

GREENLAWNS SCHOOL, WORLI
MATHEMATICS
Terminal Exam – 2025 - 26

STD: X

Marks: 80

Date: 18/09/2025

Time: 3hrs

Attempt **all** questions from **Section A** and **any four** questions from **Section B** **All working, including rough work, must be clearly shown, and must be done on the same sheet as the rest of the answer.**

Omission of essential working will result in loss of marks. The intended marks for questions or parts of questions are given in brackets []

SECTION A

(Attempt **all** questions from this Section)

Question 1. Choose the correct answers to the questions from the options given.

[15]

(Do not copy the questions, write the correct answer only)

- i. If two chords of a circle are equal, then:
a) their subtended angles at the centre are equal b) their arcs are equal
c) their distances from the centre are equal d) all of these
- ii. Which of the following is an arithmetic progression (AP)?
a) 2, 4, 8, 16, ... b) 3, 6, 9, 12, ... c) 1, 2, 4, 7, ... d) 2, 4, 6, 10, ...
- iii. If $A = \begin{bmatrix} a & b \end{bmatrix}$ and $B = \begin{bmatrix} c \\ d \end{bmatrix}$ then:
a) both matrices AB and BA are possible, $AB = BA$ b) only matrix BA is possible
c) both matrices AB and BA are possible d) only matrix AB is possible
- iv. The midpoint of the line joining (2,3) and (6,7) is:
a) (3, 4) b) (4, 5) c) (5, 6) d) (2, 5)
- v. A die is thrown once. The probability of getting a number greater than 4 is:
a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{2}{3}$ d) $\frac{1}{6}$
- vi. If $\sin \theta = \cos \theta$ then $\theta = ?$
a) 30° b) 45° c) 60° d) 90°
- vii. The probability of an event that is certain to happen is:
a) 0 b) 1 c) 50% d) $\frac{1}{2}$
- viii. The tangent to a circle is perpendicular to the:
a) secant b) chord
c) radius at the point of contact d) diameter
- ix. The value/s of 'k' for which the quadratic equation $2x^2 - kx + k = 0$ has equal roots
a) 0 only b) 4, 0 c) 8 only d) 0, 8

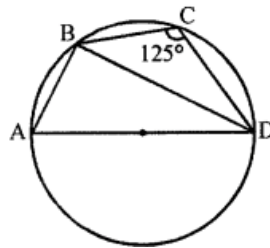
- x. If p, q, and r are in continued proportion, then :
a) $p : q = p : r$ **b)** $q : r = p^2 : q^2$ **c)** $p : q^2 = r : p^2$ **d)** $p : r = p^2 : q^2$
- xi. If $a = 2$, $r = 3$, $n = 4$, then sum =?
a) 20 **b)** 40 **c)** 80 **d)** 242
- xii. $\sec^2\theta - \tan^2\theta = ?$
a) 0 **b)** 1 **c)** -1 **d)** $\tan^2\theta$
- xiii. If a share of face value ₹100 is quoted at ₹120, then it is said to be:
a) At par **b)** At a discount **c)** At premium **d)** At loss
- xiv. If the nth term of an AP is given by $t_n = 7 + (n-1) \times 3$ then the common difference is:
a) 3 **b)** 4 **c)** 7 **d)** 10
- xv. If the mean of 6 numbers is 8, then their sum is:
a) 14 **b)** 24 **c)** 48 **d)** 64

Question 2

- a. A box contains 20 balls bearing numbers 1, 2, 3, 4,.....20. A ball is drawn at random from the box. What is the probability that the number on the ball is
(i) an odd number **(ii)** divisible by 2 or 3
(iii) prime number **(iv)** not divisible by 10. [4]

- b. A shopkeeper bought an air conditioner at a discount of 20% from a wholesaler, the printed price of the air conditioner being ₹ 28000. The shopkeeper sells it to a consumer at a discount of 10% on the printed price. If the GST rate is 18%, find
(i) the CGST and SGST payable by the shopkeeper to the Government.
(ii) the total amount paid by the consumer for the air conditioner [4]

- c. In figure, if $\angle BCD = 125^\circ$ and AD is the diameter of the circle, calculate
(i) $\angle DAB$
(ii) $\angle ADB$ [4]



Question 3

- a. Shaurya invested ₹ 8000 in 7% ₹ 100 shares at ₹ 80. After a year he sold these shares at ₹ 75 each and invested the proceeds (including his dividend) in 18%, ₹ 25 shares at ₹ 41. Find:
(i) his dividend for the first year.
(ii) his annual income in the second year.
(iii) the percentage increase in his return on his original investment. [4]

- b. Find the range of values of x which satisfies
 $-2\frac{2}{3} \leq x + \frac{1}{3} < 3\frac{2}{3}$, $x \in \mathbb{R}$
 Graph these values of x on the number line. [4]
- c. Find two numbers such that the mean proportional between them is 14 and the third proportional to them is 112. [4]
- d. Factorise $2x^3 + 9x^2 + 7x - 6$, using remainder theorem. [5]

