

$$\Rightarrow \quad \frac{x}{10} = 15$$

$$\Rightarrow \quad x = ₹\ 150$$

Therefore, the man buys each share at ₹ 150.

Sol. 2. (a) Given,total investment = ₹ 9900

Market value of each share = ₹ 90

(i) No. of shares bought = $\frac{9900}{90} = 110$

(ii) Total dividend = No. of shares × rate × face value

$$= 110\times\frac{15}{100}\times 100$$

$$= ₹\ 1650$$

(iii) ₹ 1650 is the profit on ₹ 9900

$$\text{Rate of return} = \frac{1650}{9900}\times 100 = 16.67\%$$

Therefore the return percentage is 16.67%.

(b) Given, face value = ₹ 100

Discount = ₹ 10

Market value = 100 – 10 = ₹ 90

Investment = ₹ 55800

$$\text{No. of shares} = \frac{55800}{90} = 620$$

(i) The annual dividend = $620\times\frac{12}{100}\times 100 = ₹\ 7440$

(ii) Selling price of each share = 100 + 10 = 110

Total selling value = 110 × 620 = ₹ 68200

Profit = (Selling Price + dividend) – investment

= 68200 + 7440 – 55800

= ₹ 19,840

(c) Dividend on each share = 20% of 80

$$= \frac{20}{100}\times 80$$

$$= ₹\ 16$$

Komal's dividend = ₹ 1600

(i) No. of shares he bought = $\frac{1600}{16} = 100$

(ii) Komal bought shares at 25% premium

$$\text{So, Premium} = 80\times\frac{25}{100} = ₹\ 20$$

Market Value = 80 + 20 = ₹ 100

Total investment = 100 × 100 = ₹ 10,000

(iii) Rate of return= $\frac{1600}{10000}\times 100 = 16\%$

Rate of return 16%.

Sol. 3. (a) Number of shares = 600

Face value = ₹ 50

Rate of dividend = 15%

(i) Dividend = $600\times 50\times\frac{15}{100} = ₹\ 4500$

(ii) Investment by Ajit = 600 × 60 = ₹ 36000

$$\text{Rate of investment} = \frac{4500}{36000}\times 100 = 12.5\%$$

(b) Given, number of shares = 400

Rate = 15%

Face value = ₹ 150

$$\text{Total dividend} = 400\times\frac{15}{100}\times 150 = ₹\ 9000$$

Now, income tax = 18% of 9000

$$= \frac{18}{100}\times 9000$$

$$= ₹\ 1620$$

Therefore, net income = ₹ 9000 – ₹1620 = ₹ 7380

(c) Given, Nominal value = ₹ 100

Money investment = ₹ 36000

Dividend = 15%

(SHARES & DIVIDENDS)

Maximum Time : 1 Hour **Maximum Marks : 30**

Answer all the questions

Q. 1. **[3 + 3 + 4]**

(a) Which is the better investment?
15% of ₹ 150 shares at ₹ 160 OR 10% of ₹ 120 shares at ₹ 110.

(b) How much should a man invest in ₹ 100 shares selling at ₹ 80 to obtain an annual income of ₹ 1140, if the dividend declared is 12%?

(c) A man buys a ₹ 100 share in a share market, which pays 15% dividend. He buys the shares at such a price that his profit is 10% on his investment. At what price did he buy each share?

Q. 2. **[3 + 3 + 4]**

(a) A man invests ₹ 9900 on ₹ 100 shares at ₹ 90. If the company pays dividend at the rate 15%.
Find:

(i) The number of shares he buys.

(ii) His total dividend.

(iii) His percentage of return on the shares.

(b) Mr. Vivek invested ₹ 55800 on ₹ 100 shares at a discount of Rs. 10 paying 12% dividend. At the end on one year he sells the shares at a premium of ₹ 10. Find:

(i) The annual dividend.

(ii) The profit earned including his dividend.

