MARKING SCHEME MATHEMATICS CLASS 11

SECTION-A

1. $\frac{(n+2)!}{(n+1)!}=$……………………………………..

A) $(n+1)!$ B) $(n+2)!$ **C) $(n+2)$** D) $(n+1)$

2. A square matrix $A=[a_{ij}]_{m\times n}$ is called upper triangular if:

A) $a_{ij}=0, \forall\, i>j$ B) $a_{ij}=0, \forall\, i<j$ C) $a_{ij}=0, \forall\, i=j$ D) $a_{ij}=1, \forall\, i=j$

3. The concept of complex numbers as a+bi form was given by………………..

A) Gauss B) Newton C) Archimedes D) Euler

4. If a square matrix A has two identical rows or columns then $\det(A)=$………….

A) Zero B) not equal to zero C) negative D) none of these

5. The period of $\sin\frac{2}{3}x$ is ……………………

A) π B) 2π **C) 3π** D) 4π

6. If $\vec{a}, \vec{b}, \vec{c}$ are three non-zero vectors, then the expression $\vec{a}.(\vec{b}.\vec{c})$ is ……………………

A) Scalar triple product B) Volume of parallelepiped **C) Meaningless** D) Dot product

7. The axis of symmetry of the parabola $y=3x^2-6x+1$ is ………………………..

A) $x=-1$ **B) $x=1$** C) $x=-2$ D) $x=2$

8. The maximum value of the function f(x,y)=2x+4y subjected to the constraints x≥3 and y≥3 is ………..

A) 24 B) 20 **C) 18** D) 4

9. If terminal ray of θ is in the fourth quadrant, then $\frac{\theta}{2}$ lies in ……………………. quadrant.

A) First **B) Second** C) Third D) Fourth

10. If $y=\sin 6\theta$ then frequency is …………………..

A) 2π B) $\frac{\pi}{3}$ **C) $\frac{3}{\pi}$** D) $\frac{2\pi}{3}$

11. If A is a non zero matrix then number of non zero row in its echelon form is called…………… of the matrix.

A) Solution **B) Rank** C) Value D) none of these

12. The number of terms in the expansion of $(a+b)^{100}$ is …………………

A) 99 B) 100 **C) 101** D) 102

13. The sum of the odd coefficient in the binomial expansion of $(1+x)^n$ is equal to…………

A) 2^n B) $2^{(n+1)}$ C) $2^{(n-2)}$ **D) $2^{(n-1)}$**

14. Two vectors $\vec{a}$ and $\vec{b}$ are parallel, for scalar λ if and only if ………..

A) $a \neq b$ B) $a = \lambda + b$ **C) $\boldsymbol{a = \lambda b}$** D) none of these

15. If $f(x) = \frac{1}{x}$ then domain of $f(x)$ is …………………

A) $\mathcal{R}$ B) $R - 0$ **C) $\boldsymbol{\mathcal{R} - \{0\}}$** D) ∞

16. If $Sin\theta = \frac{4}{5}$, then $Sin\ 3\theta =$……………………

A) $\frac{11}{125}$ B) $\frac{33}{125}$ **C) $\boldsymbol{\frac{44}{125}}$** D) $\frac{22}{125}$

17. A coin is flipped thrice. The number of sample space points are ……………

A) 3 **B) 8** C) 9 D) 12

18. $1^2 + 2^2 + 3^2 + \cdots + n^2 =$………………………………………

A) $\frac{n}{2}$ B) $\frac{n(n+1)}{2}$ C) $\frac{n(n+1)(2n+1)}{6}$ **D) $\boldsymbol{\left(\frac{n(n+1)}{2}\right)^2}$**

19. If none of the angle of a triangle is right angle is called ………………… triangle.

A) Obtuse **B) Oblique** C) Acute D) None

20. Infinite geometric series is convergent if and only if ………………………………..

A) $\boldsymbol{|r| < 1}$ B) $|r| \geq 1$ C) $|r| > 1$ D) $|r| \geq 1$

Section-B

Q-No-1(i) Solution: $z^3 = -1$

$z^3 + 1 = 0$

$z^3 + 1^3 = 0$

$(z+1)(z^2 - 2z + 1) = 0$

Either $z + 1 = 0$ or $z^2 - 2z + 1 = 0$

2 marks

$$z = -1 \text{ or } z = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Or $z = \frac{+2 \pm \sqrt{(-2)^2 - 4(1)(1)}}{2(1)}$

