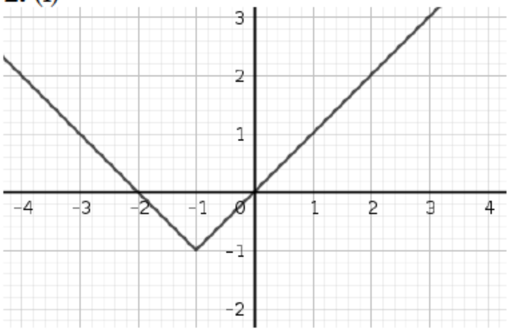
SECOND TERM EXAMINATION, ANSWER KEY, DEC - 2024

1. (i) (d) B⊆A (ii) {{}, {-1}, {1}, {-1,1}}
(iii) {x : x = 3k , k =1, 2, 3, 4, 5}

2. (i)



(ii) Domain R ; Range = $[-1, \infty)$

3. (i) (b) $\frac{1}{2}$ (ii) cos 75 = cos (45+30)
= cos 45.cos30 - sin45 sin30
$= \frac{1}{\sqrt{2}}.\frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}}.\frac{1}{2} = \frac{\sqrt{3}-1}{2\sqrt{2}}$

4. (i) (b) 6
(ii) 5! x $^6P_3$ = 5.4.3.2.1 x 6.5.4 = 14400

5. a = 3, r = $\frac{1}{2}$, Sn = $\frac{3069}{512}$

$Sn = \frac{a(1-r^n)}{(1-r)} = \frac{3\left(1-\frac{1}{2^n}\right)}{1-\frac{1}{2}} = 6\left(1-\frac{1}{2^n}\right)$

$\frac{3069}{512} = 6\left(1-\frac{1}{2^n}\right)$; $\frac{3069}{3072} = \left(1-\frac{1}{2^n}\right)$

$\frac{1}{2^n} = \frac{3}{3072} = \frac{1}{1024} = \frac{1}{2^{10}}$: n = 10

6. Distance from (a, b) to the lines are equal.

∴ $\left|\frac{9a+6b-7}{\sqrt{9^2+6^2}}\right| = \left|\frac{3a+2b+6}{\sqrt{3^2+2^2}}\right|$; $\left|\frac{9a+6b-7}{\sqrt{117}}\right| = \left|\frac{3a+2b+6}{\sqrt{13}}\right|$

$\left|\frac{9a+6b-7}{3\sqrt{13}}\right| = \left|\frac{3a+2b+6}{\sqrt{13}}\right|$;

$9a + 6b - 7 = -3(3a + 2b + 6)$
$18a + 12b + 11 = 0$
Required line is $18x + 12y + 11 = 0$

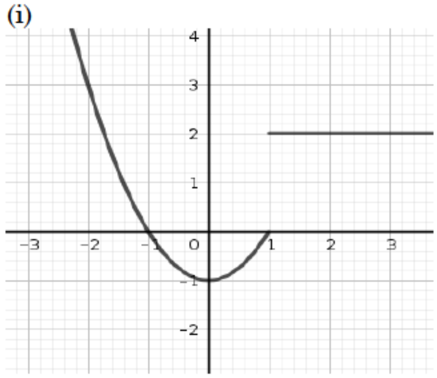
7. (i) Centre of the circle is (3, 4)
Radius = $\sqrt{(-1-3)^2 + (-2-4)^2}$
$= \sqrt{16 + 36} = \sqrt{52}$
Equation of the circle is
$(x-3)^2 + (y-4)^2 = 52$

(ii) $x^2 = -\frac{1}{4}y = -4\left(\frac{1}{16}\right)y$, a = $\frac{1}{16}$
Focus = $\left(0, -\frac{1}{16}\right)$, Directrix y = $\frac{1}{16}$

8. (i) e = 1
(ii) $3x^2 - y^2 + x - 2y + 5 = 0$ - Hyperbola
$x^2 + 3y^2 + 2x + y + 3 = 0$ - Wrong Qn
$2x^2 + 2y^2 - 3y + 2 = 0$ - Wrong Qn
$x^2 - 4x - 4y + 3 = 0$ - Parabola

9. (i) ∅ (ii) B ∪ C = {1, 2, 4, 5, 6}
A – (B ∪ C) = {3, 7}
A – B = {1, 3, 5, 7} ; A – C = {2, 3, 4, 6, 7}
(A – B) ∩(A – C) = {3, 7}
∴ A – (B ∪ C) = (A – B) ∩(A – C)

10. (i)



$f(x) = \begin{cases} x^2 - 1 , & if\ x \le 1 \\ 2 , & if\ x > 1 \end{cases}$

(ii)Domain = $\mathbb{R} - (-1, 1)$ Range = $[0, \infty)$

11. (i) (b) – sin x
(ii) $\cos x = -\frac{1}{2}$, $\sin x = -\frac{\sqrt{3}}{2}$,
$\tan x = \sqrt{3}$, $\operatorname{cosec} x = -\frac{2}{\sqrt{3}}$

$4\tan^2 x - 3\operatorname{cosec}^2 x = 4\left(\sqrt{3}\right)^2 - 3\left(\frac{-2}{\sqrt{3}}\right)^2 = 8$

