MATHEMATICS

Time allowed : 3 hours ***Maximum Marks : 100***

GENERAL INSTRUCTIONS :

(i) All questions are compulsory.

*(ii) The question paper consists of **25** questions divided into three sections — A, B and C. Section **A** contains **10** questions of **3** marks each, Section B is of **10** questions of **4** marks each and Section C is of **5** questions of **6** marks each.*

(iii) There is no overall choice. However, an internal choice has been provided in two questions of three marks each, two questions of four marks each and two questions of six marks each.

(iv) In question on construction, the drawing should be neat and exactly as per the given measurements.

(v) Use of calculators is not permitted.

QUESTION PAPER CODE 30/1/1

SECTION - A

Question numbers 1 to 10 carry three marks each.

1. Express the following as a rational expression in lowest terms :

$$\frac{x^3-8}{x^2-4}\times\frac{x^2+6x+8}{x^2-2x+1}\div\frac{x^2+2x+4}{x^2+2x-3}$$

2. Find 10th term from end of the A.P. 4, 9, 14, ..., 254.

3. Solve the following system of linear equations :

$$ax+by=a-b$$

4. Find the L.C.M. of the following polynomials :

5. Solve for x :

$$\frac{1}{a+b+x}=\frac{1}{a}+\frac{1}{b}+\frac{1}{x}\ ;\ a\neq 0, b\neq 0, x\neq 0$$

Or

Solve for x :

$a\,bx^2 + (b^2 - ac)x - bc = 0$

6. Find the number of terms of the A.P. 54, 51, 48, ... so that their sum is 513.

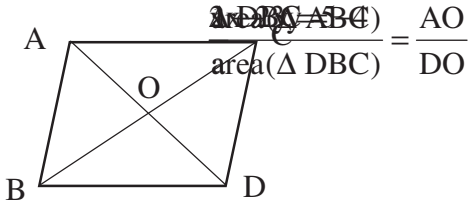
Or

If the *n*th term of an A.P. is (2*n* + 1), find the sum of first *n* terms of the A.P.

7. A loan of Rs. 10,815 is to be returned in three equal half-yearly instalments. Calculate the amount of each instalment, if the rate of interest is $13\frac{1}{3}\%$ per annum, compounded half-yearly.

8. A fan is available for Rs. 970 cash or Rs. 210 as cash down payment followed by three equal monthly instalments of Rs. 260 each. Find the rate of interest charged under instalment plan.

9. In the figure, ΔABC and are on the same base BC. AD and BC interesect at O. Prove that



$\frac{\text{area}(\Delta ABC)}{\text{area}(\Delta DBC)} = \frac{AO}{DO}$

10. OD is perpendicular to a chord AB of a circle whose centre is O. If BC is a diameter, prove that CA = 2 OD.

SECTION - B

Question numbers 11 to 20 carry 4 marks each.

11. Solve the following system of equations graphically :

Also find the points where the lines meet the x-axis.

12. The sum of two numbers a and b is 15, and the sum of their reciprocals and $\frac{1}{b}$ is $\frac{3}{10}$. Find the numbers a and b.

13. A hemispherical bowl of internal radius 9 cm is full of liquid. The liquid is to be filled into cylindrical shaped small bottles each of diameter 3 cm and height 4 cm. How many bottles are needed to empty the bowl ?

14. Prove that

$$\tan^2 A - \tan^2 B = \frac{\sin^2 A - \sin^2 B}{\cos^2 A \cos^2 B}$$

Or

Find the value of

$$\frac{-\tan\theta.\cot(90° - \theta) + \sec\theta.\operatorname{cosec}(90° - \theta) + \sin^2 35° + \sin^2 55°}{\tan 10° \tan 20° \tan 30° \tan 70° \tan 80°}$$

15. Draw a circle of radius 3.5 cm. From a point P outside the circle at a distance of 6 cm from the centre of circle, draw two tangents to the circle.

16. Find the value of x such that PQ = QR where the coordinates of P, Q and R are $(6, -1)$; $(1, 3)$ and $(x, 8)$ respectively.

Or

Find the point on x-axis which is equidistant from the points (7, 6) and .

17. The line-segment joining the points and (1, 2) is trisected at the points P and Q. If the coordinates of P and Q are and respectively, find the values of p and q.

18. Find the mean of the following distribution :

Class	Number of Students
4-8	2
8-12	12
12-16	15
16-20	25
20-24	18
24-28	12
28-32	13
32-36	3

19. Given below is the expenditure fo a person on different items out of his salary of Rs. 14,400.

Item	Clothing	Food	Rent	Education	Others	G. Total
Expenditure (in Rupees)	2,800	3,600	3,600	1,800	2,600	14,400

Draw a pie-chart to depict the above data.

