FBISE
WE WORK FOR EXCELLENCE

Federal Board HSSC-I Examination Mathematics Model Question Paper

Roll No: ☐☐☐☐☐☐

Answer Sheet No: ____________

Signature of Candidate: ____________

Signature of Invigilator: ____________

SECTION – A

Time allowed: 20 minutes Marks: 20

Note: Section-A is compulsory and comprises pages 1-7. All parts of this section are to be answered on the question paper itself. It should be completed in the first 20 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q.1 Insert the correct option i.e. A/B/C/D in the empty box provided opposite each part. Each part carries one mark.

i. Multiplicative inverse of complex number (-2, 3) is ☐

A. $\left(\frac{-2}{\sqrt{13}} , \frac{-3}{\sqrt{13}}\right)$

B. $\left(\frac{-2}{\sqrt{13}} , \frac{3}{\sqrt{13}}\right)$

C. $\left(\frac{2}{\sqrt{13}} , \frac{-3}{\sqrt{13}}\right)$

D. $\left(\frac{2}{\sqrt{13}} , \frac{3}{\sqrt{13}}\right)$

ii. Consider the circle relation “C” define for all (x,y) ε R× R such that $-1 \le x\ ,\ y \le 1,\ (x,y)\ \varepsilon\ C \leftrightarrow x^2 + y^2 = 1$ then C(x , y) is: ☐

A. 1 – 1 function
B. onto function
C. bijective function
D. not function

DO NOT WRITE ANYTHING HERE

iii. If the application of elementary row operation on $[A \; : \; I]$ in succession reduces A to I then the resulting matrix is ☐

A. $\left[A^{-1} \;:\; I\right]$

B. $\left[I \;:\; A^{-1}\right]$

C. $\begin{bmatrix} A^{-1} \\ : \\ I \end{bmatrix}$

D. $\left[A \;:\; A^{-1}\right]$

iv. If α and β be the roots of $ax^2 + bx + c = 0$, then $\alpha + \beta + \frac{1}{\alpha\beta}$ is ☐

A. $\frac{c-b}{a}$

B. $\frac{a^2 - bc}{ac}$

C. $\frac{a^2 + bc}{ac}$

D. $\frac{ac}{a^2 - bc}$

v. $\frac{1}{x-1}+\frac{1}{x+1}-\frac{1}{x}$ are the partial fractions of ☐

A. $\frac{x^2+1}{x(x^2-1)}$

B. $\frac{x^2-1}{x(x^2-1)}$

C. $\frac{1}{x(x^2-1)}$

D. $\frac{x^2+1}{x^2-1}$

vi. Which of the following is sum of n AMs between a and b? ☐

A. $\frac{(a+b)^n}{2}$

B. $\frac{na+nb}{2}$

C. $\frac{a^n+b^n}{2}$

D. $n\sqrt{ab}$

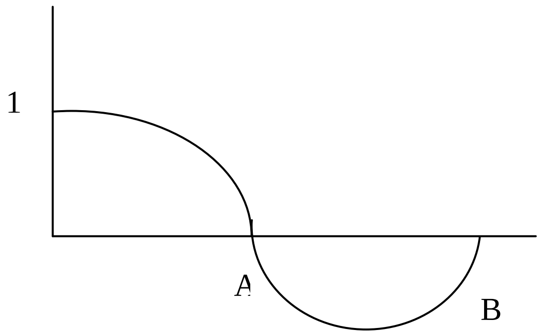
vii. 8 beads of different colours can be arranged in a necklace in ☐

A. 8 ! ways
B. 5040 ways
C. 2520 ways
D. 2 x 7 ! ways

viii. ${}^nC_2$ exist when n is ☐

A. $n< 2$
B. $n = 1$
C. $n\geq 2$
D. $n \leq 1$

ix. If *f (x)* = *cos 2x* the value of *x* at point B is ☐



A. $\frac{3\pi}{4}$

B. π

C. $\frac{3\pi}{2}$

D. 2π

x. $2\cos^2\left(\frac{3}{8}\pi\right)-1$ is ☐

A. $\frac{1}{\sqrt{2}}$

B. $-\frac{1}{\sqrt{2}}$

C. $\frac{\sqrt{3}}{2}$

D. $-\frac{\sqrt{3}}{2}$

xi. An Arc $\overset{\frown}{PQ}$ substends an angle of 60^o at the center of a circle of radius 1 cm. The length $\overset{\frown}{PQ}$ is: ☐

A. 60 cm

B. 30 cm

C. $\frac{\pi}{6}cm$

D. $\frac{\pi}{3}cm$

xii. If in a triangle $b = 37$, $c = 45$, $\alpha = 30^{o}\,50'$ ☐
Then the area of the triangle is

