Version No.					ROLL NUMBER						
0	0	0	0		0	0	0	0	0	0	0
1	1	1	1		1	1	1	1	1	1	1
2	2	2	2		2	2	2	2	2	2	2
3	3	3	3		3	3	3	3	3	3	3
4	4	4	4		4	4	4	4	4	4	4
5	5	5	5		5	5	5	5	5	5	5
6	6	6	6		6	6	6	6	6	6	6
7	7	7	7		7	7	7	7	7	7	7
8	8	8	8		8	8	8	8	8	8	8
9	9	9	9		9	9	9	9	9	9	9

Answer Sheet No._____________

Sign. of Candidate___________

Sign. of Invigilator___________

FBISE SOLVED PAST PAPERS

MATHEMATICS HSSC–II

SECTION – A (Marks 20)

Time allowed: 25 Minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

Q.1 Fill the relevant bubble for each part. All parts carry one mark.

1. What result occurs, in evaluating $\lim_{x\to 3}\frac{x^3-27}{x-3}$?
   - A. 9 ◯
   - B. -9 ◯
   - C. 27 ◯
   - D. does not exist ◯

2. Which one of the following represents an Odd function?
   - A. $f(x)=\frac{3x}{x^2+1}$ ◯
   - B. $f(x)=3x^4-2x^2+7$ ◯
   - C. $f(x)=sinx+cosx$ ◯
   - D. $f(x)=(x+2)^2$ ◯

3. Which one of the following represents $f^{-1}(\sqrt{2})$, if $f(x)=\sqrt{2\tan x}$?
   - A. $\frac{\pi}{4}$ ◯
   - B. $\frac{7\pi}{20}$ ◯
   - C. $\frac{\pi}{2}$ ◯
   - D. $\frac{3\pi}{4}$ ◯

4. If $f(x)=\cos x,\ \ x\in\left(\frac{\pi}{2},\pi\right)$ then what is the result of $f'\left(\frac{3\pi}{4}\right)$?
   - A. $\frac{\sqrt{3}}{2}$ ◯
   - B. $\frac{1}{\sqrt{2}}$ ◯
   - C. $-\frac{\sqrt{3}}{2}$ ◯
   - D. $-\frac{1}{\sqrt{2}}$ ◯

5. In which one of the following intervals, $f(x)=2x^2-8x+1$ increases its value?
   - A. $(-\infty,2]$ ◯
   - B. $(-\infty,0]$ ◯
   - C. $[0,\infty)$ ◯
   - D. $(2,\infty)$ ◯

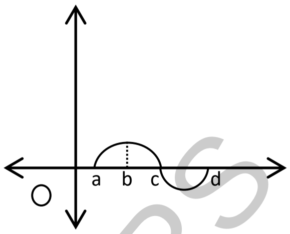
6. For a function $f(x)=\sin(\sin x)$ what evaluates $f'(0)$?
   - A. 1 ◯
   - B. 0 ◯
   - C. -1 ◯
   - D. does not exist ◯

7. Which one of the following options represents $f'(x)=e^x+\sin x+1$ and $f(0)=2$?
   - A. $f(x)=e^x+\cos x+x$ ◯
   - B. $f(x)=e^x-\cos x+x+2$ ◯
   - C. $f(x)=xe^{x-1}-\cos x+x+3$ ◯
   - D. $f(x)=e^x+\cos x$ ◯

8. What results $\int_0^{\pi/4} \frac{e^{\tan x}}{\cos^2 x} dx$?

A. $e - 1$ ○ B. e ○
C. $\frac{\pi}{4}$ ○ D. 0 ○

9. The graph of $f(x) = \int_a^x g(t)dt$ is shown in the given figure. For what value of $x, f(x)$ has its maximum value?