Or $z = \frac{+2 \pm \sqrt{4-4}}{2(1)}$

Or $z = \frac{2}{2}$

2 marks

Or $z = 1$

Solution is $z = -1$ and $z = 1$

1 mark

Q-No-1(ii) Solution: *Given vector* $\vec{v} = \hat{\imath} + \sqrt{2}\hat{\jmath} + \hat{k}$

Now $\hat{v} = \frac{\vec{v}}{|\vec{v}|}$

$\hat{v} = \frac{\hat{\imath} + \sqrt{2}\hat{\jmath} + \hat{k}}{|\hat{\imath} + \sqrt{2}\hat{\jmath} + \hat{k}|}$

$\hat{v} = \frac{\hat{\imath} + \sqrt{2}\hat{\jmath} + \hat{k}}{\sqrt{1+2+1}}$

$\hat{v} = \frac{\hat{\imath} + \sqrt{2}\hat{\jmath} + \hat{k}}{2}$

$\hat{v} = \frac{1}{2}\hat{\imath} + \frac{\sqrt{2}}{2}\hat{\jmath} + \frac{1}{2}\hat{k}$

2 marks

So direction cosines are $\cos\alpha = \frac{1}{2}$, $\cos\beta = \frac{\sqrt{2}}{2}$ and $\cos\gamma = \frac{1}{2}$

Now angle with $z -$ axis *is* $\cos\gamma = \frac{1}{2}$

2 marks

$\gamma = \cos^{-1}\left(\frac{1}{2}\right)$

$\gamma = 60^\circ = \frac{\pi}{3}$

1 mark

Q-No-1(iii) Solution: $L - H - S = \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix}$

$= \begin{vmatrix} 0 & 0 & 1 \\ a-b & b-c & c \\ a^3-b^3 & b^3-c^3 & c^3 \end{vmatrix}$ by $C_1 - C_2$ and $C_2 - C_3$

Expanding from R_1

2 marks

$$= 0\begin{vmatrix} b-c & c \\ b^3-c^3 & c^3 \end{vmatrix} - 0\begin{vmatrix} a-b & c \\ a^3-b^3 & c^3 \end{vmatrix} + 1\begin{vmatrix} a-b & b-c \\ a^3-b^3 & b^3-c^3 \end{vmatrix}$$

2 marks

$$= 0 + 0 + 1\begin{vmatrix} a-b & b-c \\ (a-b)(a^2+ab+b^2) & (b-c)(b^2+bc+c^2) \end{vmatrix}$$

Taking common $a-b$ *and* $b-c$ *from* C_1 and C_2 *respectivily*

$$= (a-b)(b-c)\begin{vmatrix} 1 & 1 \\ a^2+ab+b^2 & b^2+bc+c^2 \end{vmatrix}$$

$$= (a-b)(b-c)(b^2+bc+c^2-a^2-ab-b^2)$$

$$= (a-b)(b-c)\{b(c-a)+c^2-a^2\}$$

1 marks

$$= (a-b)(b-c)\{b(c-a)+(c+a)(c-a)\}$$

$$= (a-b)(b-c)(c-a)(a+b+c)$$

$$= R-H-S$$

Hence L-H-S=R-H-S

Q-No-1(iv) Solution:

$$\mathbf{L-H-S} = \frac{\mathbf{1+\tan^2\frac{\alpha}{2}}}{\mathbf{1-\tan^2\frac{\alpha}{2}}}$$