(c) Komal invests a sum of money is ₹ 80 shares, paying 20% dividend quoted at 25% premium. If his annual dividend is ₹ 1600. Calculate:

(i) No. of shares he bought.

(ii) The total investment.

(iii) Rate of return on his investment.

Q. 3. **[3 + 3 + 4]**

(a) Ajit owns 600 shares in a share market. The face value of each share is ₹ 50 from market he received a dividend of 15%. Calculate:

(i) The dividend he will get.

(ii) The rate of interest on his investment, if he had paid ₹ 60 for each share.

(b) Mr. Sunil has 400 shares of ₹ 150 of a company paying a dividend of 15%. Find his net income after paying an income tax of 18%.

(c) Ajay invests ₹ 36000 in buying ₹ 100 shares at ₹ 20 premium. The dividend is 15% per annum. Find:

(i) Market value of each share.

(ii) The number of shares he buys.

(iii) His yearly dividend.

(iv) The percentage of return on his investment.

$\Rightarrow \quad 888 = 111r$

$\Rightarrow \quad r = 8\%$ per annum

The rate of interest is 8% per annum.

(c) Given, Marked price = ₹ 1,00,000

and discount = ₹ $\frac{15}{100} \times 1,00,000$

= ₹ 15,000

Selling price by the manufacturer

= ₹ (1,00,000 – 15,000)

= ₹ 85,000

∴ Cost price of a machine by the wholesale

= ₹ 85,000

and now selling price by the wholesale

= ₹ $\left(1,00,000 - \frac{10}{100} \times 1,00,000\right)$

= ₹ (1,00,000 – 10,000)

= ₹ 90,000

∴ Tax paid by the wholesaler to the central government

= Tax on S.P. – Tax on C.P.

$= \frac{28}{100} \times 90,000 - \frac{28}{100} \times 85000$

$= \frac{28}{100} \times (90000 - 85000)$

$= \frac{28}{100} \times 5000$

= ₹ 1,400

Sol. 3. (a) For dealer Ajay,

Selling price = ₹ 5000 (Given)

∵ Since in case of inter-state, we get

IGST = ₹ $\frac{12}{100} \times 5000$ = ₹600

For dealer Raj,

cost price = ₹ 5000

∴ selling price = ₹ (5000 + 1500)

= ₹ 6500

For dealer Rohit,

Cost price = ₹ 5000

∴ profit = ₹ 1500

Input tax credit = ₹ 600

output tax = ₹ $\left(\frac{12}{100} \times 6500\right)$

= ₹ 780

∴ Tax liability on dealer Ram = ₹ (780 – 600)

= ₹ 180

(b) Given,

Principal = ₹ 1200 per month

Maturity value = ₹ 12440

Rate = 8% per annum

We know,

$$\text{Interest} = \frac{P \times n \times (n+1) \times r}{2 \times 12 \times 100}$$

$$= \frac{1200 \times n \times (n+1) \times 8}{2400}$$

$$= 4n^2 + 4n$$

$$\text{Maturity value} = P \times n + I$$

$\Rightarrow \quad 12440 = 1200 \times n + 4n^2 + 4n$

$\Rightarrow \quad n^2 + 301n - 3110 = 0$

$\Rightarrow \quad n^2 + 311n - 10n - 3110 = 0$

$\Rightarrow \quad n(n + 311) - 10(n + 311) = 0$

$\Rightarrow \quad (n + 311)(n - 10) = 0$

$\Rightarrow n = 10$ and -311 (not possible)

The total time the account was held is 10 months.

(c) Given, Principal = ₹ 200 per month

Time = 36 months

Rate = 11% per annum

We know,

$$\text{Interest} = \frac{P \times n \times (n+1) \times r}{2 \times 12 \times 100}$$

$$= \frac{200 \times 36 \times 37 \times 11}{2400}$$

$$= 1221$$

Maturity value $= P \times n + I$

$= 200 \times 36 + 1221$

$= 7200 + 1221$

= ₹ 8421

The total amount paid by the bank is ₹ 8421.