Section B
(Attempt any four questions)

Question 4

- a. The sales price of a washing machine, inclusive of GST, is ₹ 28,320. If the SCST is charged at the rate of 9% of the list price, find the list price of the washing machine. [3]
- b. Find the sum of the first 50 terms of the A.P: -27, -23, -19, ... [3]
- c. Let $M \times \begin{bmatrix} 1 & 1 \\ 0 & 2 \end{bmatrix} = [1 \ 2]$, where M is a matrix,
 (i) State the order of the matrix M .
 (ii) Find the matrix M . [4]

Question 5

- a. Ms.Kadam deposits ₹ 1100 per month in a cumulative time deposit account in a bank for 16 months. If at the end of maturity, she gets ₹ 19096, find the rate of interest if interest is calculated at the end of each month. [3]
- b. In figure, O is the centre of the circle.
 If $\angle BAD = 30^\circ$, find the values of p , q and r . [3]
- c. Calculate the mean and median of the following data:

Wages in Rs.	20	21	22	23	24	25	26	27	28
No. of workers	8	10	11	16	20	25	15	9	6

Question 6

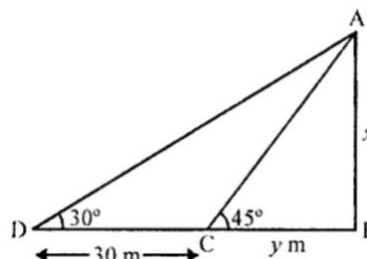
- a. Atharva owns 560 shares of a company. The face value of each share is Rs. 25. The company declares a dividend of 9%. Calculate:
 (i) the dividend Atharva would receive, and
 (ii) the rate of interest, on his investment. Considering that Atharva bought these shares @ ₹30 per share in the market. [3]
- b. Find the sum of 6 terms of the series. $12 + 6 + 3 + 1\frac{1}{2} + \dots$ [3]
- c. The frequency distribution of marks obtained by 40 students of a class is as under: Calculate the Arithmetic mean. [4]

Marks	0 - 8	8 - 16	16 - 24	24 - 32	32 - 40	40 - 48
Students	5	3	10	16	4	2

Question 7

- a. If $(4a + 9b) : (4a - 9b) = (4c + 9d) : (4c - 9d)$, Show that $a : b :: c : d$. [3]
- b. If $A = \begin{bmatrix} 8 & 1 \\ 5 & 2 \end{bmatrix}$, $B = \begin{bmatrix} -4 & 6 \\ -2 & 12 \end{bmatrix}$ find the matrix C such that $2A + 3B + 4C$ is a null matrix. [3]

- c. In the figure, it is given that AB is perpendicular to BD and is of length x metres. DC = 30m, $\angle ADB = 30^\circ$ and $\angle ACB = 45^\circ$ Without using tables, find x. [4]



Question 8

- a. Find the roots of $x^2 + 3x - 3 = 0$, giving your answer to two decimal places. [3]
- b. Prove that: $\frac{1}{\sec\theta + \tan\theta} = \frac{1 - \sin\theta}{\cos\theta}$ [3]
- c. Draw a histogram for daily earning of 20 drug stores given in the following data : [4]

Daily earnings (in Rs.)	150-200	200-250	250-300	300-350
Number of stores	14	9	3	4

Question 9

- a. In a public collection towards the erection of a memorial, 1000 people contributed sum of money varying from Rs. 1 to Rs. 100 (in units of Re. 1). The following table gives the frequency distribution of contribution:

Contribution in Rs.)	No. of people	Contribution (in Rs.)	No. of people
1-10	30	51-60	180
11-20	60	61-70	140
21-30	80	71-80	70
31-40	170	81-90	40
41-50	200	91-100	30

Using a suitable scale, draw on graph paper an ogive (cumulative frequency graph) and use it to answer the following:

- (i) Estimate the median.
(ii) If it is agreed to allow only those who contributed Rs. 45 or more to attend the unveiling ceremony, what percentage would attend?

[6]

- b. The sum of two numbers is 8 and 15 times the sum of their reciprocals is also 8. Find the numbers.

[4]

Answer key grade 10 math

SECTION A

(Attempt **all** questions from this Section)

Question 1. Choose the correct answers to the questions from the options given.
(Do not copy the questions, write the correct answer only)

[15]

- i. **d)** all of these
- ii. **b)** 3, 6, 9, 12, ...
- iii. **b)** only matrix BA is possible
- iv. **b)** (4, 5)
- v. **b)** $\frac{1}{3}$
- vi. **b)** 45°
- vii. **b)** 1
- viii. **c)** radius at the point of contact
- ix. **d)** 0, 8
- x. **d)** $p : r = p^2 : q^2$
- xi. **c)** 80
- xii. **b)** 1
- xiii. **c)** At premium
- xiv. **a)** 3
- xv. **c)** 48

Question 2

- a.** A box contains 20 balls bearing numbers 1, 2, 3, 4,.....20. A ball is drawn at random from the box. What is the probability that the number on the ball is
- (i) an odd number
 - (ii) divisible by 2 or 3
 - (iii) prime number
 - (iv) not divisible by 10.