2 marks

$$= \frac{1+\frac{\sin^2\frac{\alpha}{2}}{\cos^2\frac{\alpha}{2}}}{1-\frac{\sin^2\frac{\alpha}{2}}{\cos^2\frac{\alpha}{2}}}$$

$$= \frac{\frac{\cos^2\frac{\alpha}{2}+\sin^2\frac{\alpha}{2}}{\cos^2\frac{\alpha}{2}}}{\frac{\cos^2\frac{\alpha}{2}-\sin^2\frac{\alpha}{2}}{\cos^2\frac{\alpha}{2}}}$$

2 marks

$$= \frac{1}{\cos\alpha}$$

$$= \sec\alpha$$

1 mark

$$= R-H-S$$

Hence $L-H-S = R-H-S$

Q-No-1(v) Solution:

Given $n(S) = 36$

Event for sum of 10 is $A = \{(4,6),(5,5),(6,4)\}$

So $n(A) = 3$

Event for sum of 11 is $B = \{(5,6),(6,5)\}$

So $n(B) = 2$

1 mark

$$P(A) = \frac{n(A)}{n(S)} = \frac{3}{36} = \frac{1}{12}$$

$P(B) = \frac{n(B)}{n(S)} = \frac{2}{36} = \frac{1}{18}$

Probability that the sum of digits is 10 or 11 is

$$P(AUB) = P(A) + P(B) = \frac{1}{12} + \frac{1}{18}$$

$$P(AUB) = \frac{3+2}{36} = \frac{5}{36}$$

2 marks

Now probability that the sum of digits is neither 10 nor 11 is

$$P(AUB)' = 1 - P(AUB) = 1 - \frac{5}{36} = \frac{31}{36}$$

2 marks

Q-No-1(vi) Solution:

Given x *is nearly equal to* 1

$\text{i.e } x = 1 + h$ *where* h *is so small that* h^2 *and higher power are neglected.*

Now taking

$$L - H - S = px^p - qx^q$$

$$= p(1+h)^p - q(1+h)^q$$

$$= p(1 + ph + \cdots) - q(1 + qh + \cdots) \text{ using Binomail series}$$

2 marks

Neglecting h^2 *and higher powers*

$$= p(1 + ph) - q(1 + qh)$$

$$= p + p^2h - q - q^2h$$

$$= (p - q) + (p^2 - q^2)h$$

$$= (p - q) + (p + q)(p - q)h$$

$$= (p - q)\{1 + (p + q)h\}$$

2 marks

$$= (p - q)(1 + h)^{p+q}$$

$$= (p - q)(x)^{p+q}$$

$$= R - H - S$$

Hence $L - H - S = R - H - S$

1 mark

Q-No-1(vii) Solution:

Let $A_1, A_2, \dots, A_n$ *are* n *arithmetic mean between* a *and* b

So Arithmetic sequence is

$a, A_1, A_2, \dots, A_n, b$

Now

$$a + A_1 + A_2 + \cdots + A_n + b = S_{n+2}$$

$$A_1 + A_2 + \cdots + A_n + (a + b) = \frac{n+2}{2}\{2a + (n+1)d\}$$

$$A_1 + A_2 + \cdots + A_n = \frac{n+2}{2}\{2a + (n+1)d\} - (a + b)$$

2 marks

$$A_1 + A_2 + \cdots + A_n = \frac{n+2}{2}\{a + a + (n+1)d\} - (a + b)$$

$$A_1 + A_2 + \cdots + A_n = \frac{n+2}{2}\{a + b\} - (a + b) \qquad \because b = a + (n+1)d$$

$$A_1 + A_2 + \cdots + A_n = (a + b)\left\{\frac{n+2}{2} - 1\right\}$$

2 marks

$$A_1 + A_2 + \cdots + A_n = (a + b)\{\frac{n+2-2}{2}\}$$

$$A_1 + A_2 + \cdots + A_n = n\frac{(a+b)}{2}$$

1 marks

Hence proved.