20. A card is drawn at random from a well shuffled pack of 52 cards. Find the probability that the card drawn is neither a red card nor a queen.

SECTION - C

Question numbers 21 to 25 carry 6 marks each.

21. Prove that in a right angled triangle the square on the hypotenuse is equal to sum of the squares on other two sides.

Using the above result, prove that the sum of squares on the sides of a rhombus is equal to sum of squares on its diagonals.

22. On a horizontal plane there is a vertical tower with a flag pole on the top of the tower. At a point 9 metres away from the foot of the tower the angle of elevation of the top and bottom of the flag pole are 60° and 30° respectively. Find the height of the tower and flag pole mounted on it.

Or

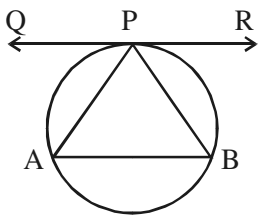
From a building 60 metres high the angle of depression of the top and bottom of lamppost are 30° and 60° respectively. Find the distance between lamppost and building. Also find the difference of height between building and lamppost.

23. A tent is in the shape of a right circular cylinder up to a height of 3 m and conical above it. The total height of the tent is 13.5 m and radius of base is 14 m. Find the cost of cloth required to make the tent at the rate of Rs. 80 per sq. m.

Or

The radii of circular ends of a solid frustum of a cone are 33 cm and 27 cm and its slant height is 10 cm. Find its total surface area.

24. If a line touches a circle and from the point of contact a chord is drawn, prove that the angles which this chord makes with the given line are equal respectively to the angles formed in the corresponding alternate segments.



Using the above theorem, prove the following :

P is mid point of arc APB. Prove that tangent QR drawn at P to the circle is parallel to AB.

Marking Scheme --- Mathematics

General Instructions

1. The Marking Scheme provides general guidelines to reduce subjectivity and maintain uniformity among large number of examiners involved in the marking. The answers given in the marking Scheme are the best suggested answers.
2. Marking is to be done as per instructions provided in the marking scheme. (It should not be done according to one's own interpretation or any other consideration.) Marking Scheme should be strictly adhered to and religiously followed.
3. Alternative methods are accepted. Proportional marks are to be awarded.
4. If a question is attempted twice and the candidate has not crossed any answer, only first attempt is to be evaluated. Write EXTRA with second attempt.
5. A full scale of marks 0 to 100 has to be used. Please do not hesitate to award full marks if the answer deserves it.

QUESTION PAPER CODE 30/1/1

EXPECTED ANSWERS/VALUE POINTS

SECTION - A

1. $\dfrac{x^3-8}{x^2-4}\times\dfrac{x^2+6x+8}{x^2-2x+1}\div\dfrac{x^2+2x+4}{x^2+2x-3}$

$=\left[\dfrac{(x-2)(x^2+2x+4)}{(x-2)(x+2)}\right]\times\left[\dfrac{(x+2)(x+4)}{(x-1)(x-1)}\right]\times\left[\dfrac{(x+3)(x-1)}{(x^2+2x+4)}\right]$ 2½ m

$=\dfrac{x^2+7x+12}{x-1}$ ½ m

2. Here $a=4,\ d=5,\ t_n=254$ ½ m

$\therefore\quad 254=4+(n-1)5$ 1 m

10th term from end is 42nd term from beginning ½ m

$\Rightarrow\quad n=42$ 1 m

$\therefore\quad 4+41\times5=209$

3. $ax + by = a - b$ ..... (i)

.....(ii)

Multiplying (i) by a and (ii) by b and adding, we get 1 m

$\Rightarrow x = 1$ 1 m

Substituting $x = 1$ in (i), we get 1 m

4. .....(i)

$x^2 - 9x + 20 = (x-4)(x-5)$ ..... (ii) } 1½ m

$x^2 - 16 = (x-4)(x+4)$ ..... (iii)

LCM of (i), (ii) and (iii) is

$2(x-4)(x^2+4x+16)(x-5)(x+4)$ 1½ m

or $2(x^3-64)(x^2-x-20)$

$\Rightarrow$ $x = \frac{}{b}$ or $x = \frac{}{a}$ $(b+a)(x+b) = 0$

5. $\frac{1}{a+b+x} = \frac{1}{a} + \frac{1}{b} + \frac{1}{x} \quad \Rightarrow \frac{1}{a+b+x} - \frac{1}{x} = \frac{1}{a} + \frac{1}{b}$ ½ m