[4]

Solution:

Total number of balls in the box bearing numbers 1 to 20 = 20

(i) Odd number between 1 to 20 = 1, 3, 5, 7, 9, 11, 13, 15, 17, 19 = 10

$\therefore$ Probability $P(E) = \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}} = \frac{10}{20} = \frac{1}{2}$

(ii) Number which are divisible by 2 or 3 are 2, 3, 4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20 = 13

$\therefore$ Probability $P(E) = \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}} = \frac{13}{20}$

(iii) Numbers which are prime = 2, 3, 5, 7, 11, 13, 17, 19 = 8

$\therefore$ Probability $P(E) = \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}} = \frac{8}{20} = \frac{2}{5}$

(iv) Numbers which are not divisible by 10 will be 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19 = 18

$\therefore$ Probability $P(E) = \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}} = \frac{18}{20} = \frac{9}{10}$

- b. A shopkeeper bought an air conditioner at a discount of 20% from a wholesaler, the printed price of the air conditioner being ₹ 28000. The shopkeeper sells it to a consumer at a discount of 10% on the printed price. If the GST rate is 18%, find
- the CGST and SGST payable by the shopkeeper to the Government.
 - the total amount paid by the consumer for the air conditioner

[4]

Sol:

Since, it is a case of intra-state transaction of goods and services.

$$\therefore \text{CGST} = \text{SGST} = 12 \times \text{GST}$$

Given, Marked price of the air conditioner for wholesaler = ₹ 28,000

Discount price = 20%

$$\text{S.P. of the air conditioner for wholesaler} = ₹ 28,000 - 20\% \text{ of } ₹ 28,000 = ₹ 28,000 - ₹ 5,600 = ₹ 22,400$$

and Rate of GST = 18%

$$\therefore \text{CGST} = 9\% \text{ of } ₹ 22,400 = 9100 \times 22400 = ₹ 2016$$

$$\text{and SGST} = 9\% \text{ of } ₹ 22,400 = 9100 \times 22400 = ₹ 2016$$

Hence, Input CGST = Input SGST for shopkeeper = ₹ 2016

The shopkeeper further sells the air conditioner at a discount of 10% to the consumer on the printed price.

$$\therefore \text{S.P. of the machine for shopkeeper} = ₹ 28000 - 10\% \text{ of } ₹ 28000 \\ = ₹ 28000 - (10100 \times 28000) = ₹ 28000 - 2800 = ₹ 25200$$

$$\therefore \text{CGST} = 9\% \text{ of } ₹ 25200 = 9100 \times 25200 = ₹ 2268$$

$$\text{and SGST } 9\% \text{ of } 25200 \times 25200 \text{ } 2268$$

Hence, output CGST = output SGST for the shopkeeper = ₹ 2268

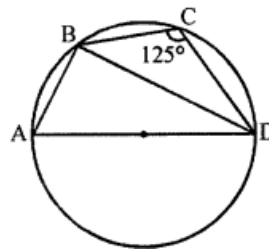
$$\text{(i) CGST payable by the shopkeeper to the government} = \text{Output GST} - \text{Input SGST} \\ = ₹ 2268 - ₹ 2016 = ₹ 252$$

$$\text{and SGST payable by the shopkeeper to the government} = \text{Output SGST} - \text{Input SGST} \\ = ₹ 2268 - ₹ 2016 = ₹ 252$$

$$\text{(ii) Thtal amount paid by the retailer} = \text{S.P. of the machine} + \text{CGST} + \text{SGST} \\ = ₹ 25200 + ₹ 2268 - ₹ 2268 = ₹ 29736$$

- c. In figure, if $\angle BCD = 125^\circ$ and AD is the diameter of the circle, calculate

- $\angle DAB$
- $\angle ADB$



[4]

Solution:

In the figure, AD is the diameter of the circle and ABCD is a cyclic quadrilateral $\angle BCD = 125^\circ$
Join BD

(i) $\because$ ABCD is a cyclic quadrilateral

$$\therefore \angle BAD + \angle BCD = 180^\circ \text{ (Sum of opposite angles)}$$

$$\Rightarrow \angle BAD + 125^\circ = 180^\circ$$

$$\Rightarrow \angle BAD = 180^\circ - 125^\circ = 55^\circ$$

(ii) Now in $\triangle ABD$,

$$\angle ABD = 90^\circ \text{ (Angle in a semicircle)}$$

$$\therefore \angle BAD + \angle ADB = 90^\circ$$

$$\Rightarrow 55^\circ + \angle ADB = 90^\circ$$

$$\Rightarrow \angle ADB = 90^\circ - 55^\circ = 35^\circ$$

$$\therefore \angle ADB = 35^\circ$$

Hence (i) $\angle BAD$ or $\angle DAB = 55^\circ$ and

(ii) $\angle ADB = 35^\circ$

Question 3

- a. Mr. Ram Gopal invested ₹ 8000 in 7% ₹ 100 shares at ₹ 80. After a year he sold these shares at ₹ 75 each and invested the proceeds (including his dividend) in 18%, ₹ 25 shares at ₹ 41.

