Greenlawns School, Worli

First Term Examination

Mathematics

STD: X | Marks: 80

Date: /09/2015 | Time: 2½hrs

Section A

(Attempt all questions of this section)

Question 1

a. What quantity must be added to each term of ratio m + n: m – n to make it equal to $(m + n)^2 : (m - n)^2$? [3]

b. The catalogue price of a computer set is ` 45000. The shopkeeper gives a discount of 7% on listed price. He gives further off season discount of 4% on balance. However, Sales Tax at 8% is charged on the remaining amount. Find:

(i) Amt. of Sales Tax a customer has to pay.

(ii) Final price he has to pay for computer set. [3]

c. If B and C are two matrices such that B = $\begin{bmatrix} 1 & 3 \\ -2 & 0 \end{bmatrix}$ & C = $\begin{bmatrix} 17 & 7 \\ -4 & -8 \end{bmatrix}$. Find the matrix A so that BA = C. [4]

Question 2

a. Mrs. Suneeta saves `8000 every year & invests it at the end of the year at 10% p.a. CI. Calculate her total savings at the end of third year. [3]

b. Evaluate: $3 \cos 80^\circ \operatorname{cosec} 10^\circ + 2 \cos 59^\circ \operatorname{cosec} 31^\circ$. [3]

c. In Δ PQR, L & M are two points on base QR, such that $\angle LPQ = \angle QRP$ & $\angle RPM = \angle RQP$. Prove that:

i) $\Delta PQL \sim \Delta RPM$

ii) $QL \times RM = PL \times PM$

iii) $PQ^2 = QR \times QL$ [4]

Question 3

a. A company with 4000 shares of nominal value of ` 110 each declare an annual dividend of 15%. Calculate

i) Total amount of dividend

ii) Annual income of a person who holds 88 shares in the company.

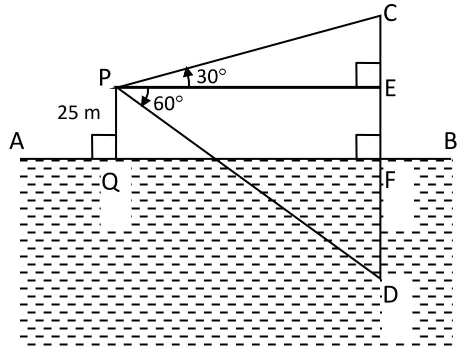
iii) If he received only 10% on his investment, find the price for each share. [3]

b. The marks of 20 students in a test were as follows:

2, 6, 8, 9, 10, 11, 11, 12, 13, 13, 14, 14, 15, 15, 15, 16, 16, 18, 19 & 20.

Calculate: (i)the mean, (ii) the median, (iii) the mode [3]

c. The angle of elevation of a stationary cloud from a point 25 m above a lake is 30° and the angle of depression of its reflection in lake is 60°. What is the height of cloud above that lake-level? [4]



Question 4

a. Given A = {x : –1 < x ≤ 5, x ∈ R}

B = {x : –4 ≤ x < 3, x ∈ R}

Represent on different number lines:

(i) A ∩ B (ii) A' ∩ B (iii) A – B [3]

b. The length of common chord of two intersecting circles is 30 cm. If the diameters of these two circles be 50 cm & 34 cm. Calculate the distance between their centers. [3]

c. Mr. Bhalu has a Savings Bank Account in Punjab National Bank. His pass book has following entries:

Date 1997	Particulars	Debit (`)	Credit (`)	Balance (`)
April 1	B/F	-	-	3220.00
April 15	By.T.	-	2010.00	5230.00
May 8	To Cheque	298.00	-	4932.00
July 15	By Clearing	-	4628.00	9560.00
July 29	By Cash	-	5440.00	15000.00
Sep. 10	To Self	-	6980.00	8020.00
Jan. 10 (1998)	By Cash	-	8000.00	16020.00

Calculate the interest due to him at the end of 31st March 1998 at the rate of 6% p.a. [4]

Section B

(Attempt any four questions of this section)

Question 5

a. The marks obtained by 120 students in a mathematics test are given below:

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of students	5	9	16	22	26	18	11	6	4	3

Use Ogive to estimate

i) Median

ii) No. of students who scored more than 75% marks in a test

iii) The no. of students who did not pass in test if the pass percentage was 40

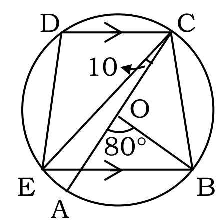
iv) The lower quartile [6]

b. If x = $\mathbf{\frac{6ab}{a+b}}$, find the value of: $\mathbf{\frac{x+3a}{x-3a}+\frac{x+3b}{x-3b}}$. [4]

Question 6

a. In the given figure, AC is diameter CD & BE is parallel. $\llcorner AOB = 80^{\circ}$, $\llcorner ACE = 10^{\circ}$.

Calculate:



i) $\llcorner BEC$

ii) $\llcorner BCD$

iii) $\llcorner CED$ [3]

b. The ratio of base area and curved surface area of a conical tent is 40: 41. If its height is 18 m. Find the air capacity of tent in terms of π. [3]

c. Mr. Batliwala has a R.D. Account of Rs. 300 per month. If the rate of interest is 12% & the maturity value is Rs. 8100. Find the time (in yrs.) of this R.D. Account. [4]

Question 7

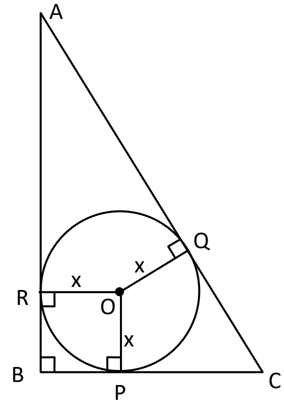
a. Show that 2x + 7 is a factor of $2x^3 + 5x^2 - 11x - 14$. Hence factorize the given expression completely, using factor theorem. [3]

b. Prove that: $(\sin A + \text{cosec } A)^2 + (\cos A + \sec A)^2 = 7 + \tan^2 A + \cot^2 A$. [3]

c. If A = $\begin{bmatrix} \mathbf{a} & \mathbf{0} \\ \mathbf{0} & \mathbf{2} \end{bmatrix}$, B = $\begin{bmatrix} \mathbf{0} & \mathbf{-b} \\ \mathbf{1} & \mathbf{0} \end{bmatrix}$, M = $\begin{bmatrix} \mathbf{1} & \mathbf{-1} \\ \mathbf{1} & \mathbf{1} \end{bmatrix}$ & BA = M^2, find values of a & b. [4]

Question 8

a ABC is a right angled triangle. AB = 12 cm, AC = 13 cm. A circle with centre O has been inscribed inside the triangle. Calculate the value of x, the radius of inscribed circle. [3]



b. The diameter of a sphere is 6 cm. It is melted & drawn into a wire of diameter 0.2 cm. Find the length of the wire. [3]

c. Mr. Ram Gopal invested ` 8000 in 7% ` 80. After a year he sold these shares at ` 75 each & invested the proceeding (including his dividend) in 18% ` 25 shares at ` 41. Find:

i) Dividend for first year

ii) Annual income in second year [4]