SOLUTIONS

Sol. 1. (a) Total amount of the services

$= ₹ (800 + 600 + 700 + 900)$

$= ₹ 3000$

Since it is a case of Intra-state transaction.

$\therefore$ CGST $= 6\%$ of $₹ 3000$

$= ₹ \frac{6}{100} \times 3000$

$= ₹ 180$

SGST $= 6\%$ of $₹ 3000$

$= ₹ \frac{6}{100} \times 3000$

$= ₹ 180$

and IGST $= ₹ 0$

Hence, the total amount of GST $= ₹ (180 + 180 + 0)$

$= ₹ 360$

(b) Given, Time $= 3$ years $= 36$ months

Rate of interest $= 7.5\%$ per annum

Maturity value $= ₹ 80325$

Let the Principal be P.

We know,

$$\text{Interest} = \frac{P \times n \times (n+1) \times r}{2 \times 12 \times 100}$$

$$= \frac{P \times 36 \times 37 \times 75}{2400 \times 10}$$

$$= 4.1625P$$

$$\text{Maturity Value} = P \times n + I$$

$$\Rightarrow \quad 80325 = 36P + 4.1625P$$

$$\Rightarrow \quad 80325 = 40.1625P$$

$$\Rightarrow \quad P = \frac{80325}{401625} \times 10000$$

$$\Rightarrow \quad P = ₹ 2000$$

$\therefore$ The monthly installment is ₹ 2000.

(c) Given, Rina has a RD account in a bank.

Principal $= ₹ 850$ per month

Time $= 30$ months

Rate $= 12\%$ per annum

We know,

$$\text{Interest} = \frac{P \times n \times (n+1) \times r}{2 \times 12 \times 100}$$

$$= \frac{850 \times 30 \times 31 \times 12}{2400}$$

$$= ₹ 3952.50$$

$$\text{Maturity value} = P \times n + I$$

$$= 850 \times 30 + 3952.50$$

$$= ₹ 29452.50$$

Maturity value paid by the bank is ₹ 29452.50.

Sol. 2. (a) Given, Maturity Value $= ₹ 11364$

Monthly installment $= ₹ 200$

Rate of interest $= 9\%$ per annum

We know,

$$\text{Interest} = \frac{P \times n \times (n+1) \times r}{2 \times 12 \times 100}$$

$$= \frac{200 \times n \times (n+1) \times 9}{2400}$$

$$= \frac{3}{4} n(n+1)$$

$$\text{Maturity value} = P \times n + I$$

$$\Rightarrow 11364 = 200 \times n + \frac{3}{4} n(n+1)$$

$$\Rightarrow 45456 = 800n + 3n + 3n^2$$

$$\Rightarrow \quad 3n^2 + 803n - 45456 = 0$$

$$\Rightarrow 3n^2 - 144n + 947n - 45456 = 0$$

$$\Rightarrow \quad 3n(n-48) + 947(n-48) = 0$$

$$\Rightarrow \quad (n-48)(3n+947) = 0$$

$$\Rightarrow \quad n = 48 \text{ and } n = -\frac{947}{3}$$

(Not applicable)

The time period at which the account was held is 48 months or 4 years.

(b) Given, Ms. Swati has a RD account in a bank.

Principal $= ₹ 200$

Maturity value $= ₹ 8088$

Time $= 3$ years $= 36$ months

We know,

$$\text{Interest} = \frac{P \times n \times (n+1) \times r}{2 \times 12 \times 100}$$

$$= \frac{200 \times 36 \times 37 \times r}{2400}$$

$$= 111r$$

$$\text{Maturity value} = P \times n + I$$

$$\Rightarrow \quad 8088 = 200 \times 36 + 111r$$

$$\Rightarrow \quad 8088 - 7200 = 111r$$