Find:

(i) his dividend for the first year.

(ii) his annual income in the second year.

(iii) the percentage increase in his return on his original investment.

[4]

Solution:

Investment made by Ram Gopal = ₹ 8000

Face value of each share = ₹ 100

Market value = ₹ 80

Rate of dividend = 7%

Number of shares = $\frac{₹ 8000}{₹ 80} = 100$

(i) Dividend for the first year = ₹ 100 × 100 × 7%

$$= 100 \times 100 \times 7\% = ₹ 700$$

(ii) M.V. of second year = ₹ 75

$\therefore$ Sale proceed = ₹ 100 × 75 = ₹ 7500

Total investment including dividend = ₹ 7500 + 700 = ₹ 8200

Rate of dividend in second year = 18%

M.V. = ₹ 41

Face value = ₹ 25

$\therefore$ Number of shares bought = $\frac{₹ 8200}{₹ 41} = 200$

Nominal value of 200 share = ₹ 25 × 200 = ₹ 5000

$\therefore$ Dividend = ₹ 5000 × 18%

$$= ₹ 5000 \times 18\% = ₹ 900$$

(iii) Increase in income = ₹ 900 – ₹ 700 = ₹ 200

$\therefore$ Increase percent = $\frac{200}{8000} \times 100$

$$= 2.5\%$$

- b. Find the range of values of x which satisfies

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

Graph these values of x on the number line.

[4]

Solution:

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

$$\Rightarrow -83 \leq x + 13 < 103$$

$$(i) -83 \leq x + 13 + 13 \Rightarrow -83 - 13 \leq x$$

$$\Rightarrow -93 \leq x \Rightarrow -3 \leq x$$

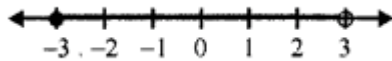
$$(ii) x + 13 < 103 \Rightarrow 103 - 13$$

$$\Rightarrow x < 93 \Rightarrow x < 3$$

From (i) and (ii)

Solution is $-3 < x < 3$

Number line



c. Find two numbers such that the mean proportional between them is 14 and the third proportional to them is 112.

[4]

Sol:

(i) Let a and b be the two numbers whose mean proportional = 14 and third proportional = 112

$$\therefore \sqrt{ab} = 14 \Rightarrow ab = 196 \Rightarrow a = \frac{196}{b} \dots(i)$$

$$\text{and } \frac{b^2}{a} = 112$$

$$\Rightarrow \frac{b^2}{\frac{196}{b}} = 112$$

$$\Rightarrow \frac{b^2 \times b}{196} = 112$$

$$\Rightarrow b^3 = 112 \times 196 = 21952$$

$$\Rightarrow b = \sqrt[3]{21952} = 28$$

$$\text{and } a = \frac{196}{b} = \frac{196}{28} = 7$$

$\therefore$ Numbers are 7, 28

d. Factorise $2x^3 + 9x^2 + 7x - 6$, using remainder theorem.

[5]

Sol; Let $f(x) = 2x^3 + 9x^2 + 7x - 6$

Factors of 6 = $\pm 1, \pm 2, \pm 3, \pm 6$

By trial and error method,

Let $x = -2$

Then $f(-2) = 2(-2)^3 + 9(-2)^2 + 7(-2) - 6$
 $= 2 \times (-8) + 9 \times 4 + 7 \times (-2) - 6$
 $= -16 + 36 - 14 - 6 = 0$
 $\therefore x + 2$ is the factor of $f(x)$
 Now dividing $f(x)$ by $x + 2$, we get

$$\begin{array}{r}
 2x^2 + 5x - 3 \\
 x + 2 \overline{) 2x^3 + 9x^2 + 7x - 6} \\
 \underline{2x^3 + 4x^2} \\
 5x^2 + 7x \\
 \underline{5x^2 + 10x} \\
 -3x - 6 \\
 \underline{-3x - 6} \\
 0
 \end{array}$$

$$\begin{aligned}
 f(x) &= (x + 2)(2x^2 + 5x - 3) \\
 &= (x + 2)\{2x^2 + 6x - x - 3\} \\
 &= (x + 2)\{2x(x + 3) - 1(x + 3)\} \\
 &= (x + 2)(x + 3)(2x - 1)
 \end{aligned}$$