Question 9

a. During every financial year, the value of a machine depreciates by 12%. Find the original cost of a machine which depreciates by Rs.2640 during second financial year of its purchase. [3]

b. A open cylindrical vessel of internal diameter 7 cm & height 8 cm stands on a table. Inside this is place a solid metallic right circular cone, the diameter of whose base is $3\frac{1}{2}$cm & height = 8 cm. Find volume of water required to fill the vessel. [3]

c. A rectangular tank has length = 4 cm, width = 3 m & capacity = 30 m^3. A small model of tank is made with capacity 240 cm^3. Find:

i) Dimensions of model

ii) Ratio between total surface area of tank and its model. [4]

Question 10

a. Find the value of 'K' if (x – 2) is a factor of $x^3 + 2x^2 – kx + 10$. Hence determine whether (x + 5) is also a factor. [3]

b. A manufacturer sells a washing machine to a wholesaler sells it to a trader at a profit of ` 1500 & trader in turn sells it to a consumer at a profit of ` 1800. If the rate of VAT is 8%, find:

(i) Amount of VAT received by State Government on sale of this machine from manufacturer & the wholesaler.

(ii) the amount the consumer pays for the machine. [3]

c. The mean of following distribution is 62.8 and the sum of all frequencies is 50. Find the missing frequencies f_1& f_2. [4]

Class	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	5	f_1	10	f_2	7	8

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Answer key

Section A

(Attempt all questions of this section)

Question 1

a. What quantity must be added to each term of ratio m + n : m – n to make it equal to (m + n)^2 : (m – n)^2 ? [3]

Solution:

Let 'x' be added to each term of given ratio.

$\therefore$ According to given condition,

$$\frac{m+n+x}{m-n+x} = \frac{(m+n)^2}{(m-n)^2}$$

$$\therefore \frac{m+n+x}{m-n+x} = \frac{m^2+2mn+n^2}{m^2-2mn+n^2}$$

By Dividendo, we get,

$$\frac{m+n+x-(m-n+x)}{m-n+x} = \frac{m^2+2mn+n^2-(m^2-2mn+n^2)}{m^2-2mn+n^2}$$

$$\frac{m+n+x-m+n-x}{m-n+x} = \frac{m^2+2mn+n^2-m^2+2mn-n^2}{m^2-2mn+n^2}$$

$$\frac{2n}{m-n+x} = \frac{4mn}{m^2-2mn+n^2}$$

$$\therefore 2n(m^2-2mn+n^2) = 4mn(m-n+x)$$

$$m^2-2mn+n^2 = 2m(m-n+x)$$

$$\therefore m^2-2mn+n^2 = 2m^2-2mn+2mx$$

$$m^2-2m^2+n^2 = 2mx$$

$$\therefore n^2-m^2 = 2mx$$

$$\therefore x = \frac{n^2-m^2}{2m}$$

Required no. to be added is

$$\therefore x = \frac{n^2-m^2}{2m}$$

b. The catalogue price of a computer set is ` 45000. The shopkeeper gives a discount of 7% on listed price. He gives further off season discount of 4% on balance. However, Sales Tax at 8% is charged on the remaining amount. Find:

(i) Amt. of Sales Tax a customer has to pay.

(ii) Final price he has to pay for computer set. [3]

Solution:

Marked Priced (MP) = ` 45000

Discount d_1 = 7%

d_2 = 4%

Rate of ST = 8%

Sale Price = $MP\left(1+\frac{d_1}{100}\right)\left(1+\frac{d_2}{100}\right)$

$= 45000\left(\frac{1}{1}+\frac{7}{100}\right)\left(\frac{1}{1}+\frac{4}{100}\right)$

$= 45000 \times \frac{93}{100} \times \frac{96}{100}$

= ` 9 × 93 × 48

Sale Price = ` 40,176

i) Sales Tax (`) = $\frac{\text{Rate of ST}}{100} \times SP$

$= \frac{8}{100} \times 40176$

Sales Tax (`) = ` 3214.08

ii) Final price for computer set = SP + Sales Tax

= 40176 + 3214.08

∴ Final Price =` 43390.08

c. If B and C are two matrices such that B = $\begin{bmatrix} 1 & 3 \\ -2 & 0 \end{bmatrix}$ & C = $\begin{bmatrix} 17 & 7 \\ -4 & -8 \end{bmatrix}$. Find the matrix A so that BA = C. **[4]**

Solution:

$B_{2\times2} \cdot A_{m\times n} = C_{2\times2}$

Using the rule for matrix multiplication

p × q ·q× r = p × r

q = 2, r = 2

∴ Order of matrix A = 2 × 2

Let A= $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$

$$BA = C$$

$$\begin{bmatrix} 1 & 3 \\ -2 & 0 \end{bmatrix}\begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} 17 & 7 \\ -4 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 1(a)+3(c) & 1(b)+3(d) \\ -2(a)+0(c) & -2(b)+0(d) \end{bmatrix} = \begin{bmatrix} 17 & 7 \\ -4 & -8 \end{bmatrix}$$

$$\begin{bmatrix} a+3c & b+3d \\ -2a & -2b \end{bmatrix} = \begin{bmatrix} 17 & 7 \\ -4 & -8 \end{bmatrix}$$

Since matrices are equal, their corresponding elements are equal,

a + 3c = 17 … (i)

$b + 3d = 7 \quad \ldots \text{(ii)}$

$-2a = -4$

$\therefore a = 2$

$-2b = -8$

$\therefore b = 4$

Substituting a = 2 in (i)

$a + 3c = 17$

$2 + 3c = 17$

$3c = 17 - 2$

$3c = 15$

$\therefore c = 5$

Substituting b = 4 in (ii)

$b + 3d = 7$

$4 + 3d = 7$

$\therefore 3d = 7 - 4$

$\therefore 3d = 3$

$\therefore d = 1$

$$\therefore A = \begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} 2 & 4 \\ 5 & 1 \end{bmatrix}$$

Question 2

a. Mrs. Suneeta saves `8000 every year & invests it at the end of the year at 10% p.a. CI. Calculate her total savings at the end of third year. [3]

Solution:

For 1st year:

P = ` 0

R = 10% p.a.

T = 1 year

$$I = \frac{P \times R \times T}{100} = \text{` } 0$$

A = P + I + savings

= 0 + 0 + 8000

A = ` 8000

For 2nd year:

P = ` 8000

R = 10% p.a.

T = 1 year

$$I = \frac{P \times R \times T}{100}$$

$$I = \frac{8000 \times 10 \times 1}{100} = \text{`}800$$

A = P + I + savings

$= 8000 + 800 + 8000 = ₹16800$

For 3rd year:

$P = ₹16800$

$R = 10\%$ p.a.