A. a ○ B. b ○
C. c ○ D. d ○

10. Which one of the following lines passes through (–7, 7), (–7, –7) and (–7, 0)?

A. $x = -7$ ○ B. $y = -7$ ○
C. $x + y = -7$ ○ D. $y = -x + 7$ ○

11. How many intercepts are there in the graph of $y = \frac{1}{x}$?

A. no intercepts ○ B. two x–intercepts ○
C. two y–intercepts ○ D. one x and one y–intercept ○

12. At what angle lines $3y = 2x + 5$ and $3x + 2y = 8$ cut each other?

A. $\frac{\pi}{6}$ ○ B. $\frac{\pi}{4}$ ○
C. 0 ○ D. $\frac{\pi}{2}$ ○

13. Which one of the following options does not satisfy $4x - 3y < 2$?

A. $(1, 1)$ ○ B. $(0, 0)$ ○
C. $(3, 0)$ ○ D. $(-2, 1)$ ○

14. What are the coordinates of the centre of a circle $x^2 + y^2 - 8x + 12y + 21 = 0$?

A. $(4, 6)$ ○ B. $(-4, 6)$ ○
C. $(4, -6)$ ○ D. $(-4, -6)$ ○

15. What is the equation of the axis of a parabola $y^2 - 2y + 8x - 23 = 0$?

A. $y = -1$ ○ B. $x = 3$ ○
C. $y = 1$ ○ D. $x = -3$ ○

16. If (5, –2), (5, 4) are the vertices of a hyperbola, then centre of the hyperbola is:

A. (0, 0) ○ B. (5, 3) ○
C. (5, 1) ○ D. (5, 0) ○

17. Which one of the following represents the graph of $4x^2 + y^2 - 8x + 4y - 9 = 0$?

A. circle ○ B. ellipse ○
C. parabola ○ D. hyperbola ○

18. For what value of $\propto$, vectors $4\underline{i} + 3\underline{j} - 3\underline{k}$ and $\propto \underline{i} + 3\underline{k}$ have the same magnitude?

A. ± 5 ○ B. 5 ○
C. 25 ○ D. -5 ○

19. If vectors $3\underline{i} - 6\underline{j} + \underline{k}$ and $2\underline{i} - 4\underline{j} + \lambda\underline{k}$ are parallel to each other, then the value of λ is:

A. $\frac{2}{3}$ ○ B. $\frac{3}{2}$ ○
C. $-\frac{3}{2}$ ○ D. $-\frac{2}{3}$ ○

20. What is the projection of $\underline{i} - \underline{k}$ along $\underline{j} + \underline{k}$?

A. $\frac{1}{\sqrt{2}}$ ○ B. $-\frac{1}{2}$ ○
C. $-\frac{1}{\sqrt{2}}$ ○ D. -1 ○

FBISE SOLVED PAST PAPERS

Federal Board HSSC-II Examination
Mathematics Model Question Paper
(Curriculum 2002)

SECTION-A (1×20 = 20 Marks)

Answer 1 Each part carries (01) mark. Key for MCQs is as under.

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

SECTION-B (4×12 = 48 Marks)

Answer 2 Attempt any TWELVE parts. Each part carries (04) marks.

(i) $f(x) = -4 + \sqrt{3-x}$, $g(x) = \sqrt{x}$

(a) $fog(x) = f[g(x)] = f(\sqrt{x}) = -4 + \sqrt{3 - \sqrt{x}}$ $(01\ mark)$

(b) $gof(x) = g[f(x)] = g(-4 + \sqrt{3-x}) = \sqrt{-4 + \sqrt{3-x}}$ $(01\ mark)$

(c) $fof(x) = f[f(x)] = f(-4 + \sqrt{3-x}) = -4 + \sqrt{7 - \sqrt{3-x}}$ $(01\ mark)$