Q-No-1(viii) Solution:

Given $A = \begin{bmatrix} 1 & 2 & 0 & 3 \\ 3 & 2 & -1 & 0 \\ 2 & -1 & 0 & 1 \end{bmatrix}$

Now $\underset{\sim}{R} \begin{bmatrix} 1 & 2 & 0 & 3 \\ 3 & 2 & -1 & 0 \\ 2 & -1 & 0 & 1 \end{bmatrix}$

$\underset{\sim}{R} \begin{bmatrix} 1 & 2 & 0 & 3 \\ 0 & -4 & -1 & -9 \\ 0 & -5 & 0 & -5 \end{bmatrix}$ by $R_2 + (-3R_1)$ *and* $R_3 + (-2R_1)$

3 marks

$\underset{\sim}{R} \begin{bmatrix} 1 & 2 & 0 & 3 \\ 0 & 1 & -1 & -4 \\ 0 & -5 & 0 & -5 \end{bmatrix}$ by $R_2 + (-1R_3)$

$\underset{\sim}{R} \begin{bmatrix} 1 & 2 & 0 & 3 \\ 0 & 1 & -1 & -4 \\ 0 & 0 & -5 & -25 \end{bmatrix}$ by $R_3 + 5R_2$

2 marks

So Rank of $A = 3$ → 1 marks

Q-No-1(ix) Solution:

Given $f(x) = \frac{x+5}{x-6}$

Domain of $f(x) = R - \{6\}$

Now to find f^{-1}

$$f(x) = y$$

$$x = f^{-1}(y) \quad \rightarrow (1)$$

2 marks

As $y = \frac{x+5}{x-6}$

$xy - 6y = x + 5$ by cross multiplication

$$xy - x = 6y + 5$$

$$x = \frac{6y+5}{y-1} \quad \rightarrow (2)$$

Comparing eq(1) and eq(2)

$$f^{-1}(y) = \frac{6y+5}{y-1}$$

Replace y by x

$$f^{-1}(x) = \frac{6x+5}{x-1}$$

2 marks

So Domain of $f^{-1}(x) = R - \{1\}$

and Range of $f^{-1}(x) = R - \{6\}$ $\because$ Range of f^{-1} = Domain of f

1 marks

Q-No-1(x) Solution:

$\vec{a} = \lambda\hat{j} + 3\hat{k}$, $\hat{b} = 2\hat{i} - \hat{j} - \hat{k}$ $\quad \hat{c} = \hat{i} + 3\hat{j} + \hat{k}$

Given vectors are coplanar

So $\vec{a}.\vec{b} \times \vec{c} = 0$

$$\begin{vmatrix} 0 & \lambda & 3 \\ 2 & -1 & -1 \\ 1 & 3 & 1 \end{vmatrix} = 0$$

3 marks

Expanding from R_1

$$0\begin{vmatrix} -1 & -1 \\ 3 & 1 \end{vmatrix} - \lambda\begin{vmatrix} 2 & -1 \\ 1 & 1 \end{vmatrix} + 3\begin{vmatrix} 2 & -1 \\ 1 & 3 \end{vmatrix} = 0$$

$$0 - \lambda(2 + 1) + 3(6 + 1) = 0$$

$$-3\lambda = -21$$

$$\lambda = 7$$

2 marks

Q-No-1(xi) Solution:

$$L-H-S = 1+\cos\beta$$

$$= 1+\frac{a^2+c^2-b^2}{2ac} \qquad \because \cos\beta = \frac{a^2+c^2-b^2}{2ac}$$

$$= \frac{2ac+a^2+c^2-b^2}{2ac}$$

3 marks

$$= \frac{(a+c)^2-b^2}{2ac}$$

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

$$= R-H-S$$

Hence $L-H-S = R-H-S$

2 marks

Q-No-1(xii) Solution:

Given $1+4x+7x^2+10x^3+\cdots$

$$S_n = ?$$

As $S_n = \frac{a_1}{1-r}+\frac{dr}{(1-r)^2}-\frac{dr^n}{(1-r)^2}-\frac{(a_1+(n-1)d)r^n}{1-r}$

2 marks

Here $a_1 = 1,\quad d=3$ and $r = x$

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

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

2 marks

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

1 marks

Q-No-1(xiii) Solution:

let $\theta = \frac{\pi}{2}-\cos^{-1}x \qquad \rightarrow (1)$

$\cos^{-1}x = \frac{\pi}{2}-\theta$

$x = \cos\left(\frac{\pi}{2}-\theta\right)$ for $0 \le \frac{\pi}{2}-\theta \le \pi$