A. 426.69 sq unit
B. 246.69 sq unit
C. 624.96 sq unit
D. 924.69 sq unit

xiii. The graph of y= tan x is along *x–axis*. The graph of $y = tan^{-1}x$ would be along ☐

A. x – axis
B. y - axis
C. origion
D. z - axis

xiv. If sin $x = \frac{1}{2}$ then x has values ☐

A. $\frac{\pi}{6}, \frac{\pi}{3}$

B. $\frac{\pi}{6}, \frac{5\pi}{6}$

C. $\frac{\pi}{2}, \frac{\pi}{6}$

D. $\frac{\pi}{6}, \frac{-5\pi}{6}$

xv. (P(A) , *) where * stands for intersection and A is a non empty set then (P(A) , *) is ☐

A. monoid group
B. abilian group
C. Group
D. bijective function

xvi. The product of all 4th roots of unity is ☐

A. 1
B. -1
C. i
D. - i

xvii. If $\frac{1}{a}, \frac{1}{H}, \frac{1}{b}$ are in H.P then H is ☐

A. $\frac{2ab}{a+b}$

B. $\frac{a+b}{2ab}$

C. $\frac{a-b}{2ab}$

D. $\frac{2ab}{a-b}$

xviii. Probability of a child being born on Friday is ☐

A. $\frac{1}{3}$

B. $\frac{1}{2}$

C. $\frac{1}{7}$

D. $\frac{1}{4}$

xix. $\cos^{-1} x + \cos^{-1}(-x)$ ☐

A. 0

B. $\frac{\pi}{2}$

C. π

D. 2 cos x

xx. In a triangle if a = 17, b =10 and c = 21 then circum radius ‘R’ is ☐

A. 84
B. 28
C. 12
D. $\frac{85}{8}$

For Examiner’s use only

Q. No.1: Total Marks: 20

Marks Obtained: ☐

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Federal Board HSSC-I Examination
Mathematics Model Question Paper

Time allowed: 2.40 hours   Total Marks: 80

Note: Sections ‘B’ and ‘C’ comprise pages 1-3 and questions therein are to be answered on the separately provided answer book. Answer any ten questions from section ‘B’ and attempt any five questions from section ‘C’. Use supplementary answer sheet i.e., sheet B if required. Write your answers neatly and legibly.

SECTION-B
(Marks: 40)

Note: Attempt any **TEN** questions.

2. Simplify by justifying each step

$$\frac{\frac{1}{a}-\frac{1}{b}}{1-\frac{1}{a}\cdot\frac{1}{b}}$$ (4)

3. If p and q are elements of a group G show that: $(pq)^{-1} = q^{-1}\,p^{-1}$ (4)

4. If A = $\begin{bmatrix} i & 1+i \\ 1 & -i \end{bmatrix}$

Show that $A+(\overline{A})^t$ is Harmitian matrix. (4)

5. A wire of length 80 cm is cut into two parts and each part is bent to form squares. If the sum of the areas of the squares is 300 cm^2. Find the length of the sides of two squares. (4)

6. Resolve into partial fraction

$$\frac{x^4}{x^3+1}$$ (4)

7. If $y = 1+2x +4x^2+8x^3+$………………….
Then show that $x = \frac{y-1}{2y}$ (4)

8. The members of a club are 12 boys and 8 girls, in how many ways can a committee of 3 boys and 2 girls be formed. (4)

9. Find $(2n+1)th$ term from the end in the expansion of $\left(x-\frac{1}{2x}\right)^{3n}$. (4)

10. Find the values of remaining trigonometric functions if cot $\theta = \sqrt{7}$ and θ is not in 1st quadrant. (4)

11. Prove that
$\cos 4x = 8 \cos^4 x - 8\cos^2 x+1$ (4)

12. If r_1, r_2, r_3 are in A.P then show that
$(a-b) (s-c) = (b-c) s-a)$ (4)

13. Solve for "x"
$\cos^{-1} (2x^2-2x) = \frac{2\pi}{3}$ (4)

14. Solve $\frac{1}{\sin^2\theta} = \frac{4}{3}$ (4)

15. If the roots of the equation $x^2 - Px + q = 0$ differ by unity, prove that $P^2 = 4q + 1$. (4)

SECTION – C

(Marks: 40)

Note: Attempt any **FIVE** questions. Each question carries equal marks.
(Marks 5x8=40)

16. Solve the system of following linear equations.

$x_1 +3x_2 +2x_3 = 3$
$4x_1 +5x_2 -3x_3 = -3$
$3x_1 -2x_2 +17x_3 = 42$
By reducing its augmented matrix to reduce Echelon form. (8)