$T = 1$ year

$$I = \frac{P \times R \times T}{100}$$

$$I = \frac{16800 \times 10 \times 1}{100} = ₹1680$$

$A = P + I +$ savings

$= 16800 + 1680 + 8000$

$A = ₹26,480$

b. Evaluate: 3 cos 80° cosec 10° + 2 cos 59° cosec 31°. [3]

Solution:

$3 \cos 80° \cdot \operatorname{cosec} 10° + 2 \cos 59° \cdot \operatorname{cosec} 31°$

$= 3 \sin (90 - 80)° \cdot \operatorname{cosec} 10° + 2 \sin(90 - 59)° \operatorname{cosec} 31°$

$= 3 \sin 10° \cdot \operatorname{cosec} 10° + 2 \sin 31° \cdot \operatorname{cosec} 31°$

$= 3 \times 1 + 2 \times 1$ … $\sin \theta \cdot \operatorname{cosec} \theta = 1$

$= 3 + 2$

$= 5$

c. In Δ PQR, L & M are two points on base QR, such that ∠LPQ = ∠QRP & ∠RPM = ∠RQP. Prove that:

i) ΔPQL ~ Δ RPM

ii) QL × RM = PL × PM

iii) $PQ^2 = QR \times QL$ [2003]

Solution:

Given:

∠LPQ = ∠QRP

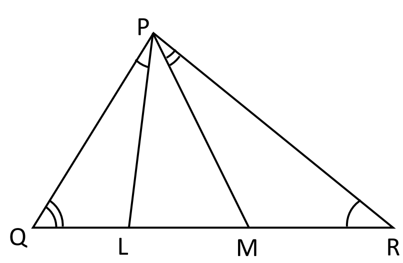
∠RPM = ∠RQP

To prove:

i) ΔPQL ~ ΔRPM

ii) QL × RM = PL × PM

iii) $PQ^2 = QR \times QL$



Proof:

	Statement	Reason
1)	In Δ PQL & ΔRPM, ∠PQL = ∠RPM ∠LPQ = ∠MRP	 Given Given
2)	ΔPQL ~ ΔRPM	By AA axiom of similarity

3)	$\frac{QM}{PM} = \frac{PL}{RM}$ $\therefore$ QL × RM = PL × PM	c.s.s.t.p.
4)	In ΔPQL &ΔRQP, ∠PQL = ∠RQP ∠LPQ = ∠PRQ	 Common angle Given
5)	ΔPQL ~ ΔRQP	By AA axiom of similarity
6)	$\frac{PQ}{RQ} = \frac{QL}{QP}$ $\therefore$ PQ ×PQ = QR × QL $\therefore$ $(PQ)^2$ = QR × QL	c.s.s.t.p. hence proved

Question 3

a. A company with 4000 shares of nominal value of ` 110 each declare an annual dividend of 15%. Calculate

i) Total amount of dividend

ii) Annual income of a person who holds 88 shares in the company.

iii) If he received only 10% on his investment, find the price for each share. [3]

Solution:

Face Value (FV) = ` 110

Rate of dividend = 15%

No. of shares = 4000

Return % = 10%

i) $\text{Dividend} = \begin{pmatrix}\text{Rate of}\\ \text{dividend}\end{pmatrix} \times \text{FV} \times \begin{pmatrix}\text{No. of}\\ \text{Shares}\end{pmatrix}$

$$= \frac{15}{100} \times 100 \times 4000$$

Dividend = ` 66000

ii) No. of shares = 88

$\text{Dividend} = \begin{pmatrix}\text{Rate of}\\ \text{dividend}\end{pmatrix} \times \text{FV} \times \begin{pmatrix}\text{No. of}\\ \text{Shares}\end{pmatrix}$

$$= \frac{15}{100} \times 110 \times 88$$

= 33 × 44

Dividend = ` 1452

iii) Return% × MV = Dividend% × FV

$$\frac{10}{100} \times \text{MV} = \frac{15}{100} \times 100$$

$$\text{MV} = \frac{15}{100} \times 110 \times \frac{100}{10}$$

MV = ` 165

b. The marks of 20 students in a test were as follows:
2, 6, 8, 9, 10, 11, 11, 12, 13, 13, 14, 14, 15, 15, 15, 16, 16, 18, 19 & 20.
Calculate: (i)the mean, (ii) the median, (iii) the mode [3]

Solution:

i) $\sum x$ = 2 + 6 + 8 + 9 + 10 + 11 + 11 + 12 + 13 + 13 + 14 + 14 + 15 + 15 + 15 + 16 + 16 + 18 + 19 + 20.

$$\sum x = 257$$

$$n = 20$$

$$\text{Mean} = \frac{\sum x}{n}$$

$$= \frac{257}{20}$$

Mean = $\underline{12.85}$

ii) N = 20 (even)

$$\text{Median} = \frac{\left(\frac{n}{2}\right)^{th}\text{term} + \left(\frac{n}{2}+1\right)^{th}\text{term}}{2}$$

$$= \frac{\left(\frac{20}{2}\right)^{th}\text{term} + \left(\frac{20}{2}+1\right)^{th}\text{term}}{2}$$

$$= \frac{10^{th}\text{term} + 11^{th}\text{term}}{2}$$

$$= \frac{13+14}{2}$$

$$= \frac{27}{2}$$

Median = $\underline{13.5}$

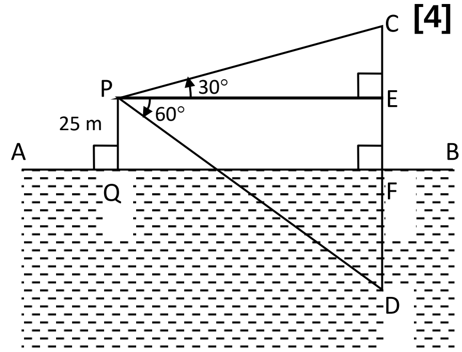
iii) No. with highest frequency = 15

$\therefore$ Mode = 15

c. The angle of elevation of a stationary cloud from a point 25 m above a lake is 30°& the angle of depression of its reflection in lake is 60°. What is the height of cloud above that lake-level? [4]

Solution:

AB = Lake level
PQ = 25 m
C = Stationary cloud
D = Image of cloud



$\angle CPE = 30°$ (Angle of elevation of S. claud)

$\angle DPE = 60°$ (Angle of depression of its reflection)

From figure, ☐PQFB is a rectangle

$$\left.\begin{aligned} PQ &= EF = 25 \text{ m} \\ PE &= QF \end{aligned}\right\} \text{Opp. sides of rectangle are equal}$$

Also, CF = DF (Laws of reflection)

In right Δ CEP,

$$\tan 30° = \frac{\text{Opp.}}{\text{Adj.}}$$

$$\frac{1}{\sqrt{3}} = \frac{CE}{PE}$$

$$PE = \sqrt{3} \cdot CE$$

In right Δ DEP,

$$\tan 60° = \frac{\text{Opp.}}{\text{Adj.}}$$

$$\sqrt{3} = \frac{ED}{PE}$$

$$PE = \frac{ED}{\sqrt{3}}$$

$$\therefore \sqrt{3} \cdot CE = \frac{ED}{\sqrt{3}}$$

$\therefore ED = 3CE$

$\therefore EF + DF = 3[CF – EF]$ … (C–E–F) & (E–F–D)

$\therefore 25 + CF = 3CF – 3 \times 25$ … (DF = CF)

$\therefore 25 + CF = 3CF – 75$

$100 = 2CF$

$\therefore CF = 50$ m

Ans.: Height of cloud above lake level = 50 m.