2 marks

$x = \cos\left(\frac{\pi}{2}-\theta\right)$ for $-\frac{\pi}{2} \le \theta \le \frac{\pi}{2}$

$x = \sin\theta$ for $\theta \epsilon [-\frac{\pi}{2},\frac{\pi}{2}]$

So $\theta = \sin^{-1}x$

2 marks

Put in eq(1)

$\sin^{-1}x = \frac{\pi}{2}-\cos^{-1}x$

Hence $\sin^{-1}x+\cos^{-1}x = \frac{\pi}{2}$

1 marks

Section-C

Attempt Any Three question of the following question. Each question carry equal marks.

Q.2) **i) prove that for any equilateral triangle $\mathbf{r : R : r_1 = 1 : 2 : 3}$.**

Solution:

Let the measure of each side of a triangle be denoted by "c"

Therefore $S = \frac{a+b+c}{2} = \frac{c+c+c}{2} = \frac{3c}{2}$

$\Delta = \sqrt{S(S-c)^3} = \sqrt{\frac{3c}{2}(\frac{3c}{2}-c)^3} = \sqrt{\frac{3c}{2}(\frac{c}{2})^3} = \frac{\sqrt{3}c^2}{4}$

$\boldsymbol{\Delta = \frac{\sqrt{3}c^2}{4}}$

2 marks

$R = \frac{abc}{4\Delta} = \frac{c^3}{4\frac{\sqrt{3}c^2}{4}} = \frac{c}{\sqrt{3}}$ $\quad r = \frac{\Delta}{S} = \frac{\frac{\sqrt{3}c^2}{4}}{\frac{3c}{2}} = \frac{c}{2\sqrt{3}}$

$\mathbf{r = \frac{c}{2\sqrt{3}}}$

$r_1 = \frac{\Delta}{S-a} = \frac{\frac{\sqrt{3}c^2}{4}}{\frac{3c}{2}-c} = \frac{\sqrt{3}c}{2}$

$\mathbf{r_1 = \frac{\sqrt{3}c}{2}}$

Now $\quad r : R : r_1 = \frac{c}{2\sqrt{3}} : \frac{c}{\sqrt{3}} : \frac{\sqrt{3}c}{2}$

2 marks

$r : R : r_1 = \frac{c}{2\sqrt{3}} \times \frac{\sqrt{3}}{c} : \frac{c}{\sqrt{3}} \times \frac{\sqrt{3}}{c} : \frac{\sqrt{3}c}{2} \times \frac{\sqrt{3}}{c}$

$r : R : r_1 = \frac{1}{2} : 1 : \frac{3}{2}$

$r : R : r_1 = 1 : 2 : 3$

1 marks

ii) Use Cramer's rule to solve $\mathbf{x - y + 4z = 4, 2x + 2y - z = 2, 3x - 2y + 3z = -3}$.

Solution:

$x - y + 4z = 4$

$2x + 2y - z = 2$

$3x - 2y + 3z = -3$

In terms of matrices:

$$\begin{bmatrix} 1 & -1 & 4 \\ 2 & 2 & -1 \\ 3 & -2 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 2 \\ -3 \end{bmatrix}$$

Where $A = \begin{bmatrix} 1 & -1 & 4 \\ 2 & 2 & -1 \\ 3 & -2 & 3 \end{bmatrix}, B = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$ and $C = \begin{bmatrix} 4 \\ 2 \\ -3 \end{bmatrix}$