$\frac{-(a+b)}{x(a+b+x)} = \frac{a+b}{ab}$ 1 m

1 m

$\therefore \quad x = -a, -b$ ½ m

OR

$abx^2 + b^2x - acx - bc = 0$ } 1 m

$bx(ax+b) - c(ax+b) = 0$

1 m

1 m

6. Let n be the number of terms of A.P. 54, 51, 48, ... so that their sum is 513.

We know $S_n = \frac{n}{2}[2a + (n-1)d]$ ½ m

$\therefore \quad 513 \times 2 = n[2 \times 54 + (n-1)(-3)]$ 1 m

or $n^2 - 37n + 342 = 0$ or $(n-18)(n-19) = 0$ (½ +½) = 1 m

$\therefore \quad n = 18$ or 19 ½ m

OR

$\therefore \quad t_1 = 3, \; t_2 = 5, \; t_3 = 7$

$\therefore \quad a = 3, \; d = 2$ (½+½) m

1 m

$= n(n+2)$

$\Rightarrow$ $S_n = \frac{15}{16}\left\{1 + x \times \left(\frac{15}{16}\right) + x\left(\frac{15}{16}\right)^2\right\} + x\left(\frac{15}{16}\right)^3$ 1 m

7. Let each instalment be = Rs x

$\therefore$ Present value of all instalments together

1 m

or $x \times \frac{15}{16}\left[1 + \frac{15}{16} + \frac{225}{256}\right] = x \times \frac{15}{16} \times \frac{721}{256} = \frac{x \times 10815}{4096}$ 1 m

This is given equal to Rs 10815

$\frac{4096 \times 10815}{10815} = x$ 1 m

Each instalment = Rs 4096

8. Cash price of fan = Rs 970

Price under instalment plan = Rs (210+260×3)

= Rs 990 1 m

$\therefore$ Interest = Rs 20

Principals owed each month (in rupees)

760, 500, 240

Total principal owed for one month = Rs 1500 1 m

Rate of interest

$\therefore$ Rate of interest = 16% 1 m

9. ..... (i) 1 m

$\therefore$ ΔS AOX and DOY are similar

$\therefore$ $\frac{AX}{DY} = \frac{AO}{DO}$ ..... (ii) 1 m

From (i) and (ii), we get $\frac{\text{Area } (\Delta ABC)}{\text{Area } (\Delta DBC)} = \frac{\frac{1}{2}BC \times AX}{\frac{1}{2}BC \times DY} = \frac{AX}{DY}$

$\frac{\text{Area } (\Delta ABC)}{\text{Area } (\Delta DBC)} = \frac{AO}{DO}$ 1 m

10. Figure ½ m

½ m

$OB = \frac{1}{2}BC$

O and D are mid-point of sides BC and AB respectively.

$\therefore$ OD || CA 1 m

1 m

$\Rightarrow$ CA = 2.OD

SECTION - B

11. Making correct tables of ordered pairs — (½ + ½) m

Correct graph of equations — (1 + 1) = 2 m

Solution : $x = 1$, $y = 2$ — ½ m

The lines meet x-axis at $(5, 0)$ and $(-2, 0)$ — ½ m

12. ..... (i) } ½ + ½ = 1 m

$$\Rightarrow \frac{15}{ab} = \frac{3}{10} \quad \text{or} \quad ab = 50$$ — 1 m

$$\therefore \quad a + \frac{50}{a} = 15 \quad \text{or} \quad a^2 - 15a + 50 = 0$$ — 1 m

$$\therefore \quad (a-5)(a-10) = 0 \Rightarrow a = 5 \text{ or } 10$$ ..... (ii) — ½ m

From (i) and (ii), $a = 10,\ b = 5$ or $a = 5,\ b = 10$ } ½ m

$$\frac{a+b}{ab} = \frac{3}{10}$$

13. Volume of liquid in hemispherical bowl — (½ + 1) = 1½ m

$$= \frac{2}{3}\pi (9)^3 \text{ cm}^3 = 486\pi \text{ cm}^3$$

Volume of one cylinderical bottle $= \pi\left(\frac{3}{2}\right)^2 \times 4 \text{ cm}^3 = 9\pi \text{ cm}^3$ — 1½ m

Let n be the number of bottles

$$\therefore \quad n = \frac{486\pi}{9\pi} = 54$$ — 1 m

$\therefore$ 54 bottles can be filled from the bowl

14. $\text{LHS} = \dfrac{\sin^2 A}{\cos^2 A} - \dfrac{\sin^2 B}{\cos^2 B} = \dfrac{\sin^2 A \cos^2 B - \cos^2 A \sin^2 B}{\cos^2 A . \cos^2 B}$ (½+1) = 1½ m