Question 4

a. Given A = {x : –1 < x ≤ 5, x ∈ R}

B = {x : –4 ≤ x < 3, x ∈ R}

Represent on different number lines:

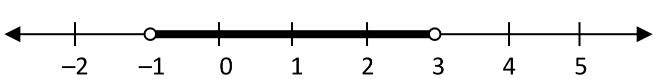
(i) A ∩ B (ii) A’ ∩ B (iii) A – B **[3]**

Solution:

i) For A ∩ B:

S.S. = {x : –1 < x < 3, x ∈ R}

The graph of A ∩ B is:



ii) For A'∩ B = B – A:

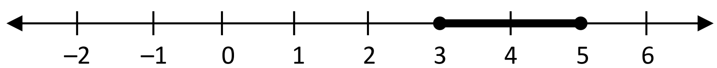
S.S. = {x : –4 ≤ x ≤ –1, x ∈ R}

The graph of A' ∩ B is:

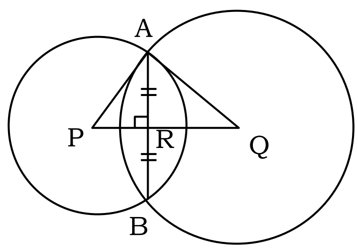
iii) For A – B:

S.S. = {x :3 ≤ x ≤5, x ∈ R}

The graph of (A – B) is:



b. The length of common chord of two intersecting circles is 30 cm. If the diameters of these two circles be 50 cm & 34 cm. Calculate the distance between their centers. [3]



Solution:

Statement	**Reason**
1) PQ ⊥ AB	Line joining centres bisects the common chord Perpendicularly.
2) $\mathrm{AR} = \frac{1}{2}\,\mathrm{AB} = \frac{1}{2} \times 30$	from (1),substitution.
	$\therefore \mathrm{AR} = 15\mathrm{cm}$
3) $\mathrm{AP} = \frac{1}{2}(34) = 17\mathrm{cm}$	$\mathrm{r} = \frac{\mathrm{d}}{2}$ & *given*
$\mathrm{AQ} = \frac{1}{2}(50) = 25$ cm	
4) In rtΔ ARP,	
$(\mathrm{AP})^2 = (\mathrm{AR})^2 + (\mathrm{PR})^2$	Pythagoras theorem
	$\therefore (\mathrm{PR})^2 = (\mathrm{AP})^2 - (\mathrm{AR})^2$
$= (17)^2 - (15)^2$	from 2 & 3
$= 289 - 225 = 64$	Taking sq. root on.both sides
$\underline{\mathrm{PR} = 8\mathrm{cm}}$	

5) In rtΔARQ,

$(\mathrm{AQ})^2 = (\mathrm{AR})^2 + (\mathrm{RQ})^2$ Pythagoras theorem

$(RQ)^2 = (AQ)^2 - (AR)^2$

$= (25)^2 - (15)^2$ from 2 & 3

$= 625 - 225$

$(RQ)^2 = 400$

Taking sq. root on both sides P – R – Q

$RQ = 20\text{cm}$

6) PQ = PR + RQ P – R – Q

$= 8 + 20$

$\therefore \underline{PQ = 28 \text{ cm}}$

c. Mr. Bhalu has a Savings Bank Account in Punjab National Bank. His pass book has following entries:

Date 1997	**Particulars**	**Debit (`)**	**Credit (`)**	**Balance (`)**
April 1	B/F	-	-	3220.00
April 15	By.T.	-	2010.00	5230.00
May 8	To Cheque	298.00	-	4932.00
July 15	By Clearing	-	4628.00	9560.00
July 29	By Cash	-	5440.00	15000.00
Sep. 10	To Self	-	6980.00	8020.00
Jan. 10 (1998)	By Cash	-	8000.00	16020.00

Calculate the interest due to him at the end of 31st March 1998 at the rate of 6% p.a. [4]

Solution:

Qualifying amount for various months:

Month	**Principal**
April, 1997	3220.00
May	4932.00
June	4932.00
July	4932.00
August	15000.00
September	8020.00
October	8020.00
November	8020.00
December	8020.00
January, 1998	16020.00
February	16020.00
March	+ 16020.00

Month	Principal
Total	**` 113156.00**

For Interest:

Principal (P) = ` 113156.00

Rate (R) = 6% p.a.

Time (T) = $\frac{1}{12}$ yr.

$$I = \frac{P \times R \times T}{100}$$

$$= \frac{113156 \times 6 \times 1}{100 \times 12}$$

$$= \frac{56578}{100}$$

$\therefore$ I = ` 565.78

Section B

(Attempt any four questions of this section)

Question 5

a. The marks obtained by 120 students in a mathematics test are given below:

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of students	5	9	16	22	26	18	11	6	4	3

Use Ogive to estimate

i) Median

ii) No. of students who scored more than 75% marks in a test

iii) The no. of students who did not pass in test if the pass percentage was 40

iv) The lower quartile **[6]**

Solution:

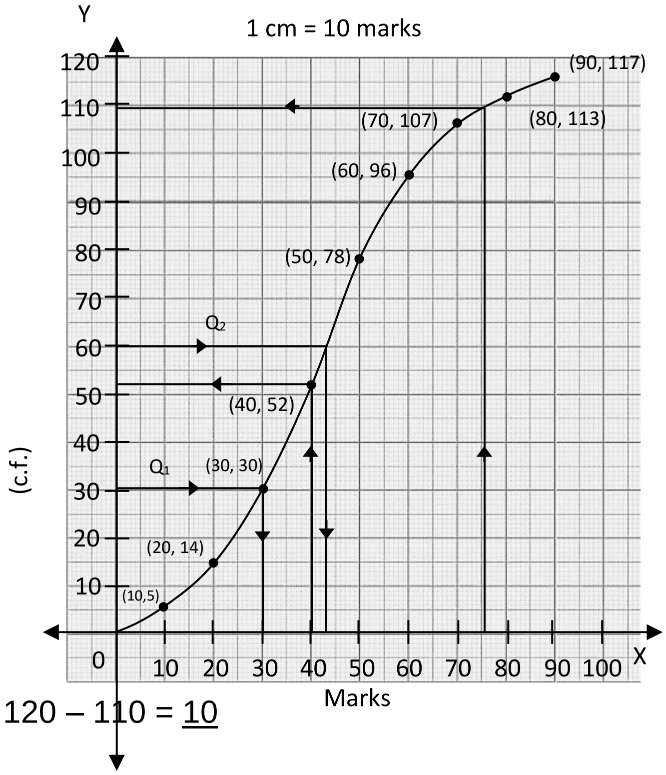
Marks	No. of Students f	Cumulative frequency c.f.	(x, y)
0-10	5	5	(10, 5)
10-20	9	5 + 9 = 14	(20, 14)
20-30	16	14 + 16 = 30	(30, 30)
30-40	22	30 + 22 = 52	(40, 52)