2 marks

$$|A| = \begin{vmatrix} 1 & -1 & 4 \\ 2 & 2 & -1 \\ 3 & -2 & 3 \end{vmatrix} = 1\begin{vmatrix} 2 & -1 \\ -2 & 3 \end{vmatrix} - (-1)\begin{vmatrix} 2 & -1 \\ 3 & 3 \end{vmatrix} + 4\begin{vmatrix} 2 & 2 \\ 3 & -2 \end{vmatrix}$$

$$= 1(6-2) + 1(6+3) + 4(-4-6)$$

$$= 4 + 9 - 40$$

$$= -27$$

$$\mathbf{|A| = -27}$$

Now for "x" using Cramer's rule

$$|A_x| = \begin{vmatrix} 4 & -1 & 4 \\ 2 & 2 & -1 \\ -3 & -2 & 3 \end{vmatrix} = 4\begin{vmatrix} 2 & -1 \\ -2 & 3 \end{vmatrix} - (-1)\begin{vmatrix} 2 & -1 \\ -3 & 3 \end{vmatrix} + 4\begin{vmatrix} 2 & 2 \\ -3 & -2 \end{vmatrix}$$

$$= 4(6-2) + 1(6-3) + 4(-4+6)$$

$$= 16 + 3 + 8$$

$$= 27$$

$$\mathbf{|A_x| = 27}$$

Now for "y" using Cramer's rule

$$|A_y| = \begin{vmatrix} 1 & 4 & 4 \\ 2 & 2 & -1 \\ 3 & -3 & 3 \end{vmatrix} = 1\begin{vmatrix} 2 & -1 \\ -3 & 3 \end{vmatrix} - (4)\begin{vmatrix} 2 & -1 \\ 3 & 3 \end{vmatrix} + 4\begin{vmatrix} 2 & 2 \\ 3 & -3 \end{vmatrix}$$

$$= 1(6-3) - 4(6+3) + 4(-6-6)$$

$$= 3 - 36 - 48$$

$$= -81$$

$$\mathbf{|A_y| = -81}$$

Now for "z" using Cramer's rule

$$|A_z| = \begin{vmatrix} 1 & -1 & 4 \\ 2 & 2 & 2 \\ 3 & -2 & -3 \end{vmatrix} = 1\begin{vmatrix} 2 & 2 \\ -2 & -3 \end{vmatrix} - (-1)\begin{vmatrix} 2 & 2 \\ 3 & -3 \end{vmatrix} + 4\begin{vmatrix} 2 & 2 \\ 3 & -2 \end{vmatrix}$$

$$= 1(-6+4) + 1(-6-6) + 4(-4-6)$$

$$= -2 - 12 - 40$$

$$= -54$$

$$\mathbf{|A_z| = -54}$$

2 marks

NOW

$$\mathbf{x} = \frac{|A_x|}{|A|} = \frac{27}{-27} = \mathbf{-1}$$

$$\mathbf{y} = \frac{|A_y|}{|A|} = \frac{-81}{-27} = \mathbf{3}$$

$$\mathbf{z} = \frac{|A_z|}{|A|} = \frac{-54}{-27} = \mathbf{2}$$

So $(\mathbf{x}, \mathbf{y}, \mathbf{z}) = (\mathbf{-1}, \mathbf{3}, \mathbf{2})$

1 mark

Q.3) **i)** $y = \frac{x}{3} + \frac{x^2}{3^2} + \frac{x^3}{3^3} + \cdots$ **where** $0 < x < 3$

Solution:

$y = \frac{x}{3} + \frac{x^2}{3^2} + \frac{x^3}{3^3} + \cdots$

here $a_1 = \frac{x}{3}$, $r = \frac{x}{3}$

$y = \frac{a_1}{1-r}$ $\quad S_\infty = \frac{a_1}{1-r}$

$y = \frac{\frac{x}{3}}{1-\frac{x}{3}} = \frac{x}{3} \div \left(1 - \frac{x}{3}\right)$

2 marks

$y = \frac{x}{3} \div \left(\frac{3-x}{3}\right) = \frac{x}{3} \times \left(\frac{3}{3-x}\right) = \frac{x}{3-x}$

$y = \frac{x}{3-x}$

$y(3-x) = x$

$3y - xy = x$

2 marks

$3y = x + xy$

$3y = x(1+y)$

$x = \frac{3y}{1+y}$

1 mark

ii) Maximize $f(x, y) = 2x + y$ subject to the constraints $x + y \le 6, x + y \ge 1,\ x, y \ge 0$

Solution:

$f(x, y) = 2x + y \rightarrow (a)$

$x + y \le 6, \quad x + y \ge 1, \quad , x, y \ge 0$

$x + y \le 6 \rightarrow (i)$

Associated equation of (i) is

$x + y = 6$

intercepts

x	**6**	**0**
Y	**0**	**6**

Take (0,0) as a test point.