Section B

(Attempt any four questions)

Question 4

- a. The sales price of a washing machine, inclusive of GST, is ₹ 28,320. If the SGST is charged at the rate of 9% of the list price, find the list price of the washing machine. [3]

Solution:

Let the marked price of washing machine = ₹ x

Rate of SGST = 9%

We know that, in case of intra state of transaction of goods and services

SGST = CGST = 12 x GST

$\therefore$ GST = 2 x SGST = 2 x 9% = 18%

Given, SP of washing machine inclusive of taxes = ₹ 28320

$\therefore$ GST Amount = ₹ $18x/100$

and final amount = ₹ $(x + 18x/100) = ₹ 118x/100$

A.T.Q

$118x/100 = ₹ 28320$

$\Rightarrow x = 28320 \times 100 / 118 = ₹ 24000$

$\therefore$ The list price of washing machine = ₹ 24000

- b. Find the sum of the first 50 terms of the A.P: -27, -23, -19, ... [3]

Sol: First 50 terms of the A.P: -27, -23, -19, ...

Here, $a = -27$, $d = -23 - (-27)$

$= -23 + 27 = 4$

$n = 50$

$\therefore S_n = n/2[2a + (n-1)d]$

$$= 50/2[2 \times (-27) + (50-1) \times 4]$$

$$S_{50} = 25[-54 + 49 \times 4] = 25[-54 + 196] = 25 \times 142 = 3550$$

c. Let $M \times \begin{bmatrix} 1 & 1 \\ 0 & 2 \end{bmatrix} = [1 \ 2]$, where M is a matrix,

(i) State the order of the matrix M. (ii) Find the matrix M.

[4]

Solution:

(i) The order of the matrix will be 1×2

(ii) Let $M = [x \ y]$, then

$$[x \ y] \times \begin{bmatrix} 1 & 1 \\ 0 & 2 \end{bmatrix} = [1 \ 2]$$

$$\Rightarrow [x \times 1 + y \times 0 \quad x \times 1 + y \times 2] = [1 \ 2]$$

$$[x + 0 \quad x + 2y] = [1 \ 2]$$

$$\Rightarrow [x \quad x + 2y] = [1 \ 2]$$

Comparing the corresponding elements

$$x = 1$$

$$x + 2y = 2 \Rightarrow 1 + 2y = 2 \Rightarrow 2y = 2 - 1 = 1$$

$$\Rightarrow y = 1/2$$

$$\therefore M = [x \ y] = [1 \ 1/2]$$

Question 5

a. Mr. Gupta deposits ₹ 1100 per month in a cumulative time deposit account in a bank for 16 months. If at the end of maturity, he gets ₹ 19096, find the rate of interest if interest is calculated at the end of each month.

[3]

Solution:

Deposit per month (P) = ₹ 1100

Period (n) = 16 months

Maturity value = ₹ 19096

Let rate = R%

Interest = Maturity value – Principal

$$= ₹ 19096 - 1100 \times 16 = ₹ 19096 - 17600 = ₹ 1496$$

Principal for one month

$$= P \times n(n+1)/2 = ₹ 1100 \times 16 \times (16+1)/2$$

$$= ₹ 1100 \times 16 \times 17/2 = ₹ 149600$$

$$\therefore \text{Rate} = \frac{\text{Interest} \times 100}{P \times t} = \frac{1496 \times 100}{1100 \times 16} = 12\%$$

$$= 12\% \text{ p.a}$$

b. In figure, O is the centre of the circle.

If $\angle BAD = 30^\circ$, find the values of p, q and r.

[3]

Solution:

In the figure,

(i) O is the centre of the circle and $\angle BAD = 30^\circ$

$\therefore$ ABCD is a cyclic quadrilateral

$\therefore \angle BAD + \angle BCD = 180^\circ$ (Sum of opposite angles)

$$\Rightarrow 30^\circ + p = 180^\circ$$

$$\Rightarrow p = 180^\circ - 30^\circ = 150^\circ$$

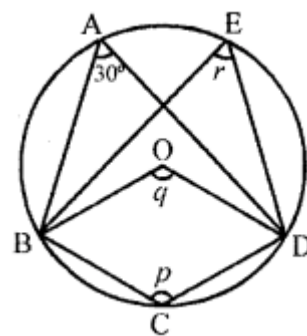
Arc BCD subtends $\angle BOD$ at the centre and $\angle BAD$ at the remaining part of the circle

$$\therefore \angle BOD = 2\angle BAD$$

$$q = 2 \times 30^\circ = 60^\circ$$

$\therefore \angle BAD$ and $\angle BED$ are in the same segment

$$\therefore \angle BED = \angle BAD$$



$$\Rightarrow r = 30^\circ$$

Hence $p = 150^\circ$, $q = 60^\circ$ and $r = 30^\circ$

c. Calculate the mean and median of the following data :