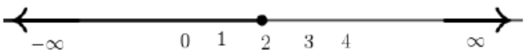
(iii) $\sin\left(\frac{-11\pi}{3}\right) = \sin\left(\frac{-11\pi}{3} + 4\pi\right) = \sin\left(\frac{\pi}{3}\right) = \frac{\sqrt{3}}{2}$

12. (i) (d) 0
(ii) $(3-2i)^2 = 3^2 - 2(3)(2i) + (2i)^2 = 5 - 12i$
(iii) Multiplicative inverse = $\frac{1}{5-12i}$
$= \frac{1}{5-12i} \cdot \frac{5+12i}{5+12i} = \frac{5+12i}{5^2+12^2} = \frac{5+12i}{169}$

13. (i) $37-(3x+5) \geq 9x-8(x-3)$

$37-3x-5 \geq 9x-8x+24$

$-4x \geq -8$; $x \leq 2$



(ii) Let the minimum mark is x.

$\frac{70+60+x}{3} \geq 50$; $130+x \geq 150$; $x \geq 20$

∴ the minimum mark is 20

14. (i) (c) 0

(ii) $(a+b)^4 = a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$

$(a-b)^4 = a^4 - 4a^3b + 6a^2b^2 - 4ab^3 + b^4$

$(a+b)^4 - (a-b)^4 = 2[a^4 + 6a^2b^2 + b^4]$

$(\sqrt{3}+\sqrt{2})^4 - (\sqrt{3}-\sqrt{2})^4$

$= 2\left[(\sqrt{3})^4 + 6(\sqrt{3})^2(\sqrt{2})^2 + (\sqrt{2})^4\right]$

$= 2[9+36+4] = 2 \times 49 = 98$

15. $\frac{x^2}{16} - \frac{y^2}{9} = 1$; For hyperbola, $a^2+b^2=c^2$

∴ a = 4, b = 3, c = 5

Focii = $(\pm c, 0) = (\pm 5, 0)$

Vertices = $(\pm a, 0) = (\pm 4, 0)$

Eccentricity, e = $\frac{c}{a} = \frac{5}{4}$

Length of latus rectum = $\frac{2b^2}{a} = \frac{9}{2}$

16. $A = (3,0,0)$; $B = (3,2,0)$; $C = (0,2,0)$;

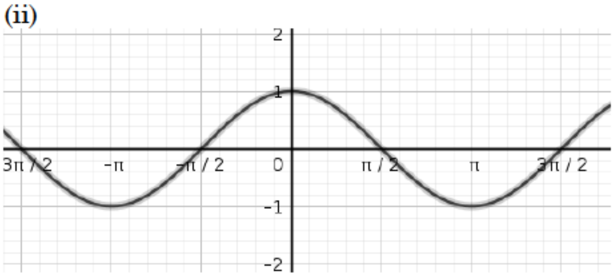
$E = (0,0,4)$; $F = (0,2,4)$; $H = (3,0,4)$

$|CG| = \sqrt{3^2+0+4^2} = 5$

17. (i) $l = r\theta$; l = 31.4 cm ; θ = $\frac{\pi}{3}$

$r = \frac{l}{\theta} = \frac{31.4}{\frac{\pi}{3}} = \frac{10\pi}{\frac{\pi}{3}} = 30$ cm

(ii)



(iii) sin 6x + sin 2x + 2 sin 4x

$= 2\sin 4x.\cos 2x + 2\sin 4x$

= 2 sin 4x (cos 2x + 1)

= 2 sin 4x . 2 $\cos^2$x

= 4 sin 4x $\cos^2$x

18. (i) $10P_r = 9P_5 + 5 \times 9P_4$

= 9.8.7.6.5+ 5. 9.8.7.6

= 2 x 9.8.7.6.5

= 10. 9. 8. 7. 6 = $10P_5$ => r = 5

(ii) Number of 4 digit numbers = $5P_4 = 120$

Number of 4 digit even numbers = 2 x $4P_3$

= 48

(iii) Number of arrangements = $\frac{8!}{3!2!} \times \frac{5!}{4!}$

= 16800

19. (i) (b) 4

(ii) a = 1, $a_5 = 256$;

$ar^4 = 256$ => $r^4 = 4^4$ => r = 4 ;

Numbers are 4, 16, 64

(iii) Let the numbers are $\frac{a}{r}, a, ar$;

Product = 1 ; $\frac{a}{r}.a.ar = 1 \Rightarrow a = 1$

Sum = $\frac{39}{10}$; $\frac{1}{r} + 1 + r = \frac{39}{10}$

$10 + 10r + 10r^2 = 39r$

$10r^2 - 29r + 10 = 0$:

(2r – 5) . (5r – 2) = 0 => $r = \frac{5}{2}$ or $\frac{2}{5}$

Numbers are $\frac{5}{2}$, 1, $\frac{2}{5}$

20. (i) (d) 90^0

(ii) (b) (4, 7)

(iii) (a) Slope of the perpendicular = $\frac{9-0}{-2-0} = -\frac{9}{2}$

Slope of the required line = $\frac{2}{9}$

Equation of the required line is

$y - 9 = \frac{2}{9}(x - -2)$

ie, $2x - 9y + 85 = 0$

(b) Distance from the origin to the line is

$\sqrt{(-2)^2+(9)^2} = \sqrt{85}$

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