0 ≤ 6 True

$x + y \ge 1 \rightarrow (ii)$

Associated equation of (i) is

$x + y = 1$

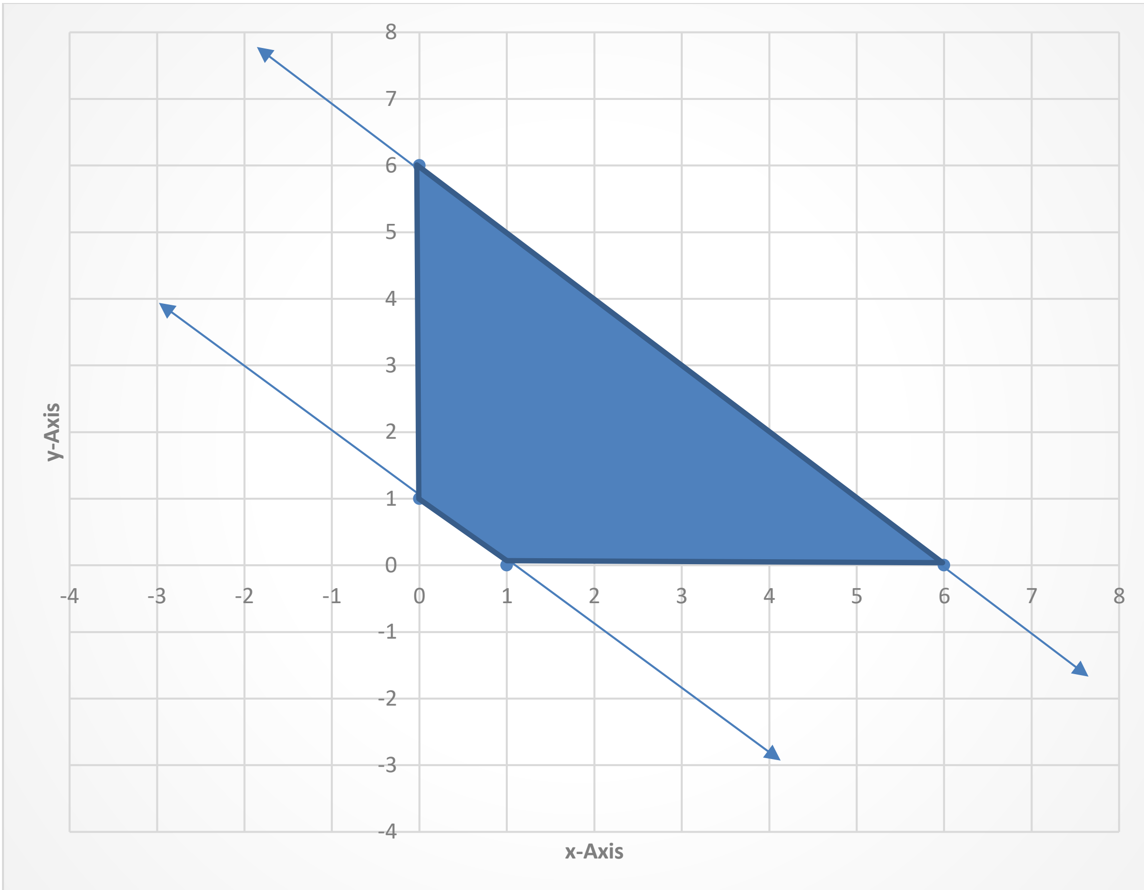
intercepts

x	**1**	**0**
y	**0**	**1**

Take (0,0) as a test point.

0 ≥ 1 false

2 marks



2 marks

So Corners points are $(6,0), (0,6), (1,0)$ and $(0,1)$

Putting $\mathbf{x = 6}$ and $\mathbf{y = 0}$ in equation (a).