(d) $gog(x) = g[g(x)] = g(\sqrt{x}) = \sqrt{\sqrt{x}}$ $(01\ mark)$

(ii) (a) $f(x) = -4 + \sqrt{3-x}$

Domain$(f) = (-\infty,\ 3] = Range(f^{-1})$ $(01\ mark)$

Range$(f) = [-4, +\infty) = Domain(f^{-1})$ $(01\ mark)$

(b) $f(x) = \frac{7+x}{x-1}$, $x \neq 1$

Domain$(f) = \mathcal{R} - \{1\} = Range(f^{-1})$ $(01\ mark)$

Range$(f) = \mathcal{R} - \{1\} = Domain(f^{-1})$ $(01\ mark)$

(iii) $f(x) = (x^4 - x^3 + x^2 - x + 1)(3x^3 - 2x^2 + x - 1)$

Differentiating w.r.t.'x'

$f'(x) = (x^4 - x^3 + x^2 - x + 1)[9x^2 - 4x + 1] + (3x^3 - 2x^2 + x - 1)[4x^3 - 3x^2 + 2x - 1](02\ marks)$

$f'(1) = (1 - 1 + 1 - 1 + 1)[9 - 4 + 1] + (3 - 2 + 1 - 1)[4 - 3 + 2 - 1](01\ mark)$

$f'(1) = (1)[6] + (1)[2] = 8(01\ mark)$

(iv) $x = 3 + cost$; $y = 1 - sint$

Differentiating w.r.t.'t'

$\frac{dx}{dt} = -sint$ $\frac{dy}{dt} = -cost(01 + 01)marks$

$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$ $(01\ mark)$

$\frac{dy}{dx} = \frac{-cost}{-sint} = cott$ $(01\ mark)$

(v) $f(x) = (x^2 - 6x + 8)(x - 5)$

$f(x) = x^3 - 11\,x^2 + 38x - 40$

Differentiating w.r.t. x

$f'(x) = 3x^2 - 22x + 38$ $(01\ mark)$

At extreme $f'(x) = 0$

$x^2 - 22x + 38 = 0 \Rightarrow x = \frac{22 \pm \sqrt{484 - 456}}{6} = \frac{11 \pm \sqrt{7}}{3} = 2.8\ or\ 4.5$ $(01\ mark)$

Consider $f'(2) = 3(2)^2 - 22(2) + 38 = 6 > 0 \Rightarrow f$ increases in $(-\infty, 2.8)$

Consider $f'(3) = 3(3)^2 - 22(3) + 38 = -1 < 0 \Rightarrow f$ decreases in $(2.8, 4.5)$

Consider $f'(5) = 3(5)^2 - 22(5) + 38 = 3 > 0 \Rightarrow f$ increases in $(4.5, +\infty)$

f increases in $(-\infty, 2.8) \cup (4.5, +\infty)$ and decreases in $(2.8, 4.5)(01 + 01)marks$

(vi) Let $f(x) = x^{1/5}$ with $x = 32$ and $\delta x = dx = 1$ $(01\ mark)$

Differentiating w.r.t. 'x'

$f'(x) = \frac{1}{5}x^{-4/5}$ $(01\ mark)$

$\because f(x + \delta x) = f(x) + f'(x)dx$

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$f(x+\delta x) = x^{1/5} + \frac{1}{5}x^{-4/5}dx$ $(01\ mark)$

$f(32+1) = (32)^{1/5} + \frac{1}{5}(32)^{-4/5}(1)$

$f(33) = 2 + \frac{1}{80}$

$33^{1/5} = \frac{161}{80}$ $(01\ mark)$

(vii) $\int \frac{lnx}{x^2}dx = \int (lnx)(x)^{-2}\,dx$ $(01\ mark)$

$= (lnx)\left(-\frac{1}{x}\right) - \int \left(\frac{1}{x}\right)\left(-\frac{1}{x}\right)dx$ $(01\ mark)$

$= -\frac{1}{x}lnx + \int x^{-2}dx$ $(01\ mark)$

$= -\frac{1}{x}lnx - \frac{1}{x} + c$ $(01\ mark)$

(viii) $f(x) = 4x - x^2$

For x-intercepts $4x - x^2 = 0 \Longrightarrow$ $x(4-x) = 0 \Longrightarrow x = 0, 4$ $(01\ mark)$

