

QUESTION ONE (13 Marks)**Marks**

- (a) Simplify: $-3x^3 \times 4x^2$ 1
- (b) Factorise (i) $x^2 - 8x - 9$ 1+2+2
 (ii) $6x^3 - 54xy^2$
 (iii) $(x+h)^3 - 1$
- (c) Simplify: $\frac{3}{k^2 - 4} \frac{2}{k^2 - 3k + 2}$ 3
- (d) Solve for x : $\frac{5}{x} + \frac{3}{2x} = 2$ 2
- (e) If $s = \frac{1}{2}(u+v)$, find u . 2

QUESTION TWO (13 Marks) Start a new page

- (a) Write 0.00000725 number in scientific notation. 1
- (b) Express $0.\dot{2}5\dot{7}$ as a fraction in lowest terms. 2
- (c) Solve the following pair of simultaneous equations: 2

$$\begin{aligned} 3x - y &= 5 \\ 5x + 3y &= -8 \end{aligned}$$
- (d) Express with a rational denominator:
 (i) $\frac{14}{\sqrt{7}}$ 2+2
 (ii) $\frac{3\sqrt{2}}{\sqrt{5} - \sqrt{2}}$
- (e) If $x = \sqrt{5} - 2$, find the value of $\frac{x^2 + 2x}{x + 3}$, expressing your answer with a rational denominator. 4

Question Three on Page 2 ...

QUESTION THREE (10 Marks) Start a new page**Marks**

- (a) State the natural domain of each of the following functions: 2
 (i) $f(x) = \frac{1}{x+2}$ (ii) $f(x) = \sqrt{2x+3}$
- (b) Sketch each of the following, showing any intercepts with the axes, asymptotes or vertices: 8
 (i) $y = \sqrt{25 - x^2}$ (ii) $y = 3^x + 2$
 (iii) $y = -(x-2)^2 + 3$ (iv) $y = \frac{1}{x-4} - 1$

QUESTION FOUR (12 Marks) Start a new page

- (a) (i) Solve for x if $|2x - 5| = 3$ 2
 (ii) Solve for x if $|8x - 9| = 5x$ 3
- (b) By first factorizing the LHS, find the solution for $3x^2 - 28x + 25 > 0$ 2
- (c) If $f(x) = \begin{cases} x+1, & x \geq 0 \\ \frac{1}{x}, & x < 0 \end{cases}$ then $f(0)$ equals: 2
- (d) Test if the function $f(x) = \frac{3x}{3+x^2}$ is odd, even or neither 2
- (e) Find the largest possible domain of $x = -\sqrt{4 - y^2}$ 2

END OF PAPER

QUESTION ONE (13 Marks)

Marks

- (a) Simplify: $-3x^3 \times 4x^2 = -12x^5$ 1
- (b) Factorise
- (i) $x^2 - 8x - 9 = (x-9)(x+1)$ 1+2+2
- (ii) $6x^3 - 54xy^2 = 6x(x^2 - 9y^2) = 6x(x-3y)(x+3y)$
- (iii) $(x+h)^3 - 1 = (x+h)^3 - (1)^3 = [(x+h)-1][(x+h)^2 + (x+h)1 + 1^2] = (x+h-1)(x^2 + 2xh + h^2 + x + h + 1)$
- (c) Simplify: $\frac{3}{k^2-4} - \frac{2}{k^2-3k+2}$ 3
- $= \frac{3}{(k-2)(k+2)} - \frac{2}{(k-2)(k-1)}$
- $= \frac{3(k-1) - 2(k+2)}{(k-2)(k+2)(k-1)}$
- $= \frac{k-7}{(k-2)(k+2)(k-1)}$
- (d) Solve for x: $\frac{5}{x} + \frac{3}{2x} = 2$ 2
- $\frac{10}{2x} + \frac{3}{2x} = \frac{4x}{2x}$ $4x = 13$ $x = \frac{13}{4}$ $x = 3\frac{1}{4}$
- (e) If $s = \frac{1}{2}(u+v)t$, find u. 2
- $2s = (u+v)t$ $\frac{2s}{t} = (u+v)$ $u = \frac{2s}{t} - v$