$f(6,0) = 2(6) + 0 = 12$

Putting $\mathbf{x = 0}$ and $\mathbf{y = 6}$ in equation (a).

$f(0,6) = 2(0) + 6 = 6$

Putting $\mathbf{x = 6}$ and $\mathbf{y = 0}$ in equation (a).

$f(1,0) = 2(1) + 0 = 2$

Putting $\mathbf{x = 6}$ and $\mathbf{y = 0}$ in equation (a).

$f(0,1) = 2(0) + 1 = 1$

1 marks

S0 $f(x, y)$ is maximum at $(6,0)$.

Q.4) **i) Find the area of parallelogram whose diagonals are: $\vec{a} = 4\hat{i} + \hat{j} - \hat{k}$,**

$$\vec{b} = 2\hat{i} + 3\hat{j} + 4\hat{k}.$$

Solution: *Given diagonals are* $\vec{a} = 4\hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = 2\hat{i} + 3\hat{j} + 4\hat{k}$.

$$\vec{a} \times \vec{b} = \begin{vmatrix} i & j & k \\ 4 & 1 & -1 \\ 2 & 3 & 4 \end{vmatrix}$$

2 marks

Expanding from R_1

$$\vec{a} \times \vec{b} = i(4 + 3) - j(16 + 2) + k(12 - 2)$$

$$\vec{a} \times \vec{b} = 7i - 18j + 10k$$

For diagonals

$$\text{Area of paralleogram} = \frac{|\vec{a}\times\vec{b}|}{2}$$

$$\text{Area of paralleogram} = \frac{|7i-18j+10k|}{2}$$

2 marks

$$\text{Area of paralleogram} = \frac{\sqrt{49+324+100}}{2}$$

$$\text{Area of paralleogram} = \frac{\sqrt{473}}{2}$$

1 mark

ii) If $z_1 = 1+i,\ z_2 = 1-i,$ then find $\left|\frac{z_1+z_2+1}{z_1-z_2+1}\right|$

solution:

$$\left|\frac{z_1+z_2+1}{z_1-z_2+1}\right| = \left|\frac{1+i+1-i+1}{1+i-1+i+1}\right|$$

$$= \left|\frac{3}{1+i}\right|$$

$$= \left|\frac{3(1-i)}{(1+i)(1-i)}\right|$$

2 marks

$$= \left|\frac{3-3i}{1^2-i^2}\right|$$

$$\left|\frac{z_1+z_2+1}{z_1-z_2+1}\right| = \left|\frac{3}{2}-\frac{3}{2}i\right|$$

$$= \sqrt{\frac{3}{2}^2+\frac{3}{2}^2}$$

$$= \sqrt{\frac{9}{4}+\frac{9}{4}}$$

$$= \sqrt{\frac{18}{4}}$$

2 marks

Therefore $s\left|\frac{z_1+z_2+1}{z_1-z_2+1}\right| = \frac{3\sqrt{2}}{2} = \frac{3}{\sqrt{2}}$ → 1 marks

Q.5) **i) How many number each lying between 10 and 1000 can be formed with digits 2,3,4,0,8,9 using only once.**

Solution:

Two digits numbers:

Total number $= E_1.E_2 = 5\times 5 = 25$

2 marks

Three digits numbers:

Total number $= E_1.E_2.E_3 = 5\times 5\times 4 = 100$

2 marks

Therefore

Total$= 25+100 = 125$ → 1 marks

ii) Find the maximum and minimum of the function $y = \frac{1}{18-5\sin(3\theta-45)}$

Solution:

Consider $y' = 18 - 5\sin(3\theta - 45)$

Here $a = 18$, and $b = -5$

1 mark

$M = \text{maximum} = a + |b| = 18 + |-5| = 18 + 5 = 23$

$m = \text{minimum} = a - |b| = 18 - |-5| = 18 - 5 = 13$

2 marks

Now maximum of y is $M' = \frac{1}{m} = \frac{1}{13}$

Now minimum of y is $m' = \frac{1}{M} = \frac{1}{23}$.

2 marks