Required Area $= \int_0^4 f(x) = \int_0^4 (4x - x^2)dx$ $(01\ mark)$

$= \left[\frac{4x^2}{2} - \frac{x^3}{3}\right]_0^4 = \frac{1}{3}[6x^2 - x^3]_0^4$ $(01\ mark)$

$= \frac{32}{3}$Square units $(01\ mark)$

(ix) Let l be the required line having slope $m = tan30° = \frac{1}{\sqrt{3}}$ $(01\ mark)$

Equation of the line l passing through $(x_1, y_1) = (-4, 8)$ with slope $m = \frac{1}{\sqrt{3}}$ is

$y - y_1 = m(x - x_1)$ $(01\ mark)$

$y - 8 = \frac{1}{\sqrt{3}}(x+4)$ $(01\ mark)$

$x - \sqrt{3}y + 8\sqrt{3} + 4 = 0$ $(01\ mark)$

(x) Let $l : 2x - 4y + 7 = 0$ be the given line

Now $-2x + 4y - 7 = 0$

At $P(3, 1)$

$-2x + 4y - 7 = -2(3) + 4(1) - 7 = -9 < 0$ $(01\ mark)$

P lies below l $(01\ mark)$

At $Q(-1, 6)$

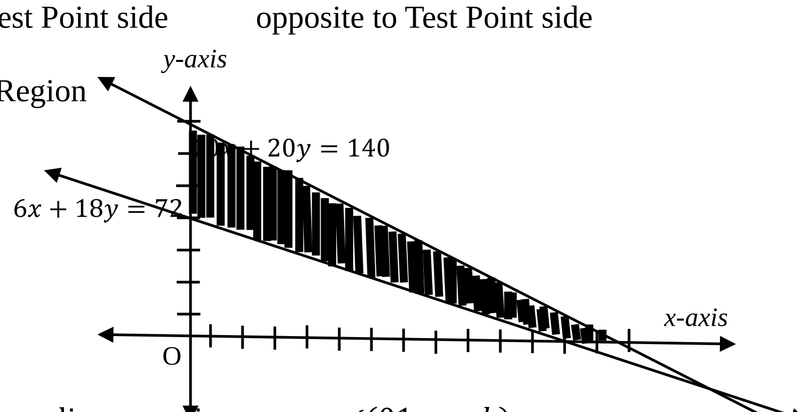
$-2x + 4y - 7 = -2(-1) + 4(6) - 7 = 20 > 0$ $(01\ mark)$

Q lies above l $(01\ mark)$

(xi) Constraints: $10x + 20y \le 140$; $6x + 18y \ge 72$; ≥ 0 ; $y \ge 0$

Corresponding Equations:	$10x + 20y = 140$;	$6x + 18y = 72$	
Intercepts:	$(14, 0), (0, 7)$	$(12, 0), (0, 4)$	$(01\ mark)$
In Equations:	$10x + 20y < 140$;	$6x + 18y > 72$	
Test Point: $O(0, 0)$	$0 < 140$	$0 > 72$	$(01\ mark)$
Solution Region lies	towards Test Point side	opposite to Test Point side	

Common shaded region is the Solution Region



Graph: Lines representing the corresponding equations $(01\ mark)$
Correct shade of the feasible solution region $(01\ mark)$