17. Resolve into partial fractions.

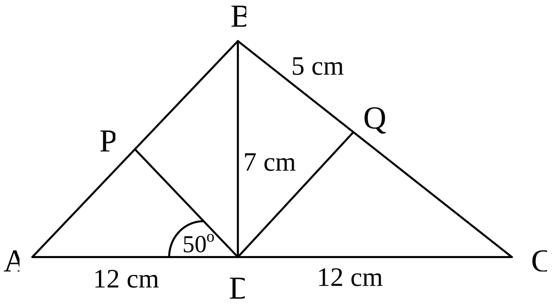
$$\frac{1}{x^2(x^2+a^2)}$$ (8)

18. Prove that the sum of all positive integers less than 100 which do not contain the digit 7 is 3762. (8)

19. Write down and simplify the expansion of $(1-P)^5$. Use this result to find the expansion of $(1-x-x^2)^5$ in assending power of x as far as the terms in x^3. Find the value of x which would enable you to estimate $(0.9899)^5$ from this expansion. (8)

20. Draw the graph of $y = cot\ x$ for the complete period. (8)

21.



The diagram shows the supports for the roof of a building in which $\overline{BD} = 7cm$, $\overline{AD} = \overline{DC} = 12cm$, $\overline{BQ} = 5cm$, $\angle P\hat{D}A = 50^o$, then calculate

(i) $\angle B\hat{A}D$ (ii) $\overline{PD}$ (iii) $\overline{DQ}$ (iv) $\overline{CQ}$ (8)

22. Solve the given equations.

$x^2 - y^2 = 5$
$4x^2 - 3xy = 18$ (8)

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Federal Board HSSC – I Examination
Mathematics – Mark Scheme

SECTION A

Q.1

i.	A	ii.	D	iii.	B
iv.	B	v.	A	vi.	B
vii.	C	viii.	C	ix.	C
x.	B	xi.	D	xii.	A
xiii.	B	xiv.	B	xv.	A
xvi.	B	xvii.	B	xviii.	C
xix.	C	xx.	A		

(20×1=20)

SECTION B

Q.2 **(4)**

$$\frac{\frac{1}{a}-\frac{1}{b}}{1-\frac{1}{ab}}$$

$$=\frac{\frac{1}{a}\times\frac{b}{b}-\frac{1}{b}\times\frac{a}{a}}{1\cdot\frac{ab}{ab}-\frac{1}{ab}}$$ Multiplication (1 mark)

$$=\frac{\frac{b}{ab}-\frac{a}{ab}}{\frac{ab}{ab}-\frac{1}{ab}}$$ Golden rule of fraction (1 mark)

$$=\frac{\frac{1}{ab}(b-a)}{\frac{1}{ab}(ab-1)}$$ Distribution property of multiplication over subtraction (1 mark)

$$=\frac{\cancel{\frac{1}{ab}}(b-a)}{\cancel{\frac{1}{ab}}(ab-1)}$$ Cancellation property (1 mark)

Q.3 **(4)**

Given that a, b ε G & G is group so

$(ab)\, b^{-1}a^{-1}) = a\,(bb^{-1})\, a^{-1}$

$= a(e)\, a^{-1}$

$= a\, a^{-1}$

$= e$ -------------------------- I (2 marks)

Now let

$(b^{-1}a^{-1})\,(ab) = b\,(a^{-1}a)\, b$

$= b^{-1}(e)\, b$

$= b^{-1}b$

$= e$ ------------------ II (2 marks)

From I & II ab & $b^{-1}a^{-1}$ are inverse of each other.

Q.4 **(4)**

$$A = \begin{pmatrix} i & 1+i \\ 1 & -i \end{pmatrix}$$

$$\overline{A} = \begin{pmatrix} -i & 1-i \\ 1 & i \end{pmatrix}$$ (1 mark)

$$\left(\overline{A}\right)^t = \begin{pmatrix} -i & 1 \\ 1-i & i \end{pmatrix}$$

$$A + \left(\overline{A}\right)^t = \begin{pmatrix} i & 1+i \\ 1 & -i \end{pmatrix} + \begin{pmatrix} -i & 1 \\ 1-i & i \end{pmatrix}$$