Wages in Rs.	20	21	22	23	24	25	26	27	28
No. of workers	8	10	11	16	20	25	15	9	6

Solution:

Wages (in Rs.)	No. of workers (f)	c.f.
20	8	8
21	10	18
22	11	29
23	16	45
24	20	65
25	25	90
26	15	105
27	9	114
28	6	120

Total number of workers = 120 which is even

$\therefore$ Median = $\frac{n}{2}$ th term = $\frac{120}{2} = 60$ th term

Which lies between 46 to 65 of c.f. column

$\therefore$ Median = Rs. 24

Question 6

a. Atharva owns 560 shares of a company. The face value of each share is Rs. 25. The company declares a dividend of 9%. Calculate:

- the dividend Arun would receive, and
- the rate of interest, on his investment. Considering that Arun bought these shares @ ₹30 per share in the market.

[3]

Solution:

Number of shares Arun has = 560

Face value of each share = ₹ 25

Rate of dividend = 9%

Now total face value of 560 shares = ₹ 25 x ₹ 560 = ₹ 14000

(i) Total dividend received by Arun

= ₹ 14000 $\times$ 9/100 = ₹ 1260

(ii) Market value of each share = ₹ 30

Total investment = ₹ 30 x 560 = ₹ 16800

Rate of interest on the investment

$$= ₹ 1260 \times 10016800$$

$$= 7.5\% \text{ or } 712\%$$

b. Find the sum of 6 terms of the series. $12 + 6 + 3 + 1\frac{1}{2} + \dots$

[3]

Solution:

(i) $12 + 6 + 3 + 1\frac{1}{2} + \dots$ n terms

$$\text{Here, } a = 12, r = \frac{6}{12} = \frac{1}{2}$$

$$\therefore S_n = \frac{a(1-r^n)}{1-r} \quad (\because r < 1)$$

$$= \frac{12 \left[1 - \left(\frac{1}{2} \right)^n \right]}{1 - \frac{1}{2}} = \frac{12}{\frac{1}{2}} \left[1 - \left(\frac{1}{2} \right)^n \right]$$

$$= \frac{12 \times 2}{1} \left[1 - \left(\frac{1}{2} \right)^n \right] = 24 \left[1 - \left(\frac{1}{2} \right)^n \right]$$

c. The frequency distribution of marks obtained by 40 students of a class is as under:
Calculate the Arithmetic mean.

[4]

Marks	Class Mark x	Frequency (f)	f × x
0-8	4	5	20
8-16	12	3	36
16-24	20	10	200
24-32	28	16	448
32-40	36	4	144
40-48	44	2	88
Total		40	936

Marks	0 - 8	8 - 16	16 - 24	24 - 32	32 - 40	40 - 48
Students	5	3	10	16	4	2

Solution:

$$\text{Mean} = \frac{\sum fx}{\sum f} = \frac{936}{40} = 23.4 \text{ marks}$$

Question 7

- a. If $(4a + 9b) : (4a - 9b) = (4c + 9d) : (4c - 9d)$, Show that $a : b :: c : d$. [3]

Solution:

$$(4a + 9b) : (4a - 9b) = (4c + 9d) : (4c - 9d)$$

$$\Rightarrow 4a+9b \cdot 4c-9d = 4c+9d \cdot 4a-9b$$

Applying componendo and dividendo,

$$\frac{4a+9b+4a-9b}{4a+9b-4a+9b} = \frac{4c+9d+4c-9d}{4c+9d-4c+9d}$$

$$\Rightarrow \frac{8a}{18b} = \frac{8c}{18d}$$

$$\Rightarrow a/b = c/d \text{ (Dividing by 18)}$$

$$\therefore a : b :: c : d$$

- b. If $A = \begin{bmatrix} 8 & 1 \\ 5 & 2 \end{bmatrix}$, $B = \begin{bmatrix} -4 & 6 \\ -2 & 12 \end{bmatrix}$ find the matrix C

such that $2A + 3B + 4C$ is a null matrix.

[3]

Solution:

Now $2A + 3B + 4C$ is a null matrix

$$\therefore 2 \begin{bmatrix} 8 & 1 \\ 5 & 2 \end{bmatrix} + 3 \begin{bmatrix} -4 & 6 \\ -2 & 12 \end{bmatrix} + 4C = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 16 & 2 \\ 10 & 4 \end{bmatrix} + \begin{bmatrix} -12 & 18 \\ -6 & 36 \end{bmatrix} + 4C = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 16-12 & 2+18 \\ 10-6 & 4+36 \end{bmatrix} + 4C = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