40-50	26	52 + 26 = 78	(50, 78)
50-60	18	78 + 18 = 96	(60, 96)
60-70	11	96 + 11 = 107	(70, 107)
70-80	6	107 + 6 = 113	(80, 113)
80-90	4	113 + 4 = 117	(90, 117)
90-100	3	117 + 3 = 120	(100, 120)

Scale:

On X-axis

1 cm = 10 marks



i) $N = 120$ (even)

$$\text{Median} = \left(\frac{N}{2}\right)^{th} \text{term}$$

$$= \left(\frac{120}{2}\right)^{th} \text{term}$$

$$= 60^{th} \text{ term}$$

$$\text{Median} = \underline{43}$$

ii) No. of students scoring more than 75% marks = 120 – 110 = <u>10</u>

iii) No. of students who did not pass = <u>52</u>

iv) $$\text{Lower Quartile } (Q_1) = \left(\frac{N}{4}\right)^{th} \text{term}$$

$$= \left(\frac{120}{4}\right)^{th} \text{term}$$

$$= 30^{th} \text{ term}$$

$$Q_1 = \underline{30}$$

b. **If $x = \dfrac{6ab}{a+b}$, find the value of: $\dfrac{x+3a}{x-3a} + \dfrac{x+3b}{x-3b}$.** **[4]**

Solution:

$$x = \frac{6ab}{a+b} \qquad \text{… given}$$

$$\therefore \frac{x}{3a} = \frac{2b}{a+b}$$

By Componendo-Dividendo, we get,

$$\frac{x+3a}{x-3a} = \frac{2b+a+b}{2b-a-b}$$

$$\therefore \frac{x+3a}{x-3a} = \frac{3b+a}{b-a} \qquad \text{… (i)}$$

$$x = \frac{6ab}{a+b} \qquad \text{… given}$$

$$\frac{x}{3b} = \frac{2a}{a+b}$$

By Componendo-Dividendo, we get,

$$\frac{x+3b}{x-3b} = \frac{2a+a+b}{2a-a-b}$$

$$\therefore \frac{x+3b}{x-3b} = \frac{3a+b}{a-b} \qquad \ldots \text{(ii)}$$

Add (i) & (ii), we get,

$$\frac{x+3a}{x-3a} + \frac{x+3b}{x-3b} = \frac{3b+a}{b-a} + \frac{3a+b}{a-b}$$

$$= \frac{3b+a}{b-a} - \frac{3a+b}{a-b}$$

$$= \frac{3b+a-3a-b}{b-a}$$

$$= \frac{2b-2a}{b-a}$$

$$= \frac{2(b-a)}{(b-a)}$$

$$\frac{x+3a}{x-3a} + \frac{x+3b}{x-3b} = 2$$

Question 6

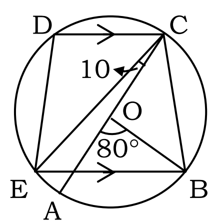
a. **In the given figure, AC is diameter CD & BE are parallel.** $\angle \mathbf{AOB} = \mathbf{80}^\circ$**,** $\angle \mathbf{ACE} = \mathbf{10}^\circ$**.**

Calculate:

i) $\angle \mathbf{BEC}$

ii) $\angle \mathbf{BCD}$

iii) $\angle \mathbf{CED}$



[3]

Solution:

Statement	**Reason**
1) $\angle AOB + \angle BOC = 180^\circ$	Linear pair
2) $80^\circ + \angle BOC = 180^\circ$	Substitution.
	$\angle BOC = 100^\circ$
3) $\angle BEC = \frac{1}{2}\angle BOC$	Central □s is twice the angle at remaining circumference.
□ $\angle BEC = \frac{1}{2} \times 100^\circ = 50^\circ$	
4) $\angle DCE = \angle BEC$	alternate□s.
$\therefore \angle DCE = 50^\circ$	
5) $\angle ACB = \frac{1}{2}\angle AOB$	Central □s is twice are angle at remaining circumference.

$\angle ACB = \frac{1}{2} \times 80^\circ = 40^\circ$

6) $\angle BCD = \angle DCE + \angle ACE + \angle ACB$ Angle additionProp.

$\angle BCD = 50^\circ + 10^\circ + 40^\circ$

$\boxed{\angle BCD = 100^\circ}$

7) $\angle BCD + \angle BED = 180^\circ$ Opp □s of angle □ are suppl.

8) $\angle BCD + \angle BEC + \angle CED = 180^\circ$ Angle add P.

$100^\circ + 50^\circ + \angle CED = 180^\circ$ From 3 & 6.

$\boxed{\angle CED = 30^\circ}$

b. The ratio of base area and curved surface area of a conical tent is 40: 41. If its height is 18 m. Find the air capacity of tent in terms of π. [3]

Solution:

For conical tent:

Height (h) = 18 m

According to given condition,

$$\frac{\text{Area of base}}{\text{Curved surface area}} = \frac{40}{41}$$

$$\frac{\pi r^2}{\pi r l} = \frac{40}{41}$$

$r : l = 40 : 41$

Let the common multiple be x.

radius (r) = $40x$;

slant height(l) = $41x$

$l^2 = h^2 + r^2$ … Pythagoras theorem

$(41x)^2 = (18)^2 + (40x)^2$

$1681x^2 = 324 + 1600x^2$

$\therefore 1681x^2 - 1600x^2 = 324$

$81x^2 = 324$

$x^2 = \frac{324}{81} = 4$ … Taking square root on both sides

$x = 2$

$r = 40x = 40 \times 2 = 80$ cm

Air capacity of tent = Volume of cone

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

$= \frac{1}{3}\pi (80)^2 \times 18$

$\therefore$ Air capacity of tent = $\underline{38400 \text{ m}^3}$

c. Mr. Batliwala has a R.D. Account of Rs. 300 per month. If the rate of interest is 12% & the maturity value is Rs. 8100. Find the time (in yrs.) of this R.D. Account. [4]

Solution:

Monthly Installment = ` 300

Let No. of months be 'n'.