$= \dfrac{\sin^2 A(1-\sin^2 B) - (1-\sin^2 A)\sin^2 B}{\cos^2 A . \cos^2 B}$ 1½ m

$= \dfrac{\sin^2 A - \sin^2 B}{\cos^2 A . \cos^2 B}$ 1 m

OR

$\cot(90° - \theta) = \tan\theta, \cos ec(90° - \theta) = \sec\theta$

$\sin^2 55° = \sin^2(90-35)° = \cos^2 35°$ 2½ m

$\tan 80° = \cot 10°, \tan 70° = \cot 20°$ and $\tan 30° = \dfrac{1}{\sqrt{3}}$

∴ Given exp ression

$\dfrac{\sec^2 10° - \tan^2 80° + (\sin^2 35° + \cos^2 35°}{\tan 10° \cot 10° \tan 20° \cot 20° . \dfrac{1}{\sqrt{3}}}$ 1 m

$= (1+1)\sqrt{3}$

$= 2\sqrt{3}$ ½ m

15. Correct construction with correct measurements. 4 m

16. $P(6,-1)$, $Q = (1,3)$, $R = (x,8)$

(1+1) = 2 m

$PQ^2 = QR^2 \Rightarrow (x-1)^2 = 16$ 1 m

$\Rightarrow x - 1 = \pm 4$

1 m

OR

Any point on x-axis is (x, 0) ½ m

Let P be (x, 0), Q(7, 6) and R(−3, 4)

It is given that ½ m

$\Rightarrow (x-7)^2+36=(x+3)^2+16$ 1 m

$\Rightarrow (x+3)^2-(x-7)^2=20$

$(x^2+6x+9)-(x^2-14x+49)=20$ 1 m

$\Rightarrow \quad 20x-40=20 \quad \Rightarrow \quad x=3$ ½ m

The required point is (3, 0) ½ m

17.

Figure ½ m

P and Q are points of trisection

1½ m

Again AQ : QB = 2 : 1

$\therefore \quad q=\dfrac{4-4}{3}=0$ 2 m

18.

xi :	6	10	14	18	22	26	30	34
fi :	2	12	15	25	18	12	13	3
fi xi :	12	120	210	450	396	312	390	102

½ m

$\Rightarrow \sum fi = 100$ ½ m

2 m

(½+½) = 1 m

19. Calculating the central angles as

Item :	Clothing	Food	Rent	Education	Others	Total
Expenditure:	2800	3600	3600	1800	2600	14400
Central Angles	70°	90°	90°	45°	65°	360°

2 m

2 m

20. Total number of Cards = 52

Number of red cards and number of black queens = $26 + 2 = 28$ 2 m

$\therefore$ P (Neither a red card nor a queen) $= \frac{52-28}{52} = \frac{24}{52} = \frac{6}{13}$ 2 m

SECTION - C

21. Correct figure, Correctly Stated Given, To prove, Construction (½+½+½+½) = 2 m

Correct Proof : 2 m

Here AB = BC = CD = DA

$BO = \frac{BD}{2}$ and $AO = \frac{AC}{2}$ ½ m

In right triangle AOB

$AB^2 = OB^2 + OA^2 = \frac{BD^2}{4} + \frac{AC^2}{4}$ ½ m

or $4(AB^2) = BD^2 + AC^2$ ½ m

or $AB^2 + BC^2 + CD^2 + DA^2 = BD^2 + AC^2$ ½ m

22. Figure 1 m

In right ΔBCD

1 m

$\Rightarrow x = 3\sqrt{3} \cong 5.196$ 1 m

1 m

$\Rightarrow \quad y = 6\sqrt{3}$ or 10.392 1 m

$\therefore$ x = 5.196 m and y = 10.392m 1 m

Height of Tower = or 5.196m; Height of Flag pole = $6\sqrt{3}$ or 10.392 m

OR

Correct Figure (angles of depression should be shown) 1 m

Getting the trigonometric equation

$$\frac{60-x}{y} = \tan 30° \qquad 1 \text{ m}$$

$$\text{or } \frac{60-x}{y} = \frac{1}{\sqrt{3}}$$

1 m

$$\text{Again, } \frac{60}{(60-x)\sqrt{3}} = \tan 60° = \sqrt{3} \qquad 1 \text{ m}$$

$$\Rightarrow \quad 60 = 3(60-x) \qquad 1 \text{ m}$$

Distance between building and lamp post = $\left(2.\frac{}{7}\times 14\times 3+\frac{}{7}\times 14\times 17.5\right)\text{m}^2$ 1 m