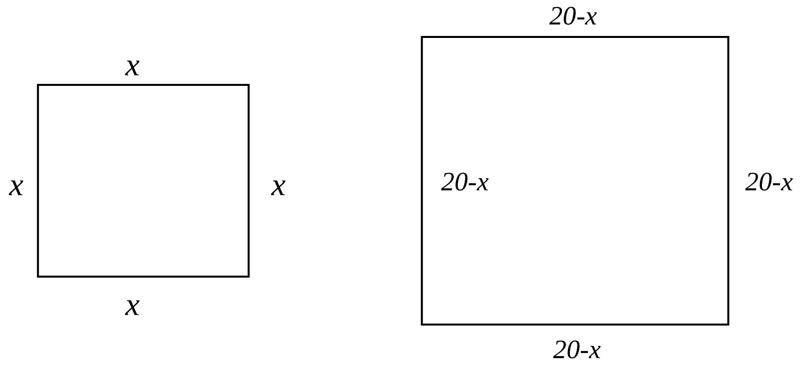
$$A + \left(\overline{A}\right)^t = \begin{pmatrix} 0 & 2+i \\ 2-i & 0 \end{pmatrix}$$ (1 mark)

Let $B = A + (\overline{A})^t$

$$\overline{B} = \begin{pmatrix} 0 & 2-i \\ 2+i & 0 \end{pmatrix} \Rightarrow (\overline{B})^t = \begin{pmatrix} 0 & 2+i \\ 2-i & 0 \end{pmatrix}$$ (2 marks)

So $(\overline{B})^t = B$ $\quad$ *Hence* $A + (\overline{A})^t$ Harmitian Matrix

Q.5 **(4)**



Let length of each side of one square = *x*cm

Remaining Length of wire = 80 -4x (1 mark)

Length of each side of other square $=\frac{80-4x}{4}$

$= 20 - x$ (1 mark)

By given condition

$$x^2 + (20\text{-}x)^2 = 300$$

$$x^2 - 20\text{-}x+50 = 0$$

$$x=\frac{-(20)\pm\sqrt{(-20)^2-4(1)(50)}}{2}$$ (1 mark)

$x = 17.07$ $x = 2.93$ (1 mark)

Hence length of sides of square is 2.93 cm & 17.07 cm.

Q.6 **(4)**

$$\frac{x^4}{x^3+1} \qquad \begin{array}{r|l} & x \\ \hline x^3+1 & x^4 \\ & -x^4 \pm x \\ \hline & -x \end{array}$$

$$= \quad x-\frac{x}{x^3+1}$$ (1 mark)

For partial fraction Let

$$\frac{x}{x^3+1}=\frac{x}{(x+1)(x^2-x+1)}$$

$$\frac{x}{(x+1)(x^2-x+1)}=\frac{A}{x+1}+\frac{Bx+C}{x^2-x+1} \qquad \rightarrow \qquad I$$

Multiplying with $(x+1)(x^2\text{-}x\text{-}1)$

$$x = A(x^2-x+1) + (Bx+c)(x+1) \qquad \rightarrow \qquad II$$

$Put\ x+1=0 \quad \Rightarrow \quad x=-1$

$1 = A(1 + 1 - 1) \Rightarrow \boxed{A=-1}$ (1 mark)

Comparing the coefficient of x^2 on both sides

$0=A+B\Rightarrow\boxed{B=+1}$

Comparing the coefficient of x

$1 = -A + B + C$

$1 = 1 + 1 + C$

$\boxed{C=-1}$ So putting A, B, C in I (1 mark)

$$\frac{x}{(x+1)(x^2-x+1)}=\frac{-1}{x+1}+\frac{x-1}{x^2-x+1}$$

Hence complete Partial fraction is

$$\frac{x^4}{x^3+1}=x+\frac{1}{x+1}-\frac{x-1}{x^2-x+1}$$ (1 mark)

Q.7 **(4)**

$y = 1+2x+4x^2+8x^3+$-------------------------$\propto$

$a = 1, r = 2x$ than (1 mark)

$S_\infty = \frac{a}{1-r}$

$y = \frac{a}{1-r}$ (1 mark)

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

$y - 2xy = 1$ (1 mark)

$y - 1 = 2x$

$2xy = y - 1$ (1 mark)

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

Q.8 **(4)**

Total members of the club = 20

No of boys = 12

No. of Girls = 8 (1 mark)

No. of ways of selecting 3 boys = ${}^{12}C_3$

= 220 (1 mark)

No. of ways of selecting 2 girls = ${}^{8}C_2$

= 28 (1 mark)

Total No. of ways $= {}^{12}C_3 \times {}^{8}C_2$

$= 220 \times 28$

= 6160 (1 mark)

Q.9 **(4)**

According to the problem

$a = -\frac{1}{2x}, \qquad b = x, \quad n = 3n$

Total No. of terms = $3x$+1, Required term = 2x +1

So r = 2n (1 mark)