Equivalent Principal for 1 month

$$(P) = MI \times \frac{n(n+1)}{2}$$

$$= 300 \times \frac{n(n+1)}{2}$$

$$\therefore P = 150\,n(n+1)$$

Rate (R) = 12% p.a.

$$\text{Time (T)} = \frac{1}{12} \text{ yr.}$$

$$I = \frac{P \times R \times T}{100}$$

$$= \frac{150\,n(n+1) \times 12 \times 1}{100 \times 12}$$

$$I = \frac{5n(n+1)}{10}$$

Actual deposit = MI × n

= 300 × n

= `300n

$$\text{Maturity Value} = \begin{pmatrix}\text{Actual} \\ \text{deposit}\end{pmatrix} + \text{Interest}$$

$$\therefore 8100 = 300n + \frac{15n(n+1)}{10}$$

$$8100 = \frac{600n + 3n^2 + 3n}{2}$$

$$\therefore 3n^2 + 603n = 16200$$

Divide each term by 3, we get,

$$n^2 + 201n - 5400 = 0$$

$$n^2 + 225n - 24n - 5400 = 0$$

$$n(n + 225) - 24(n + 225) = 0$$

$$(n + 225)(n - 24) = 0$$

… (Factorizing left side)

$$n + 225 - 0 = 0$$

or $n - 24 = 0$

… (Zero product rule)

$$n = -225$$

or $n = 24$

'n' cannot be negative

$\therefore$ n = 24 months

$\therefore$ Time = $\frac{24}{12}$ = 2 yrs.

Question 7

a. **Show that 2x + 7 is a factor of $2x^3 + 5x^2 - 11x - 14$. Hence factorize the given expression completely, using factor theorem.** **[3]**

Solution:

$f(x) = 2x^3 + 5x^2 - 11x - 14$

By remainder theorem, when f(x) is divided by (2x + 7),

the remainder is $f\left(-\frac{7}{2}\right)$

$$f\left(-\frac{7}{2}\right) = 2\left(-\frac{7}{2}\right)^3 + 5\left(-\frac{7}{2}\right)^2 - 11\left(-\frac{7}{2}\right) - 14$$

$$f\left(-\frac{7}{2}\right) = 2\left(\frac{-343}{8}\right) + 5\left(\frac{49}{4}\right) + \frac{77}{2} - \frac{14}{1}$$

$$f\left(-\frac{7}{2}\right) = -\frac{343}{4} + \frac{245}{4} + \frac{77}{2} - \frac{14}{1}$$

$$f\left(-\frac{7}{2}\right) = \frac{-343 + 245 + 154 - 56}{4}$$

$$f\left(-\frac{7}{2}\right) = \frac{-399 + 399}{4}$$

$$f\left(-\frac{7}{2}\right) = \frac{0}{4} = 0$$

By factor theorem, $\because f\left(-\frac{7}{2}\right) = 0$

(2x + 7) is a factor of f(x).

For other factors:

$$
\begin{array}{r|l}
 & \quad x^2 - x - 2 \\
\hline
2x+7 & \quad 2x^3 + 5x^2 - 11x - 14 \\
 & - \quad 2x^3 + 7x^2 \\
 & \quad (-) \quad (-) \\
\hline
 & \qquad\quad -2x^2 - 11x - 14 \\
 & \quad - \qquad -2x^2 - 7x \\
 & \qquad\quad (+) \quad (+) \\
\hline
 & \qquad\qquad\quad -4x - 14 \\
 & \qquad\quad - \qquad -4x - 14 \\
 & \qquad\qquad\quad (+) \quad (+) \\
\hline
 & \qquad\qquad\qquad x
\end{array}
$$

$$
\begin{aligned}
f(x) &= 2x^3 + 5x^2 - 11x - 14 \\
f(x) &= (2x + 7)(x^2 - x - 2) \\
&= (2x + 7)(x^2 - 2x + x - 2) \\
&= (2x + 7)[x(x - 2) + 1(x - 2)] \\
\therefore f(x) &= (2x + 7)(x - 2)(x + 1)
\end{aligned}
$$

b. Prove that: $(\sin A + \operatorname{cosec} A)^2 + (\cos A + \sec A)^2 = 7 + \tan^2 A + \cot^2 A$. [3]

Solution:

$$
\begin{aligned}
\text{L.H.S.} &= (\sin A + \operatorname{cosec} A)^2 + (\cos A + \sec A)^2 \\
&= \sin^2 A + 2 \sin A \cdot \operatorname{cosec} A + \operatorname{cosec}^2 A + \cos^2 A + 2 \cos A \cdot \sec A + \sec^2 A \\
& \qquad \ldots (a + b)^2 = a^2 + 2ab + b^2 \\
&= \sin^2 A + \operatorname{cosec}^2 A + 2 + \cos^2 A + 2 + \sec^2 A \\
& \qquad \ldots \sin\theta \times \operatorname{cosec}\theta = 1 \ \& \ \sec\theta \times \cos\theta = 1 \\
&= 1 + \operatorname{cosec}^2 A + 2 + 2 + \sec^2 A \ldots \sin^2\theta + \cos^2\theta = 1 \\
&= 5 + 1 + \cot^2 A + 1 + \tan^2 A \qquad \ldots \operatorname{cosec}^2\theta = 1 + \cot^2\theta \ \& \ \sec^2\theta = 1 + \tan^2\theta \\
&= 7 + \tan^2 A + \cot^2 A \\
\therefore \text{L.H.S.} &= \text{R.H.S.} \qquad \ldots \text{hence proved.}
\end{aligned}
$$

c. If $A = \begin{bmatrix} a & 0 \\ 0 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 0 & -b \\ 1 & 0 \end{bmatrix}$, $M = \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}$ & $BA = M^2$, find values of a & b. [4]

Solution:

$$
\begin{aligned}
BA &= M^2 \qquad \ldots \text{given} \\
BA &= M \cdot M
\end{aligned}
$$

$$
\begin{bmatrix} 0 & -b \\ 1 & 0 \end{bmatrix}\begin{bmatrix} a & 0 \\ 0 & 2 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}\begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}
$$

$$\begin{bmatrix} 0(a)+b(0) & 0(0)+b(2) \\ 1(a)+0(0) & 1(0)+0(2) \end{bmatrix} = \begin{bmatrix} 1(1)+(-1)1 & 1(-1)+(-1)1 \\ 1(1)+(1)(1) & 1(-1)+1(1) \end{bmatrix}$$

$$\begin{bmatrix} 0 & -2b \\ a & 0 \end{bmatrix} = \begin{bmatrix} 0 & -2 \\ 2 & 0 \end{bmatrix}$$

Since the matrices are equal, their corresponding elements are also equal.