(xii) Let $l_1 : 3y = 4x - 5$ and $l_2 : 3y = -4x - 13$

$l_1 + l_2$: $6y = -18$ $\Longrightarrow y = -3$

$l_1 - l_2$: $0 = 8x + 8$ $\Longrightarrow x = -1$

Centre of the circle: $C(h, k) = (-1, -3)$ $(01\ mark)$

If $P(-5, 0)$ be the point lying on the circle,

then radius $r = |CP| = \sqrt{(-5+1)^2 + (0+3)^2} = 5$ $(01\ mark)$

Circle Equation: $(x-h)^2 + (y-k)^2 = r^2$ $(01\ mark)$

$(x+1)^2 + (y+3)^2 = 5^2$

or $x^2 + y^2 + 2x + 6y - 15 = 0$ $(01\ mark)$

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(xiii) Let F$(-2,1)$ be the focus and l: $x-5=0$ be the directrix of the parabola.
Consider a point P(x,y) on the parabola. Draw $\overline{PM}\perp l$ and join P to F.
By definition $|\overline{PF}|=|\overline{PM}|$ $(01\ mark)$
$\sqrt{(x+2)^2+(y-1)^2}=\frac{|x-5|}{\sqrt{1^2}}$ $(01\ mark)$
$(x+2)^2+(y-1)^2=(x-5)^2$ $(01\ mark)$
$(y-1)^2=7(3-2x)$ $(01\ mark)$

(xiv) $16x^2+25y^2=1 \Rightarrow \frac{x^2}{1/16}+\frac{y^2}{1/25}=1$
Comparing with $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ to get $a^2=1/16$ and $b^2=1/25$
At the point $(x_1,y_1)=(4,12/5)$
Equation of the tangent: $\frac{xx_1}{a^2}+\frac{yy_1}{b^2}=1$ $(01\ mark)$
$\Rightarrow \frac{4x}{1/16}+\frac{12y/5}{1/25}=1 \Rightarrow 64x+60y-1=0$ $(01\ mark)$
Equation of the normal: $y-y_1=\frac{a^2y_1}{b^2x_1}(x-x_1)$ $(01\ mark)$
$\Rightarrow y-\frac{12}{5}=\frac{\left(\frac{1}{16}\right)\left(\frac{12}{5}\right)}{\left(\frac{1}{25}\right)4}(x-4) \Rightarrow 75x-80y-108=0$ $(01\ mark)$

(xv) $\underline{u}=-2\underline{i}+5\underline{j}+3\underline{k}$; $\underline{v}=\underline{i}+3\underline{j}-2\underline{k}$; $\underline{w}=-3\underline{i}+\underline{j}-2\underline{k}$
Volume of Parallelepiped $=\begin{vmatrix}-2 & 5 & 3\\ 1 & 3 & -2\\ -3 & 1 & -2\end{vmatrix}$ $(02\ marks)$
$=-2(-4)-5(-8)+3(10)=78$ $(01+01)marks$

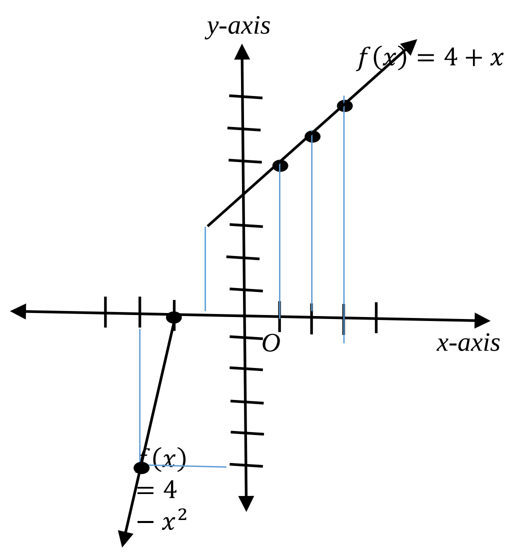
(xvi) $\underline{u}=3\underline{i}+\underline{j}-\underline{k}$; $\underline{v}=2\underline{i}-\underline{j}+\underline{k}$
$\underline{u}.\underline{v}=(3)(2)+(1)(-1)+(-1)(1)=4$ $(01\ mark)$
$|\underline{u}|=\sqrt{9+1+1}=\sqrt{11}$; $|\underline{v}|=\sqrt{4+1+1}=\sqrt{6}$ $(01\ mark)$
If θ be the angle between$\underline{u}$ $and\underline{v}$, then
$\cos\theta=\frac{\underline{u}.\underline{v}}{|\underline{u}||\underline{v}|}=\frac{4}{\sqrt{11}\sqrt{6}}$ $(01\ mark)$
$\theta=\cos^{-1}\left(\frac{4}{\sqrt{66}}\right)=60.5°$ $(01\ mark)$