$T_{r+1} = \binom{n}{r} a^{n-r} b^r$ (1 mark)

$$T_{r+1} = \binom{3n}{2n} \left(-\frac{1}{2x}, \right)^{3n-2n} . \ (x)^{2n}$$

$$= \frac{(3n)1}{x^1 (2^n)1} . \frac{(-1)^n}{2^n} . \ x^n$$

$$= \frac{(-1)^n}{2^n} \cdot \frac{(3n)1}{n1(2n)1} \cdot x^n$$ (2 marks)

Q.10 **(4)**

$Cot\theta = \sqrt{7} \quad \Rightarrow \quad \tan\theta = \frac{1}{\sqrt{7}}$

tan θ is +ve so θ lies in IIIrd quad (1 mark)

So y = -1 , x = $-\sqrt{7}$

$r^2 = x^2 + y^2$

$r^2 = 1+7$ (1 mark)

$r^2 = 8$

$r = \sqrt{8} \quad = 2\sqrt{2}$

Sin θ = *y/r*

$Sin\theta = \frac{-1}{2\sqrt{2}}$

$Cos\theta = \frac{-\sqrt{7}}{2\sqrt{2}}$

$Co\sec\theta = -2\sqrt{2}$

$Co\sec\theta = {}^{-2\sqrt{2}}\!\big/_{\sqrt{7}}$ (2 marks)

Q.11 **(4)**

$Cos4x = Cos(2\,(2x))$

$= Cos^2 2x - Sin^2 2x$ (1 mark)

$= (Cos^2 x - Sin^2 x) - (2sin\ cos)^2$

$= (Cos^2 x - Sin^2 x) - 4sin^2 x\ cos^2 x$ (1 mark)

$= (2\ Cos^2 x -1)2 - 4\ (1-Cos^2 x)\ Cos^2 x$

$= 4\ Cos^4 x - 4Cos^2 + 1 - 4(1 - Cos^2 x)\ Cos^2 x$

$= 8\ Cos^4 x - 8Cos^2 + 1$ (2 marks)

Q.12 **(4)**

Given that r_1, r_2, r_3 are all in an A.P, so

$r_2 - r_1 = r_3 - r_2$ (1 mark)

$$\frac{\Delta}{s-b} - \frac{\Delta}{s-a} = \frac{\Delta}{s-c} - \frac{\Delta}{s-b}$$

$$\Delta\left(\frac{1}{s-b} - \frac{1}{s-a}\right) = \Delta\left(\frac{1}{s-c} - \frac{1}{s-b}\right)$$ (1 mark)

$$\Delta\left(\frac{s-a-s+b}{(s-a)(s-b)}\right) = \Delta\left(\frac{s-b-s+c}{(s-c)(s-b)}\right)$$

$$\frac{b-a}{s-a} = \frac{c-b}{s-c}$$ (1 mark)

$$\frac{a-b}{s-a}=\frac{b-c}{s-c}$$

$(a-b)(s-c)=(b-c)(s-a)$ (1 mark)

Q.13 **(4)**

$$Cos^{-1}(2x^2-2x)=\frac{2\pi}{3}$$

$(2x^2-2x)=Cos\frac{2\pi}{3}$ (1 mark)

$$(2x^2-2x)=Cos120^o$$

$$(2x^2-2x)=-{}^{1}\!/_{2}$$

$4x^2-4x=1$ (1 mark)

$$4x^2-4x+1=0$$

$$a=4,\quad b=-4,\quad c=1$$

$x=\frac{4\pm\sqrt{16-16}}{8}$ (1 mark)

$$x=\frac{4}{8}\quad=\frac{1}{2}$$

$Hence\ \ x={}^{1}\!/_{2}$ (1 mark)

Q.14 **(4)**

$$\frac{1}{Sin^2\theta}=\frac{4}{3}$$

$$\frac{1}{Sin\theta}=\pm\frac{2}{\sqrt{3}}$$

$Sin\theta=\frac{\sqrt{3}}{2}$, $Sin\theta=\frac{-\sqrt{3}}{2}$ (1 mark)

<u>Case I</u>

If $Sin\theta=\frac{\sqrt{3}}{2}$

$\theta = 60^0 = \frac{\pi}{3}$ (1 mark)

Sinθ is +ve so θ lies in Ist and 2nd quadrant.