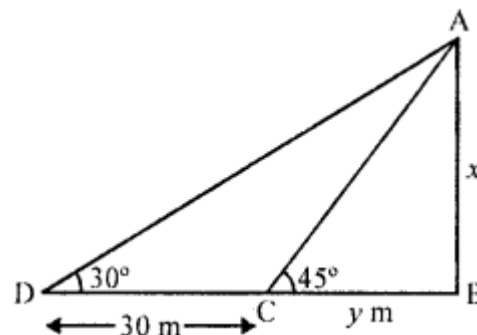
$$\Rightarrow \begin{bmatrix} 4 & 20 \\ 4 & 40 \end{bmatrix} + 4C = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\Rightarrow 4C = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} - \begin{bmatrix} 4 & 20 \\ 4 & 40 \end{bmatrix}$$

$$\Rightarrow 4C = \begin{bmatrix} 0-4 & 0-20 \\ 0-4 & 0-40 \end{bmatrix} = \begin{bmatrix} -4 & -20 \\ -4 & -40 \end{bmatrix}$$

$$\Rightarrow C = \begin{bmatrix} -1 & -5 \\ -1 & -10 \end{bmatrix}$$

- c. In the figure, it is given that AB is perpendicular to BD and is of length x metres. DC = 30m, $\angle ADB = 30^\circ$ and $\angle ACB = 45^\circ$. Without using tables, find x.



[4]

Solution:

In the figure, $AB = x$, $DC = 30$ m

$\angle ADB = 30^\circ$, $\angle ACB = 45^\circ$

Let $BC = y$ m

Now in right $\triangle ABC$

$$\tan \theta = \frac{AB}{BC} \Rightarrow \tan 45^\circ = \frac{x}{y} \Rightarrow 1 = \frac{x}{y}$$

$$\Rightarrow x = y$$

Again in right $\triangle ABD$, ($\because \tan 45^\circ = 1$)

$$\tan 30^\circ = \frac{AB}{BD} \Rightarrow \frac{1}{\sqrt{3}} = \frac{x}{xy+30}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{x}{xx+30} \quad (\because y = x)$$

$$\Rightarrow \sqrt{3} x = x + 30 \Rightarrow \sqrt{3} x - x = 30$$

$$\Rightarrow (1.732 - 1) x = 30 \Rightarrow 0.732x = 30$$

$$\Rightarrow x = 300.732 = 40.98 \text{ m}$$

$$\therefore x = 40.98 \text{ m}$$

Question 8

- a. Find the roots of $x^2 + 3x - 3 = 0$, giving your answer to two decimal places.

[3]

Sol: Solution:

$$x^2 + 3x - 3 = 0$$

Here $a = 1$, $b = 3$, $c = -3$

$$\therefore D = b^2 - 4ac = (3)^2 - 4 \times 1 \times (-3)$$

$$= 9 + 12 = 21$$

$$\therefore x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-3 \pm \sqrt{21}}{2 \times 1}$$

$$= \frac{-3 \pm 4.58}{2}$$

$$\therefore x_1 = \frac{-3 + 4.58}{2} = \frac{1.58}{2} = 0.79$$

$$x_2 = \frac{-3 - 4.58}{2} = \frac{-7.58}{2} = -3.79$$

$$\therefore x = 0.79, -3.79$$

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

[3]

$$\begin{aligned} \text{Solution: L.H.S.} &= \frac{1}{\sec\theta + \tan\theta} \\ &= \frac{1}{\frac{\sec\theta - \tan\theta}{\sec\theta - \tan\theta}} \\ &= \frac{\sec\theta - \tan\theta}{(\sec\theta + \tan\theta)(\sec\theta - \tan\theta)} \\ &= \frac{\sec\theta - \tan\theta}{\sec^2\theta - \tan^2\theta} = \frac{\sec\theta - \tan\theta}{1} \\ &\quad \{\because \sec^2\theta - \tan^2\theta = 1\} \\ &= \frac{1}{\cos\theta} - \frac{\sin\theta}{\cos\theta} = \frac{1 - \sin\theta}{\cos\theta} = \text{R.H.S.} \end{aligned}$$

- c. Draw a histogram for daily earning of 20 drug stores given in the following data :

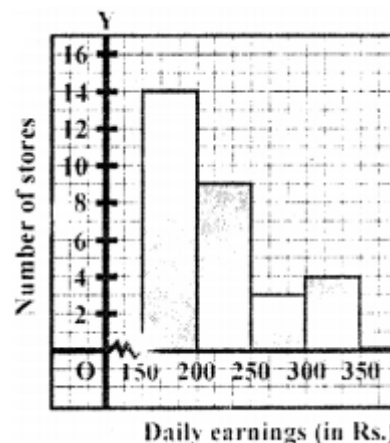
[4]

Daily earnings (in Rs.)	150-200	200-250	250-300	300-350
Number of stores	14	9	3	4

Solution:

We represent daily earnings in rupees along x-axis and number of stores along y-axis and prepare the histogram shown in the figure given here.