SECTION-C (8×4 = 32 Marks)

Answer 3 $f(x)=\begin{cases}4-x^2\ , & if\ x\le 0\\ 4+x\ , & if\ x>0\end{cases}$

(a) Correct Table of values $(01\ mark)$
Correct graph $(01\ mark)$

x	-3	-2	-1	0	1	2	3
y	-5	0	3	4	5	6	7



(b) At $x=0$, $f(x)=4-x^2$
$\Rightarrow f(0)=4$ $(01\ mark)$

(c) $\lim_{x\to0^-}f(x)=\lim_{x\to0^-}(4-x^2)=4$ $(01\ mark)$
$\lim_{x\to0^+}f(x)=\lim_{x\to0^+}(4+x)=4$ $(01\ mark)$

(d) Since $\lim_{x\to0^-}f(x)=\lim_{x\to0^+}f(x)=4$
$\Rightarrow \lim_{x\to0}f(x)=4$ $(01\ mark)$
And $\lim_{x\to0}f(x)=f(0)$ $(01\ mark)$
Therefore f is continuous at $x=0$ $(01\ mark)$

Answer 4 $f(x)=sinx+\cos^2x$; $x\epsilon\left[0,\frac{\pi}{2}\right]$

(a) Differentiating w.r.t. x
$f'(x)=cosx-2cosx.sinx$ $(01\ mark)$

(b) Differentiating again w.r.t. x
$f''(x)=-sinx-2(\cos^2x-\sin^2x)=-sinx-2cos2x$ $(01\ mark)$

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(c) For extreme values put $f'(x) = 0$

$cosx - 2cosx.sinx = 0 \Longrightarrow cosx(1 - 2sinx) = 0$

$cosx = 0$ gives $x = \frac{\pi}{2}$ $(01\ mark)$

$1 - 2sinx = 0$ gives $sinx = \frac{1}{2} \Longrightarrow x = \frac{\pi}{6}$ $(01\ mark)$

(d) $f''\left(\frac{\pi}{2}\right) = -sin\left(\frac{\pi}{2}\right) - 2cos2\left(\frac{\pi}{2}\right) = 1 > 0$ $(01\ mark)$

$f_{min} = f\left(\frac{\pi}{2}\right) = sin\left(\frac{\pi}{2}\right) + \cos^2\left(\frac{\pi}{2}\right) = 1$ $(01\ mark)$

$f''\left(\frac{\pi}{6}\right) = -sin\left(\frac{\pi}{6}\right) - 2cos2\left(\frac{\pi}{6}\right) = -\frac{3}{2} < 0$ $(01\ mark)$

$f_{max} = f\left(\frac{\pi}{6}\right) = sin\left(\frac{\pi}{6}\right) + \cos^2\left(\frac{\pi}{6}\right) = \frac{5}{4}$ $(01\ mark)$

Answer 5 $\int \frac{x^3+4}{(x^2-1)(x^2+3x+2)}dx$

(a) $\frac{x^3+4}{(x+1)^2(x-1)(x+2)} = \frac{A}{(x+1)} + \frac{B}{(x+1)^2} + \frac{C}{(x-1)} + \frac{D}{(x+2)} \rightarrow eqn\ I$

$x^3 + 4 = A(x+1)(x-1)(x+2) + B(x-1)(x+2) + C(x+1)^2(x+2) + D(x+1)^2(x-1) \rightarrow eqn\ II$

For B put $x = -1$ $\quad -1 + 4 = B(-2)(1) \Longrightarrow B = -3/2$ $(01\ mark)$

For C put $x = 1$ $\quad 1 + 4 = C(4)(3) \quad \Longrightarrow C = 5/12$ $(01\ mark)$

For D put $x = -2$ $\quad -8 + 4 = D(1)(-3) \Longrightarrow D = 4/3$ $(01\ mark)$