23. Figure 1 m

$$\lambda^2 = 14^2 + (10.5)^2 = (17.5)^2$$

$$\Rightarrow \quad \lambda = 17.5 \qquad 1½ \text{ m}$$

Area of cloth required = 1 m

1½ m

$$= (264 + 770) \text{ or } 1034\text{m}^2$$

$\therefore$ Cost of cloth =Rs (1034×80) = Rs 82720 1 m

OR

Total surface area of a solid frustum

$$S = \pi\left[(r_1 + r_2)\lambda + r_1^{\,2} + r_2^{\,2}\right]$$ 1½

Here $r_1 = 33\text{cm}, r_2 = 27\text{cm}, \lambda = 10\text{cm}$ ½ m

$$\therefore \quad S = \frac{22}{7}\left[(33+27)\times 10 + 1089 + 729\right]\text{cm}^2$$ 2 m

$$= \frac{22}{7}\left[2418\right]\text{cm}^2$$ 2 m

$$= 7599.43\text{cm}^2$$

24. Correct figure, correctly stated Given, To Prove and Construction (½+½+½+½) = 2 m

Correct Proof : 2 m

P is the mid-point of arc APB

$\Rightarrow \quad \overset{\frown}{AP} = \overset{\frown}{PB} \Rightarrow AP = PB$ [illegible] the Alt Seg.)

$= \text{Rs}\left(19000 + 24000 \times \frac{\square}{100}\right)$

.....(i) ½ m

.....(ii) ½ m

From (i) and (ii)

1 m

25. Taxable income $= \text{Rs}\,(18200\times 12 - 8400 - 6000 - 30000)$ ½ m

$= \text{Rs}\ 174000$

Income Tax

$= \text{Rs}\ 26200$ 1 m

Total Savings

$\therefore$ Maximum Rebate on Savings 1 m

Rebate for being a women = Rs 5000 ½ m

Income Tax payable

1 m

Education cess2% = Rs 214 ½ m

Total Tax payable = Rs 10914 ½ m

Tax already paid = Rs (900×11) = Rs 9900 ½ m

Tax to be paid in the last month

= Rs (10914 −9900) ½ m

= Rs 1014

QUESTION PAPER CODE 30/1

EXPECTED ANSWERS/VALUE POINTS

SECTION - A

1. $\left(\frac{x+7}{x+8}-\frac{x-4}{x-3}\right)+\frac{x+8}{x^2+5x-24}$

$=\frac{(x^2+4x-32)-(x^2+4x-21)}{x^2+5x-24}+\frac{x+8}{x^2+5x-24}$ 1½ m

$=\frac{x+8-11}{(x+8)(x-3)}=\frac{(x-3)}{(x+8)(x-3)}$ 1 m

$=\frac{1}{x+8}$ ½ m

Note : If a candidate does $\left(\frac{x+7}{x+8}-\frac{x-4}{x-3}\right)+\frac{x+8}{x^2+5x-24}$ to get

$\frac{[(x^2+4x-21)-(x^2+4x-32)]+x+8}{x^2+5x-24}$ 2 m

$=\frac{x+19}{x^2+5x-24}$, full credit is to be given. 1 m

2. We have to find $11 + 13 + ... + 99$

Here $a = 11,\ d = 2,\ t_n = 99$ ½ m

$99 = 11 + (n-1)\times 2 \Rightarrow n = 45$ 1 m

½ m

$$= \frac{45}{2}[11+99] = 45\times 55 = 2475$$ 1 m

3. $bx + ay = 2ab$ ..... (i)

.....(ii)

Multiplying (i) by b and (ii) by a and adding we get

$(a^2 + b^2)x = 2ab^2 - ab^2 + a^3$ 1 m

$= ab^2 + a^3 = a(a^2 + b^2)$

$\Rightarrow x$ 1 m

Putting $x = a$ in (i) to get $y = b$ 1 m

OR

Let x be tens' digit and y be units' digit

Number is ½ m

According to question,

1 m

Also,

[Rejecting $y = 0$] 1 m

$2x = y \Rightarrow x = 3$

The number is 36 ½ m

4. .....(i)

$q(x) = (x+3)(x+4)(x^2+7x+b)$ ..... (ii)

1 m

$HCF = (x+1)(x+3)$

is a factor of

$\therefore \quad (-3)^2 + 2(-3) + a = 0 \quad \Rightarrow \; a = -3$ 1 m

and $(x+1)$ is a factor of

$\Rightarrow \; (-1)^2 + 7(-1) + b = 0$

$\Rightarrow \; b = 6$ 1 m

5. (½+½) m

$\therefore \quad x = \dfrac{-(b^2-a^2) \pm \sqrt{(b^2-a^2)^2 + 4a^2b^2}}{2a^2b^2}$ 1 m