In Ist quadrant	In 2nd quadrant
$\theta_1 = \theta$	$\theta_2 = \pi - \theta$
$\theta_1 = \frac{\pi}{3}$	$= \pi - \frac{\pi}{3}$
	$\theta_2 = \frac{2\pi}{3}$

(1 mark)

Case II

$Sin\theta = \frac{-\sqrt{3}}{2}$

Sinθ is –ve so θ lies in IIIrd and 4th quadrant

In IIIrd quadrant	In 4th quadrant
$\theta_3 = \pi + \theta$	$\theta_4 = 2\pi - \theta$
$= \pi + \frac{\pi}{3}$	$= 2\pi - \frac{\pi}{3}$
$\theta_3 = \frac{4\pi}{3}$	$\theta_4 = \frac{5\pi}{3}$

(1 marks)

Q.15 **(4)**

Let α, β be the roots of equation

$x^2 - Px + q = 0$ then (1 mark)

$\alpha + \beta = -b/a$

$\boxed{\alpha + \beta = P}$

$\alpha\ \beta = c/a$

$\boxed{\alpha\ \beta = q}$ (1 mark)

According to given problem

$\alpha - \beta = 1$

$(\alpha - \beta)^2 = (1)^2$

$(\alpha - \beta)^2 = 1$ (1 mark)

$(\alpha + \beta)^2 - 4\alpha\ \beta = 1$

$P^2 - 4q = 1$

$\boxed{P^2 = 4q + 1}$ (1 mark)

SECTION C

Q.16 **(8)**

$x_1 + 3x_2 + 2x_3 = 3$

$4x_1 + 5x_2 - 3x_3 = -3$

$3x_1 - 2x_2 + 17x_3 = 42$

$$A = \begin{pmatrix} 1 & 3 & 2 & : & 3 \\ 4 & 5 & -3 & : & -3 \\ 3 & -2 & 17 & : & 42 \end{pmatrix} \begin{matrix} R_2 - 4R_1 \\ R_3 - 3R1 \end{matrix}$$ (1 mark)

$$= \begin{pmatrix} 1 & 3 & 2 & : & 3 \\ 0 & -7 & -11 & : & -15 \\ 0 & -8 & 11 & : & 33 \end{pmatrix} R_2 + R_3$$ (1 mark)

$$=\begin{pmatrix} 1 & 3 & 2 & : & 3 \\ 0 & 1 & 0 & : & -6/5 \\ 0 & 0 & -11/8 & : & -33/8 \end{pmatrix} \qquad \frac{R_2}{-15} \quad \frac{R_3}{-8}$$ (1 mark)

$$=\begin{pmatrix} 1 & 3 & 2 & : & 3 \\ 0 & 1 & 1 & : & -6/5 \\ 0 & 0 & 0 & : & 3 \end{pmatrix} \qquad R_3 \times \frac{-8}{11}$$ (1 mark)

$$=\begin{pmatrix} 1 & 0 & 2 & : & 33/5 \\ 0 & 1 & 0 & : & -6/5 \\ 0 & 0 & 1 & : & 3 \end{pmatrix} \qquad R_1 - 3R_2$$ (1 mark)

$$=\begin{pmatrix} 1 & 0 & 0 & : & 3/5 \\ 0 & 1 & 0 & : & -6/5 \\ 0 & 0 & 1 & : & 3 \end{pmatrix} \qquad R_1 - 2R_3$$ (1 mark)

Equations are (1 mark)

$x_1 = 3/5$

$x_2 = -6/5$

$x_3 = 3$ S.S. $\left\{\left(3/5, \frac{-6}{5}, 3\right)\right\}$ (1 mark)

Q.17 **(8)**

$$\frac{1}{x^2(x^2+a^2)} = \frac{A}{x} + \frac{B}{x^2} + \frac{Cx+D}{x^2+a^2}$$

$1 = Ax(x^2+a^2) + B(x^2+a^2) + (Cx+D)(x^2)$ -------------------I

$1 = A(x^3+a^2x) + B(x^2+a^2) + C(x^3) + D(x^2)$ ------------------II

Put $x = 0$ *in equation 1* (2 marks)

$1 = B(0+a^2)$

$1 = a^2B \quad \Rightarrow \quad B = \frac{1}{a^2}$ (1 mark)

Comparing the co-efficients of like powers of ‘x’

$0 = A+C$------------------III $0 = B+D$------------------IV

$0 = a^2 A$------------------V

Eq –V ⇒ A = 0

Put A = 0 in III ⇒ 0 = 0 +c

C = 0

Put $B = \frac{1}{a^2}$ in IV

$0 = \frac{1}{a^2} + D \qquad D = \frac{-1}{a^2}$ (3 marks)

$$\frac{1}{x^2(x^2+a^2)} = \frac{0}{x} + \frac{1}{a^2x^2} + \frac{0x - \frac{1}{a^2}}{x^2+a^2}$$

$= \frac{1}{a^2x^2} - \frac{1}{a^2(x^2+a^2)}$ (2 marks)

Q.18 **(8)**

First '99'positive integers are 1, 2,3, ………………….99

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

$S_{99} = \frac{99}{2}[2\times1+(99-1)\times1]$

$S_{99} = \frac{99}{2}[2+98]$

$S_{99} = \frac{99}{2}\times100$

$S_{99} = 99\times50$

$S_{99} = 4950$ (3 marks)