Consider $eqn\ II$ as

$x^3 + 4 = A(x^3 + 2x^2 - x - 2) + B(x^2 + x - 2) + C(x^3 + 4x^2 + 5x + 2) + D(x^3 + x^2 - x - 1)$

Equating the coefficients of like powers of x^3

$1 = A + C + D$

$1 = A + \frac{5}{12} + \frac{4}{3} \Longrightarrow A = -\frac{3}{4}$ $(01\ mark)$

Substituting values in $eqn\ I$

$\frac{x^3+4}{(x+1)^2(x-1)(x+2)} = -\frac{3}{4(x+1)} - \frac{3}{2(x+1)^2} + \frac{5}{12(x-1)} + \frac{4}{3(x+2)}$

(b) $\int \frac{x^3+4}{(x+1)^2(x-1)(x+2)}dx = -\frac{3}{4}\int \frac{1}{(x+1)}dx - \frac{3}{2}\int (x+1)^{-2}dx + \frac{5}{12}\int \frac{1}{(x-1)}dx + \frac{4}{3}\int \frac{1}{(x+2)}dx$

$\int \frac{x^3+4}{(x+1)^2(x-1)(x+2)}dx = -\frac{3}{4}ln(x+1) + \frac{3}{2(x+1)} + \frac{5}{12}ln(x-1) + \frac{4}{3}ln(x+2)$

$(01 + 01 + 01 + 01)marks$

Answer 6 $A(-1,1)$, $B(5,5)$, $C(4,1)$

(a) Slope of $l = m = \frac{5-1}{5+1} = \frac{2}{3}$ $(01\ mark)$

(b) Equation of l through point $(x_1, y_1) = A(-1,\ 1)$

is given by $\quad y - y_1 = m(x - x_1)$ $(01\ mark)$

$y - 1 = \frac{2}{3}(x+1) \Longrightarrow \quad 2x - 3y + 5 = 0$ $(01\ mark)$

(c) $2x - 3y + 5 = 0 \Longrightarrow -2x + 3y - 5 = 0$

Divide the eqn by $\sqrt{(2)^2 + (-3)^2}$ or $\sqrt{13}$

$-\frac{2}{\sqrt{13}}x + \frac{3}{\sqrt{13}}y = \frac{5}{\sqrt{13}}$ $(01\ mark)$

Comparing with $xcos\alpha + ysin\alpha = p$

$cos\alpha = -\frac{2}{\sqrt{13}} < 0$; $sin\alpha = \frac{3}{\sqrt{13}} > 0$; $p = \frac{5}{\sqrt{13}}$ (α in 2nd Quadrant)

$\Longrightarrow tan\alpha = -\frac{3}{2}\alpha = \tan^{-1}\left(-\frac{3}{2}\right) = 123.69°$ $(01\ mark)$

Normal Form: $xcos(123.69°) + ysin(123.69°) = \frac{5}{\sqrt{13}}$ $(01\ mark)$

(d) $A(-1,1)$, $B(5,5)$, $C(4,1)$

Area of Triangle ABC $= \frac{1}{2}\begin{vmatrix} -1 & 1 & 1 \\ 4 & 1 & 1 \\ 5 & 5 & 1 \end{vmatrix}$ $(01\ mark)$

$= \frac{1}{2}[-1(-4) - 1(-1) + 1(15)] = 10$ $(01\ mark)$

Answer 7 Let number of conventional phones be x and number of smart phones be y.

Time constraints for assembling and finishing of conventional and smart phones are $x + 2y \leq 24$ and $2x + y \leq 24$ respectively.