$= \dfrac{-(b^2-a^2) \pm (a^2+b^2)}{2a^2b^2} = \dfrac{1}{b^2} \; , \; \dfrac{-1}{a^2}$ 1 m

OR

$\dfrac{x-1}{x-2} + \dfrac{x-3}{x-4} = \dfrac{10}{3}$

$\Rightarrow \quad \dfrac{1}{x-2} + \dfrac{1}{x-4} = \dfrac{4}{3}$ 1 m

$\Rightarrow \quad 3(2x-6) = 4(x^2-6x+8)$

or $\quad 4x^2 - 30x + 50 = 0 \quad$ or $\quad 2x^2 - 15x + 25 = 0$ 1 m

$(2x-5)(x-5) = 0 \;\Rightarrow\; x = 5 \quad$ or $\quad x = \dfrac{5}{2}$ 1 m

6. $t_n = a + (n-1)d$, where a is the first term and d is common difference. ½ m

$\therefore \quad t_8 = a + 7d = 0 \Rightarrow a = -7d$ ½ m

$t_{18} = a + 17d = -7d + 17d = 10d$ 1 m

$t_{38} = a + 37d = -7d + 37d = 30d$ ½ m

$\therefore \quad t_{38} = 3.t_{18}$ ½ m

7. Cash price of machine = Rs 9000

Price under instalment plan = Rs $(2200 + 5 \times 1400)$

= Rs 9200

$\therefore$ Interest charged = Rs = Rs 200 1 m

Principals to be paid in first, second, ..., fifth month (in Rs)

6800, 5400, 4000, 2600, 1200

Total principal for one month = Rs 20000 1 m

$$\text{Rs}\left(130000 \times \frac{P \times (T+1)}{2400}\right) = \text{Rs}\,1352$$

Rate of interest 1 m

$\therefore$ Interest = 12%

8. Present value of first instalment ½ m

Present value of second instalment = Rs $\left(135200 \times \frac{25}{26}\right)$ = Rs 130000 ½ m

Present value of third instalment = Rs 125000 ½ m

Total present value = Rs 390200 ½ m

Total amount paid in installments = Rs (140608×3) = Rs 421824

Interest paid = Rs 31624 1 m

9. Figure ½ m

Draw $AD \perp CB$. Let and (Given)

In right ..... (i)

and $AC^2 = AD^2 + x^2$ .....(ii) } 1 m

From (ii), we have $AD^2 = AC^2 - x^2$

$\therefore \quad AB^2 = AC^2 + 8x^2$ 1 m

$\Rightarrow 2AB^2 = 2AC^2 + 16x^2$

$= 2AC^2 + (4x)^2 = 2AC^2 + BC^2$ ½ m

10. Let AD= x, then $DE = 15 - x$

As

1 m

1 m

$\therefore$ DE = 12 cm, if AD = 3 cm

or DE = 3 cm, if AD = 12 cm } x = 3, 12 1 m

$x - \frac{}{x} + 2 = 0$

SECTION - B

11. Making correct tables of ordered pairs (½ + ½) m

Correct graphs of equations (1 + 1) m

Solution : x = 3 , y = 2 ½ m

Lines meet y-axis at ½ m

12. Let x be tens' digit and y, the units' digit

..... (i) 1 m

..... (ii) 1 m

From (i) and (ii), we get

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

$\therefore \quad x = 3, \quad x = -5$ is rejected 1 m

½ m

The required number is 35 ½ m

13. Volume of cone $= \frac{32}{3}\pi$ cu. cm 1 m

Volume of one sphere $= \frac{4}{3}\pi(1)^3$ cu. cm $= \frac{4}{3}\pi$ cu. cm 1 m

Let n be the number of spheres formed.

$\therefore \quad n \times \frac{4}{3}\pi = \frac{32}{3}\pi$ 1 m

$\Rightarrow \quad n = 8$

Number of spheres formed = 8 1 m

14. The given identity can be written as

$\therefore$ 1 y = 5, $\frac{1}{\sec x - \tan x} - \frac{1}{\sec x + \tan x} = \frac{2}{\cos x}$