Draw histograms for the following distributions :



Question 9

- a. In a public collection towards the erection of a memorial, 1000 people contributed sums of money varying from Rs. 1 to Rs. 100 (in units of Re. 1). The following table gives the frequency distribution of contribution:

Contribution in Rs.)	No. of people	Contribution (in Rs.)	No. of people
1-10	30	51-60	180
11-20	60	61-70	140
21-30	80	71-80	70
31-40	170	81-90	40
41-50	200	91-100	30

Using a suitable scale, draw on graph paper an ogive (cumulative frequency graph) and use it to answer the following:

- Estimate the median.
- If it is agreed to allow only those who contributed Rs. 45 or more to attend the unveiling ceremony, what percentage would attend?

[6]

Solution:

Writing the classes in exclusive forms

Contribution (in Rs.)	No. of people (f)	c.f.
0.5-10.5	30	30
10.5-20.5	60	90
20.5-30.5	80	170
30.5-40.5	170	340
40.5-50.5	200	540
50.5-60.5	180	720
60.5-70.5	140	860
70.5-80.5	70	930
80.5-90.5	40	970
90.5-100.5	30	1000

Plot the points (10.5, 30), (20.5, 90), (30.5, 170), (40.5, 340), (50.5, 540), (60.5, 720), (70.5, 860), (80.5, 930), (90.5, 970) and (100.5, 1000) on the graph and join them with free hand to get an ogive as shown.

Here $n = 1000$

$\therefore$ Median = $n/2 = 1000/2 = 500$ th term

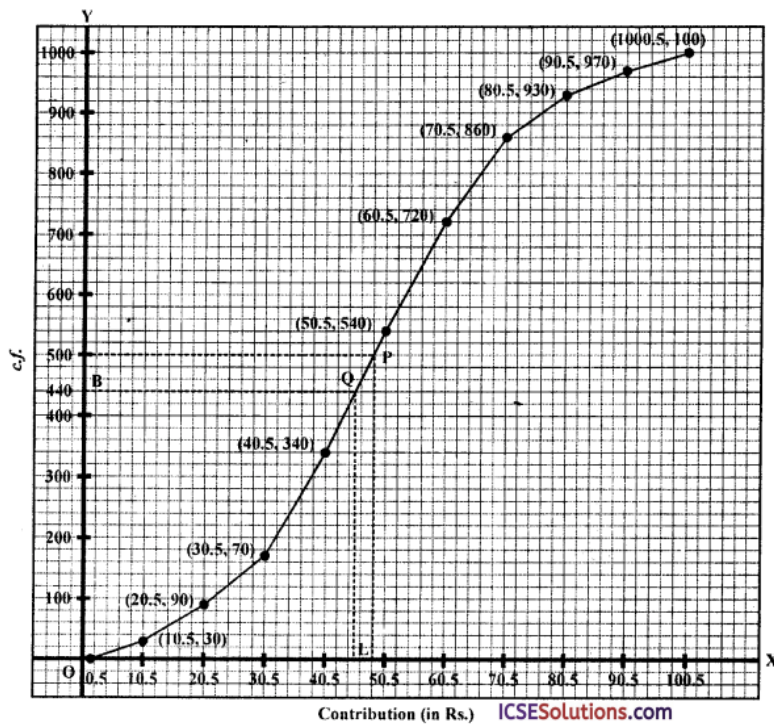
From 500 on y-axis; draw a line parallel to x-axis which meets the curve at P. From P, draw $PL \perp$ x-axis then L is the median which is 49

$\therefore$ Median = 49 rupees

- From Rs. 45 on x-axis, draw a perpendicular which meets the curve at Q and from Q, draw a parallel line to x-axis which meets y-axis at B Then B is 440

∴ Persons who could attend the ceremony = $1000 - 440 = 560$

Percentage = $\frac{560 \times 100}{1000} = 56\%$



- b. The sum of two numbers is 8 and 15 times the sum of their reciprocals is also 8.
Find the numbers.

[4]

Solution:

Sum of two numbers = 8

Let first number = x

Then second number = $8 - x$

According to the condition,

$$15\left[\frac{1}{x} + \frac{1}{(8-x)}\right] = 8$$

$$\Rightarrow 8x - x^2 = 15$$

$$\Rightarrow x^2 - 8x + 15 = 0$$

$$\Rightarrow x^2 - 5x - 3x + 15 = 0$$

$$\left\{ \begin{array}{l} \because 15 = (-5) \times (-3) \\ -8 = -5 - 3 \end{array} \right\}$$

$$\Rightarrow x(x - 5) - 3(x - 5) = 0$$

$$\Rightarrow (x - 5)(x - 3) = 0$$

Either $x - 5 = 0$, then $x = 5$

or $x - 3 = 0$, then $x = 3$

If first number is 5,

then second number = $8 - 5 = 3$

If first number is 3, then

second number = $8 - 3 = 5$

$\therefore$ Numbers are 3, 5