The restriction on number of gadgets in a day is $x + y \leq 15$

The objective function as Profit function is $P(x,y) = 1000x + 4000y$

Constraints: $x + 2y \leq 24$; $2x + y \leq 24$; ≥ 0 ; $y \geq 0$

Corresponding Equations: $x + 2y = 24$; $2x + y = 24$

Intercepts: $(24,0), (0,12)$; $(12,0), (0,24)$ $(01\ mark)$

In Equations: $x + 2y < 24$; $2x + y < 24$

Test Point: $O(0,0)$ $0 < 24; 0 < 24$ $(01\ mark)$

Solution Region lies: towards Test Point side

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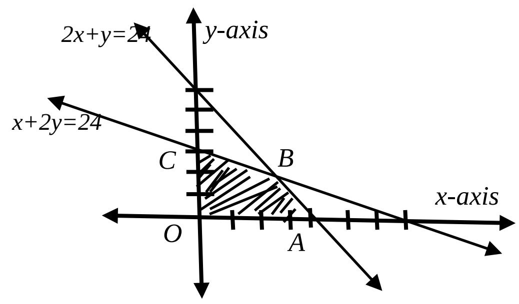
The graph shows OABC as feasible solution region.

For B solving $x + 2y = 24$ and $2x + y = 24$

$\frac{x}{-48+24} = \frac{-y}{-24+48} = \frac{1}{1-4} \Rightarrow x = 8,\ y = 8 \Rightarrow B(8,8)$ (01 *mark*)

Graph: $\begin{cases} \text{Lines representing the corresponding equations} \\ \text{Correct shade of the feasible solution region} \end{cases}$ $\begin{cases} (01 + 01)\,marks \\ (01\ mark) \end{cases}$

Corner Points	Objective Function $P(x, y) = 1000x + 4000y$
$O(0,0)$	$P(0,0) = 0$
$A(12,0)$	$P(12,0) = 12{,}000$
$B(8,8)$	$P(8,8) = 40{,}000$
$C(0,12)$	$P(0,12) = 48{,}000$ (max)



Correct Table of values (01 *mark*)

The point C(0, 12) gives the most profit, and that profit is Rs. 48,000.
Therefore, we conclude that one should manufacture 12 smart phones daily to obtain the maximum profit. (01 *mark*)

Answer 8 $4x^2 - 5y^2 + 40x - 30y - 45 = 0$

$4(x + 5)^2 - 5(y + 3)^2 = 100$

$\frac{(x+5)^2}{25} - \frac{(y+3)^2}{20} = 1$ (Horizontal Hyperbola) (01 *mark*)

$\frac{X^2}{25} - \frac{Y^2}{20} = 1$ where $X = x + 5$ *and* $Y = y + 3$

Comparing with $\frac{X^2}{a^2} - \frac{Y^2}{b^2} = 1$ to get $a = 5$ and $b = 2\sqrt{5}$ (01 *mark*)

Taking $c^2 = a^2 + b^2 = 25 + 20 = 45 \Rightarrow c = 3\sqrt{5}$ (01 *mark*)

Centre: $(0,0) \Rightarrow X = 0$; $Y = 0$

$\Rightarrow x + 5 = 0$; $y + 3 = 0$

$\Rightarrow x = -5$; $y = -3 \Rightarrow (-5, -3)$ (01 *mark*)

Foci: $(\pm c, 0) \Rightarrow X = \pm c$; $Y = 0$

$\Rightarrow x + 5 = \pm 3\sqrt{5}$; $y + 3 = 0$

$\Rightarrow x = -5 \pm 3\sqrt{5}$; $y = -3 \Rightarrow (-5 \pm 3\sqrt{5},\ -3)$ (01 *mark*)

Eccentricity: $e = \frac{c}{a} = \frac{3\sqrt{5}}{5}$ (01 *mark*)

Vertices: $(\pm a,\ 0) \Rightarrow X = \pm a$; $Y = 0$

$\Rightarrow x + 5 = \pm 5$; $y + 3 = 0$

$\Rightarrow x = -5 \pm 5$; $y = -3 \Rightarrow (-5 \pm 5,\ -3)$ (01 *mark*)

Directrices : $X = \pm \frac{c}{e^2}$

$\Rightarrow x + 5 = \pm \frac{3\sqrt{5}}{(3\sqrt{5}/5)^2}$ $\Rightarrow x = \frac{-15 \pm 5\sqrt{5}}{3}$ (01 *mark*)

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