$\therefore$ 3 $= \pi(2)^2 \times 8$ cu. cm

$$\text{LHS} = \frac{\sec x + \tan x + \sec x - \tan x}{\sec^2 x - \tan^2 x}$$ 2½ m

$$= \frac{2\sec x}{1} = \frac{2}{\cos x} = \text{RHS}$$ 1½ m

Alternatively, $\text{LHS} = \frac{\cos x}{1-\sin x} - \frac{1}{\cos x} = \frac{\cos^2 x - 1 + \sin x}{\cos x\,(1-\sin x)}$ 1 m

$$= \frac{\sin x(1-\sin x)}{\cos x(1-\sin x)} = \tan x$$ 1 m

Again $\text{R.H.S.} = \frac{1}{\cos x} - \frac{\cos x}{1+\sin x} = \frac{1+\sin x - \cos^2 x}{\cos x\,(1+\sin x)}$ 1 m

$$= \frac{\sin x\,(1+\sin x)}{\cos x\,(1+\sin x)} = \tan x = \text{LHS}$$ 1 m

OR

$\sec^2 54° = \sec^2(90-36)° = \operatorname{cosec}^2 36°,\ \operatorname{cosec}^2 57° = \operatorname{cosec}^2(90-33)° = \sec^2 33°$

$\sec^2 52° = \sec^2(90-38)° = \operatorname{cosec}^2 38°,\ \sin^2 45° = \left(\frac{1}{\sqrt{2}}\right)^2 = \frac{1}{2}$ 2 m

$\therefore$ Given expression 1 m

$$= 1 + 2 - \frac{1}{2} = \frac{5}{2}$$ 1 m

15. Correct construction of Quadrilateral ABCD 2 m

Similar Quadrilateral A'BC'D' 2 m

[Dimensions to be correct]

16. Let $A(0, 0),\ B(5, 5),\ C(-5, 5)$ be the vertices of the triangle

$$= \frac{\operatorname{cosec}^2(90-36)° - \cot^2 36°}{\sec^2 33° - \tan^2 33°} + 2\sin^2 38°.\operatorname{cosec}^2 38° - \frac{1}{2}$$ 3 m

$BC^2 = (5+5)^2 + (5-5)^2 = 100$

$AC^2 = (0+5)^2 + (0-5)^2 = 50$

$\therefore$ $AB = AC$ and $AB^2 + AC^2 = BC^2$ ½ m

$\therefore$ ΔABC is an isosceles right triangle ½ m

OR

1 m

$PB^2 = (x+1)^2 + (y-5)^2 = x^2 + y^2 + 2x - 10y + 26$ 1 m

$PA = PB \Rightarrow PA^2 = PB^2$

$\therefore$ $x^2 + y^2 - 10x - 2y + 26 = x^2 + y^2 + 2x - 10y + 26$ 1 m

$12x = 8y \Rightarrow 3x = 2y$ 1 m

17.

½ m

½ m

Let the coordinates of P be (x, y)

1½ m

$\therefore$ P (3, – 2) lies on ½ m

1 m

Note : If a candidate takes the ratio 2 : 1 and finds and full credit may be given.

18.

xi	10	15	p	25	30
fi	5	10	7	8	2
fi xi	50	150	7p	200	60

½ m

1½ m

$x = \frac{\Sigma fi}{\Sigma fi} = 3, \quad y = \frac{}{3} = -2$ PB = 1 : 2

½ m

$\therefore \quad 18.75 = \frac{460 + 7p}{32}$ ½ m

$600 = 460 + 7p$ 1 m

$\Rightarrow \quad p = 20$

19. For calculating correct central angles as

Bus	Cycle	Train	Car	Scooter
60°	90°	120°	40°	50°

1½ m

Correct Pie chart 2½ m

[correct central angles to be drawn]

20. (i) P (Red or White) 1 m

(ii) P (Not Black) $= \frac{7}{9}$ 1½ m

(iii) P (Neither white nor Black) $= \frac{8}{18} = \frac{4}{9}$ 1½ m

SECTION - C

21. Correct figure, Correctly stated Given, To prove, Construction (½+½+½+½) = 2 m

Correct Proof : 2 m

$\Delta COD \sim \Delta AOB$ ½ m

½ m

$\frac{ar(\Delta COD)}{84} = \frac{1}{4} \Rightarrow ar(\Delta COD) = 21\ cm^2$ (½+½) = 1 m