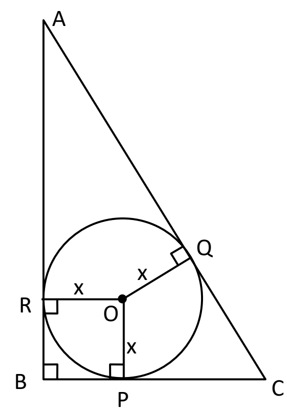
$-2b = -2$ & $a = 2$

$\therefore b = 1$

Ans.: a = 2, b = 1

Question 8

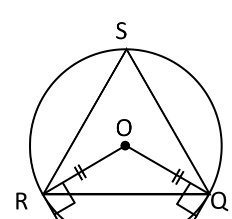
a ABC is a right angled triangle. AB = 12 cm, AC = 13 cm. A circle with centre O has been inscribed inside the triangle. Calculate the value of x, the radius of inscribed circle. [3]



Solution:

	Statement		**Reason**
1)	OP = OR = OQ = x	…	Radii of same circle
2)	□OPBR is a square	…	∵ Each Angle is 90°& Adjacent sides are equal
3)	∴ OP = BP = BR = x	…	from (1)&(2)
4)	In right ΔABC,	…	Pythagoras theorem
	$(AC)^2 = (AB)^2 + (BC)^2$	…	Substitution
	$(13)^2 = (12)^2 + (BC)^2$		
	$(BC)^2 = 169 - 144$		
	$BC^2 = 25$	…	Taking square root on both sides
	BC = <u>5 cm</u>		
5)	AR = AQ	…	Tangents from ext. point are equal
6)	AQ = AB – BR	…	A–R–B
	AQ = <u>(12 – x)</u>	…	from 3 & given
7)	CP = CQ	…	Tangents from exterior point are equal
8)	CQ = BC – BP	…	B–P–C
	CQ = <u>(5 –x)</u>		
9)	AC = AB + QC	…	A–Q–C
	13 = 12 – x + 5 – x	…	from (6)& (8)
	13 = 17 – 2x		
	2x = 4		
	x = <u>2 cm</u>		

Radius = <u>x = 2 cm</u>



b. **The diameter of a sphere is 6 cm. It is melted & drawn into a wire of diameter 0.2 cm. Find the length of the wire.**

Solution:

For sphere:

Diameter = 6 cm

Radius (r_s) = $\frac{6}{2}$ = 3 cm

For cylindrical wire:

Diameter = 0.2 cm

Radius = $\frac{0.2}{2}$ = $\underline{0.1 \text{ cm}}$

Length = Height = ?

According to given condition,

$$\frac{4}{3}\pi r_s^3 = \pi r^2 h$$

$$\therefore \frac{4}{3} \times (3)^2 = (0.1)^2 \times h$$

$$h = \frac{4 \times 9}{0.1 \times 0.1} = \frac{36}{0.01} = 3600 \text{ cm} = 36 \text{ cm}$$

$\therefore$ Length of wire = $\underline{36 \text{ m}}$

c. **Mr. Ram Gopal invested ` 8000 in 7% ` 80. After a year he sold these shares at ` 75 each & invested the proceeding (including his dividend) in 18% ` 25 shares at ` 41. Find:**

i) Dividend for first year

ii) Annual income in second year

iii) Percentage increases in his return on his original investment. **[4]**

Solution:

For first year:

Investment = ` 8000

Face Value (FV) = ` 100

Market Value (MV) = ` 80

Rate of dividend = 7%

i) No. of shares = $\frac{\text{Investment}}{\text{MV}}$

$= \frac{8000}{80}$

= 100 shares

$$\text{Dividend} = \begin{pmatrix}\text{Rate of} \\ \text{dividend}\end{pmatrix} \times \text{FV} \times \begin{pmatrix}\text{No. of} \\ \text{Shares}\end{pmatrix}$$

$$= \frac{7}{100} \times 100 \times 100$$

Dividend = ` 700 -------------- 1m

For Second Year:

SP of 1 share = ` 75

SP of 100 shares = ` 7500

Sale Proceeds = ` 7500

Investment = Sale Proceed + Dividend

= 7500 + 700

= ` 8200 --------------------- 1m

Face Value (FV) = ` 25

Market Value (MV) = ` 41

Rate of dividend = 18%

ii) No. of shares = $\dfrac{\text{Investment}}{\text{MV}}$

$= \dfrac{8200}{41} = 200$

Dividend = $\begin{pmatrix}\text{Rate of}\\ \text{dividend}\end{pmatrix} \times \text{FV} \times \begin{pmatrix}\text{No. of}\\ \text{Shares}\end{pmatrix}$

$= \dfrac{18}{100} \times 25 \times 200$

Dividend = ` 900 ------------------------------1m

iii) Increase in Income

$= \begin{pmatrix}\text{Dividend}\\ \text{in } 2^{\text{nd}} \text{ year}\end{pmatrix} - \begin{pmatrix}\text{Divide}\\ \text{in } 1^{\text{st}} \text{ year}\end{pmatrix}$

= 900 – 700

= ` 200

Percentage Increase $= \dfrac{\text{Increase}}{\text{Original Inv.}} \times 100$

$= \dfrac{200}{8000} \times 100$

Percentage Increase = 2.5 % --------------------1m

Question 9

a. During every financial year, the value of a machine depreciates by 12%. Find the original cost of a machine which depreciates by Rs.2640 during second financial year of its purchase. [3]

Solution:

For 1st year:

Principal (P) = ` P … (assumption)

Rate (R) = 12% p.a.

Time (T) = 1 year

$I = \dfrac{P \times R \times T}{100}$

$= \dfrac{P \times 12 \times 1}{100}$

I = ` $\dfrac{12P}{100}$

A = P + I … ($\because$ depreciation)

A = P − $\dfrac{12P}{100}$ = ` $\dfrac{88P}{100}$

For 2nd year:

P = ` $\dfrac{88P}{100}$

R = 12% p.a.

T = 1 year

I = $\dfrac{P \times R \times T}{100}$

2640 = $\dfrac{88P \times 12 \times 1}{100 \times 100}$

$\therefore$ P = $\dfrac{2640 \times 100 \times 100}{88 \times 12}$

$\therefore$ P = ` 2500

Ans.: The original cost of a machine
= ` 25000.

b. A open cylindrical vessel of internal diameter 7 cm & height 8 cm stands on a table. Inside this is place a solid metallic right circular cone, the diameter of whose base is $3\frac{1}{2}$ cm & height = 8 cm. Find volume of water required to fill the vessel. [3]

Solution:

For cylindrical vessel,

Diameter = 7 cm

Radius (r) = $\dfrac{7}{2}$ cm

Height (h) = 8 cm

For solid metallic cone,

Diameter = $\dfrac{7}{2}$ cm

Radius (r_c) = $\dfrac{7}{4}$ cm

Height (h) = 8 cm … same as cylindrical vessel

According to given condition,

$$\begin{pmatrix}\text{Volume of water} \\ \text{to fill the vessel}\end{pmatrix} = \begin{pmatrix}\text{volume of} \\ \text{cylindrical vessel}\end{pmatrix} - \begin{pmatrix}\text{Volume of} \\ \text{solid cone}\end{pmatrix}$$

$$= \pi r^2 h - \frac{1}{3}\pi r_c^2 h$$

$$= \pi h\left[r^2 - \frac{1}{3}r_c^2\right]$$

$$= \frac{22}{7}\times 8\left[\left(\frac{7}{2}\right)^2 - \frac{1}{3}\times\left(\frac{7}{4}\right)^2\right]$$

$$= \frac{22}{7}\times 8\left[\frac{49}{4} - \left(\frac{1}{3}\times\frac{49}{16}\right)\right]$$

$$= \left[\frac{49}{4} - \frac{49}{48}\right]$$

$$= \left[\frac{588 - 49}{48}\right]$$

$$= \frac{22}{7}\times 8\_\ \ \_\times\frac{539}{48}$$

$$= \frac{847}{3} = 282.33$$

Volume of water $= \underline{282.33\ \text{cm}^3}$

c. A rectangular tank has length = 4 cm, width = 3 m & capacity = 30 m^3. A small model of tank is made with capacity 240 cm^3. Find:

i) Dimensions of model

ii) Ratio between total surface area of tank and its model. [4]