Now, sum of numbers like 7+17+27+37…………97

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

$S_{10} = \frac{10}{2}[2\times7+(10-1)\times10]$

$S_{10} = 5[14+90]$

$S_{10} = 5\times104$

$S_{10} = 520$ (3 marks)

Also sum of the numbers like 70+71+72+73+74+75+76+78+79
= 668 (1 mark)

Required sum = 4950 – 520 – 668
= 3762 (1 mark)

Q.19 **(8)**

We have

$$(1+x)n = 1+nx+\frac{n(n-1)}{2!}x^2+\frac{n(n-1)(n-2)}{2!}x3+--------$$

$$(1-P)^5 = 1+5(-P)+\frac{5(4)}{2!}(-P)^2+\frac{5(4)(3)}{3!}(-P)^3+-------$$

$= 1-5P+10P^2-10P^3+-----------$ (3 marks)

Put $P = x+x^2$ in above expression

$$[1-(x+x_2)]^5 = 1-5(x+x^2)+10(x+x^2)^2 + ----------$$
$$= 1-5x-5x^2+10(x^2+2x^3+------)$$
$$= 1-5x-5x^2+10x^2+20x^3+------$$
$$= 1-5x+5x^2+20x^3+------$$
(3 marks)

New $(0.9899)^5 = (1-0.0101)^5$
$= 1-5\ (+\ 0.0101) + 10(-0.0101)^2$
$= 1-0.0505 + 0.00102$
$= 0.9495$
(2 marks)

Q.20 **(8)**

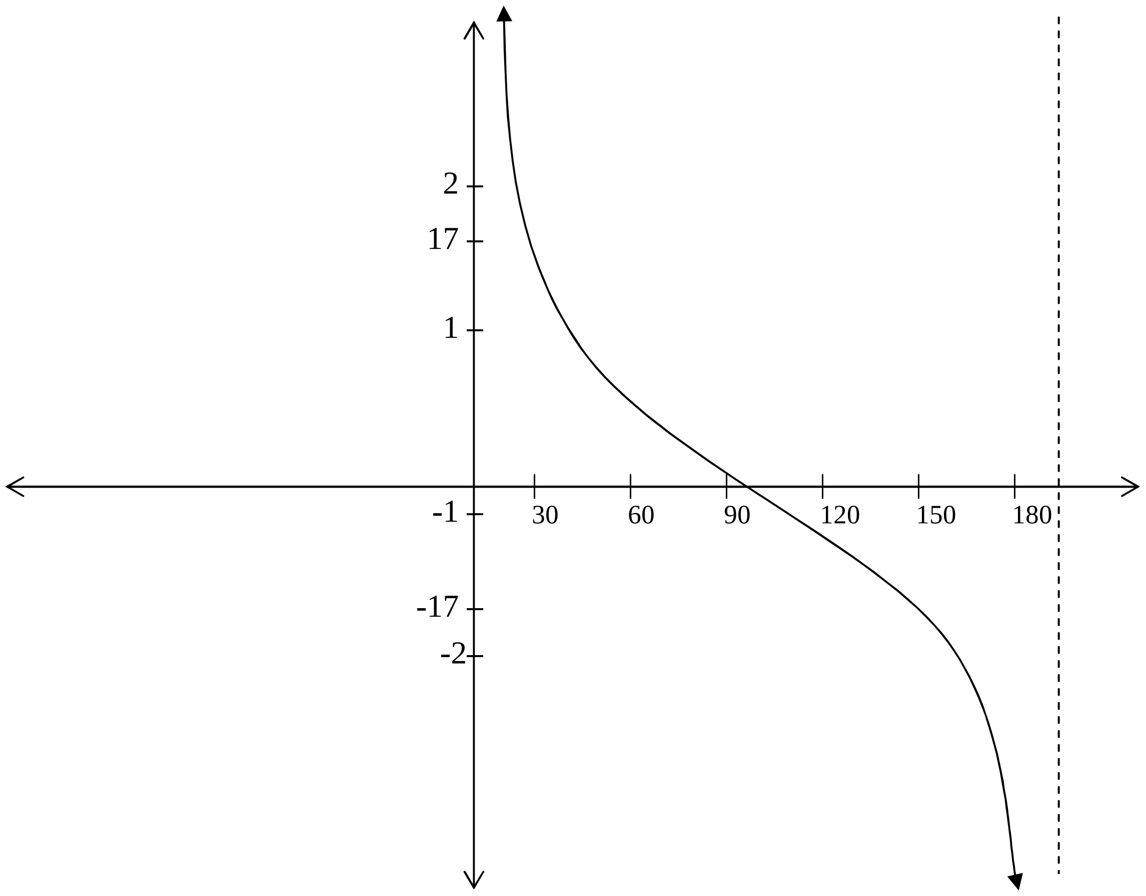
y = cot π   x ε [0   π]