$\frac{ar(\Delta COD)}{ar(\Delta AOB)} = \frac{DC^2}{AB^2}$ $\frac{x^2}{4x^2}$

22. Figure 1 m

In

$\Rightarrow y = \sqrt{3}x$ 1½ m

In ΔBCO, $\frac{y}{150 - x} = \tan 30°$ 1 m

$\Rightarrow \frac{\sqrt{3}x}{150 - x} = \frac{1}{\sqrt{3}}$

$\Rightarrow 4x = 150$ 1 m

1 m

$y = \sqrt{3}x = 37.5\sqrt{3}$

or $\frac{75}{2} \times 1.732 = 64.95m$ ½ m

OR

Figure 1 m

Let PR = x m and AB = h m

In Δ ARP, $\frac{h-10}{x} = \tan 60° = \sqrt{3}$

$\Rightarrow \quad x = \frac{h-10}{\sqrt{3}}$ 1½ m

In ΔPRB, $\frac{10}{x} = \tan 30° = \frac{1}{\sqrt{3}}$

$\therefore \quad x = 10\sqrt{3}$ 1½ m

$\therefore$ Distance of hill from ship = $10\sqrt{3}$ m or 17.32 m

$\therefore \quad \frac{h-10}{\sqrt{3}} = 10\sqrt{3}$

$\Rightarrow \quad h = 40$ 1½ m

½ m

23. Figure ½ m

Capacity (Volume) of Tent

= Volume of cylinderical Part + Volume of Conical Part

½ m

$\left[\frac{22}{7} \times (2.1)^2 \times 4 + \frac{1}{3} \times \frac{22}{7} \times (2.1)^2 \times (2.8)\right] m^3 = 68.38 m^3$ 2 m

For Conical Part $\lambda^2 = (2.8)^2 + (2.1)^2 = (3.5)^2$

m 1 m

$= (11 \times 3 \times 2.3) m^2 = 75.9\ m^2$ 1 m

$\therefore$ Cost of canvas for making tent

= Rs (100 ×75.9) = Rs 7590 1 m

OR

Figure 1 m

1 m

Volume of bucket

$$= \left[\frac{1}{3}\times\frac{22}{7}\times 28^2\times 60 - \frac{1}{3}\times\frac{22}{7}\times 7^2\times 15\right]\text{cm}^3$$

$$= \frac{1}{3}\times\frac{22}{7}\times 15\left[4\times 28^2 - 7^2\right]\text{cm}^3$$

$$= \frac{22\times 15}{21}\times 49\ (63)\text{cm}^3 = 48510\text{cm}^3$$ 1½ m

$$\text{Total surface area} = \left[(\pi.28\times\lambda - \pi.7\times\lambda_1) + \pi\,(7)^2\right]\text{cm}^2$$ ½ m

where $\lambda = \sqrt{60^2 + 28^2}$ and $\lambda_1 = \sqrt{15^2 + 7^2}$

$= \sqrt{4384}$ $= \sqrt{274} = 16.55$

$= 66.21$ 1 m

$$\text{Total Surface area} = \left[\frac{22}{7}\times 28\times 66.21 - \frac{22}{7}\times 7^2 + \frac{22}{7}\times 28\times 16.55\right]\text{cm}^2 = 2466$$ 1 m

$= 5616\ \text{cm}^2$ (app.)

Alternately, using the formula

Figure 1 m

AB = 28 cm, CD = 7 cm $\Rightarrow$ PB = 21 cm

$\therefore \quad \lambda = \sqrt{2466} = 49.66$ 1 m

$$\text{Volume} = \frac{\pi h}{3}\left[(r_1^2 + r_2^2 + r_1 r_2)\right]$$ ½ m

$$= \frac{22}{7}\times\frac{45}{3}\left[(28)^2 + (7)^2 + 28\times 7\right]\text{cm}^3$$

$$= \frac{330}{7}[784 + 49 + 196]\ \text{cm}^3$$

$= 48510\ \text{cm}^3$ 1½ m

Total Surface area $= \pi[(r_1 + r_2)\lambda + r_2^2]$ ½ m

$$= \frac{22}{7}\left[(28+7)(49.66)+49\right]\text{cm}^2$$

$$= 22\,[255.3] = 5616.6\ \text{cm}^2$$ 1½ m

24. Correct figure, correctly stated Given, To Prove and Construction (½+½+½+½) = 2 m

Correct Proof : 2 m

In the figure, DAB is a secant and PQ is a tangent ½ m

$\therefore \quad DP^2 = DA.DB$ ..... (i)

$DQ^2 = DA.DB$ ..... (ii) } 1 m

From (i) and (ii), DP = DQ ½ m

25. Taxable income

= Rs 214000 $\doteq$ Rs (750000 + 36000) = Rs 750001 = Rs $\left(21000\times12 - 6000 - 4000\times\frac{1}{2} - 30000\right)$ ½ m

Income Tax 1 m

Total Savings

Maximum Rebate for savings } 1 m

Additional Rebate for senior citizen = Rs 20000 ½ m

Tax payable } 1 m

Education cess 2% = Rs 154

Total Tax payable = Rs 7854 } 1 m

Tax already paid = Rs 6600 ½ m

Tax to be paid in the last month = Rs 1254 ½ m