Solution:

For rectangular tank,

Capacity = Vol. of cuboids

$30 = l \times b \times h$

$\therefore h = \frac{30}{4\times 3} = 2.5$ cm

* $\frac{\text{Volume of model}}{\text{Volume of tank}} = k^3$

$\therefore \frac{240\ \text{cm}^3}{30\ \text{m}^3} = k^3$

$$k^3 = \frac{240\ \text{cm}^3}{30\times 100\times 100\times 100\ \text{cm}^3}$$

Taking cube root on both sides

$k = \frac{2}{100}$

$k = \frac{1}{50}$

i) $\dfrac{\text{length of model}}{\text{length of tank}} = k$

$\text{length of model} = \dfrac{1}{50} \times 4 \text{ m}$

$\text{length of model} = \dfrac{1}{50} \times 400 \text{ cm} = 8 \text{ cm}$

$\dfrac{\text{breadth of model}}{\text{breadth of tank}} = k$

$\therefore \text{breadth of model} = \dfrac{1}{50} \times 3 \text{ cm}$

$= \dfrac{1}{50} \times 300 \text{ cm}$

$\therefore \text{breadth of model} = 6 \text{ cm}$

$\dfrac{\text{Height of model}}{\text{Height of tank}} = k$

$\text{Height of model} = \dfrac{1}{50} \times 2.5 \text{ m}$

$= \dfrac{1}{50} \times 250 \text{ cm}$

$\text{Height of model} = 5 \text{ cm}$

ii) $\dfrac{\text{Total surface area of model}}{\text{T.S.Area of tank}} = k^2$

$= \left(\dfrac{1}{50}\right)^2$

$= \dfrac{1}{2500}$

$\therefore$ TSA of tank : TSA of model $=$ 2500 : 1

Question 10

a. Find the value of 'K' if (x – 2) is a factor of $x^3 + 2x^2 - kx + 10$. Hence determine whether (x + 5) is also a factor. [3]

Solution:

$f(x) = x^3 + 2x^2 - kx + 10$

By remainder theorem,

when f(x) is divided by (x – 2), the remainder is f(2).

$f(2) = (2)^3 + 2(2)^2 - k(2) + 10$

$= 8 + 8 - 2k + 10$

$f(2) = 26 - 2k$ … (i)

(x – 2) is a factor of f(x) … given

$\therefore$from (i) & (ii)

$26 - 2k = 0$

$\therefore 2k = 26$

$\therefore k = 13$

$\therefore f(x) = x^3 + 2x^2 - 13x + 10$

By remainder theorem, when f(x) is divided by (x + 5), the remainder is f(–5).

$$\therefore f(-5) = (-5)^3 + 2(-5)^2 - 13(-5) + 10$$
$$= -125 + 50 + 65 + 10$$
$$= -125 + 125$$
$$f(-5) = 0$$

By factor theorem $\because f(-5) = 0$

(x + 5) is a factor of f(x).

b. A manufacturer sells a washing machine to a wholesaler sells it to a trader at a profit of ` 1500 & trader in turn sells it to a consumer at a profit of ` 1800. If the rate of VAT is 8%, find:

(i) Amount of VAT received by State Government on sale of this machine from manufacturer & the wholesaler.

(ii) the amount the consumer pays for the machine. [3]

Solution:

For manufacturer:

i) SP = ` 15000

Rate of VAT = 8%

Tax received from manufacturer

= 8% of 15000

$= \frac{8}{100} \times 15000$

= ` 1200

$\therefore$ VAT received by govt. from manufacture = ` 1200.

For wholesaler:

Profit = ` 1200

Rate of VAT = 8%

Tax received from wholesaler

= 8% of 12000

$= \frac{8}{100} \times 12000$

= ` 96

$\therefore$ VHT received by govt. from wholesaler = ` 96

ii) Total SP = 15000 + 1200 + 1800

= ` 18000

Rate of ST = 8%

Amt. paid = ?

$$\text{Amt. paid} = SP\left(1 + \frac{\text{Rate of ST}}{100}\right)$$
$$= 18000\left(1 + \frac{8}{100}\right)$$
$$= 18000\left(\frac{108}{100}\right)$$

$\therefore$ Amt. paid by customer = ` 19440

c. The mean of following distribution is 62.8 and the sum of all frequencies is 50. Find the missing frequencies f_1& f_2. **[4]**

Class	**0-20**	**20-40**	**40-60**	**60-80**	**80-100**	**100-120**
Frequency	**5**	**f_1**	**10**	**f_2**	**7**	**8**

Solution:

Class	**frequency**		**f × x**
	x	**f**	
0-20	10	5	50
20-40	30	f_1	$30f_1$
40-60	50	10	500
60-80	70	f_2	$70f_2$
80-100	90	7	630
100-120	110	+ 8	+ 880
		$\sum f = 30 + f_1 + f_2$	$\sum fx = 2060 + 30f_1 + 70f_2$

$$\text{Now, Mean} = \frac{\sum fx}{\sum f}$$

$$\therefore 62.8 = \frac{2060 + 30f_1 + 70f_2}{50}$$

$$62.8 \times 50 = 2060 + 30f_1 + 70f_2$$

$$3140 - 2060 = 30f_1 + 70f_2$$

$$\therefore 30f_1 + 70f_2 = 1080$$

$$\therefore 3f_1 + 7f_2 = 108 \quad \dots \text{(i)}$$

$$\text{Also, } 30 + f_1 + f_2 = 50$$

$$f_1 + f_2 = 20 \quad \dots \text{(ii)}$$

Multiplying equation (ii) by 3,

$$3f_1 + 3f_2 = 60$$

$$-3f_1 + 7f_2 = 108$$

$$\underline{(-) \quad (-)(-)}$$

$$-4f_2 = -48$$

$$\therefore f_2 = \frac{48}{4}$$

$$\therefore f_2 = 12$$

Substitute f_2 in equation (ii),

$$f_1 + f_2 = 20$$

$$f_1 + 12 = 20$$

$$f_1 = 20 - 12$$

$$f_1 = 8$$

Ans.: $f_1 = \underline{8}$; $f_2 = \underline{12}$

****