Period of cot x is π so complete period

Is 0 to π (2 marks)

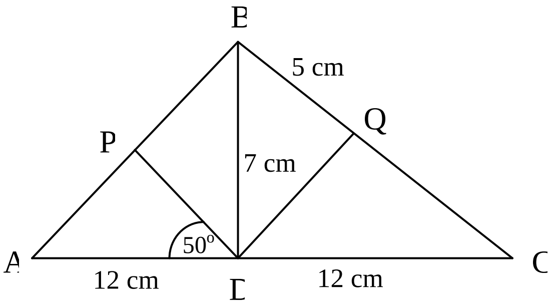
x	0	$\pi/6$	$\pi/3$	$\pi/3$	$\pi/2 - 0$	$2\pi/2 + 0$	$5\pi/3$	π
y	$\pm\infty$	1.73	0.58	∞	$-\infty$	-0.58	1.73	$+\infty$

(2 marks)



(4 marks)

Q.21 **(8)**



I. In ΔAPD

$\angle P\hat{A}D + 50^o + 90^o = 180^o$

$\angle P\hat{A}D = 40^o$

$\angle P\hat{A}D = \angle B\hat{A}D = 40^o$

(2 marks)

II.

$\angle P\hat{A}B = 40^o$

$In\ \Delta BPD$

$Cos 40^o = \frac{PD}{7}$

$PD = 7\cos 40^o$

$PD =$

(2 marks)

III.

$DQ = ?$

$In\ \Delta BDQ$

$(BD)^2 = (BQ)^2 + (DQ)^2$

$49 = 25 + (DQ)^2$

$DQ = \sqrt{24}$

(2 marks)

IV.

$CQ = ?$

$In\ \Delta DQC$

$(DC)^2 = (DQ)^2 + (CQ)^2$

$(12)^2 = (\sqrt{24})^2 + (CQ)^2$

$(CQ)^2 = 144 - 24$

$(CQ)^2 = 120$

$(CQ) = \sqrt{120}$

(2 marks)

Q.22 **(8)**

Solve the given equations.

x^2-y^2 = 5 ---------------*I* 4x^2-3xy=18---------------*II* (1 mark)

Multiply eq 1 by 18 and eq 2 by 5 and then subtracting

$$\begin{array}{l} 18x^2 - 18y^2 = \cancel{90} \\ \underline{-20x^2 \pm 15xy = \cancel{-90}} \\ -2x^2 \pm 15xy - 18y^2 = 0 \end{array}$$

(1 mark)

$$2x^2 - 15xy + 18y^2 = 0$$

$$2x^2 - 12xy - 3xy + 18y^2 = 0$$

$$2x(x-6y) - 3y(x-6y) = 0$$

$$(x-6y)(2x-3y) = 0$$

$$x - 6y = 0 \qquad 2x - 3y = 0$$

$$x = 6y \qquad 2x = 3y$$

$$x = 6y \; ----III \qquad x = \frac{3}{2}y --------IV$$

(1 mark)

$$Put\ x = 6y \quad in \quad eq----I$$

$$(6y)^2 - y^2 = 5$$

$$36y^2 - y^2 = 5$$

$$35y^2 = 5$$

$$y^2 = \frac{1}{7}$$

$$y = \pm\frac{1}{\sqrt{7}}$$

$$Putrt \quad y = \pm\frac{1}{\sqrt{7}} \quad in \quad eq\ III$$

$$x = 6(\pm\frac{1}{\sqrt{7}})$$

$$x = \pm\frac{6}{\sqrt{7}}$$

$$Put\ x = \frac{3}{2}y\ in \quad eq-----I$$

$$(\frac{3}{2}y)^2 - y^2 = 5$$

$$\frac{9}{4}y^2 - y^2 = 5$$

$$9y^2 - 4y^2 = 20$$

$$5y^2 = 20$$

$$y^2 = 4$$

$$y = \pm 2$$

$$Put \quad y = \pm 2\ in \quad eq\ IV$$

$$x = \frac{3}{2}(\pm 2)$$

$$x = (\pm 3)$$

(4 marks)

$$S.S. = \left\{\left(\frac{6}{\sqrt{7}}, \frac{1}{\sqrt{7}}\right)\!.\!\left(\frac{-6}{\sqrt{7}}, \frac{-1}{\sqrt{7}}\right)\!.(3,2),\ (-3,-2)\right\}$$ (1 mark)

The End