QUESTION TWO (13 Marks) Start a new page

- (a) Write 0.00000725 number in scientific notation. 1
- $= 7.25 \times 10^{-6}$
- (b) Express $0.2\dot{5}\dot{7}$ as a fraction in lowest terms. 2
- $10 \times 0.2\dot{5}\dot{7} = 2.575757\dots$
- $1000 \times 0.2\dot{5}\dot{7} = 257.5757\dots$
- $\therefore 990 \times 0.2\dot{5}\dot{7} = 255$ $0.2\dot{5}\dot{7} = \frac{255}{990} = \frac{17}{66}$
- (c) Solve the following pair of simultaneous equations: 2
- $3x - y = 5$ (i)
- $5x + 3y = -8$ (ii) $3\left(\frac{1}{2}\right) - y = 5$
- $9x - 3y = 15$ (i)x3 $\left(\frac{3}{2}\right) - 5 = y$
- $14x = 7$ add
- $x = \frac{1}{2}$ $y = \frac{-7}{2}$
- (d) Express with a rational denominator: 2+2
- (i) $\frac{14}{\sqrt{7}} = \frac{14\sqrt{7}}{\sqrt{7}\sqrt{7}} = \frac{14\sqrt{7}}{7} = 2\sqrt{7}$
- (ii) $\frac{3\sqrt{2}}{\sqrt{5}-\sqrt{2}} = \frac{3\sqrt{2}(\sqrt{5}+\sqrt{2})}{(\sqrt{5}-\sqrt{2})(\sqrt{5}+\sqrt{2})} = \frac{3\sqrt{10}+6}{5-2} = \frac{3\sqrt{10}+6}{3} = \sqrt{10}+2$
- (e) If $x = \sqrt{5} - 2$, find the value of $\frac{x^2+2x}{x+3}$, expressing your answer with a rational denominator. 4
- $\frac{(\sqrt{5}-2)^2 + 2(\sqrt{5}-2)}{(\sqrt{5}-2)+3}$
- $= \frac{5 - 4\sqrt{5} + 4 + 2\sqrt{5} - 4}{\sqrt{5}+1}$
- $= \frac{5 - 2\sqrt{5}}{\sqrt{5}+1} \times \frac{(\sqrt{5}-1)}{(\sqrt{5}-1)}$ *Rationalize*
- $= \frac{5\sqrt{5} - 5 - 10 + 2\sqrt{5}}{5-1}$
- $= \frac{7\sqrt{5} - 15}{4}$

IF NOT COMPLETED

QUESTION THREE (10 Marks) Start a new page

Marks

(a) State the natural domain of each of the following functions: 2

(i) $f(x) = \frac{1}{x+2}$

$x+2 \neq 0$ (undefined)
 $x \neq -2$

All x except $x = -2$

1 mark

(ii) $f(x) = \sqrt{2x+3}$

$2x+3 \geq 0$
 $2x \geq -3$
 $x \geq -\frac{3}{2}$

1 mark

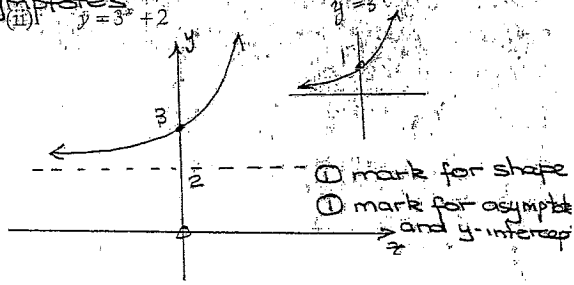
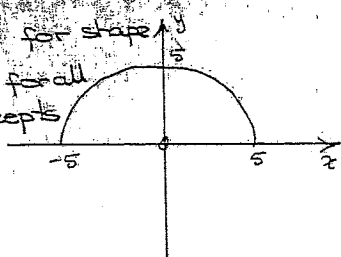
(b) Sketch each of the following, showing any intercepts with the axes, asymptotes or vertices: 8

asymptotes or vertices:

general comment: diagrams need to be larger and axes and origin labeled. hyperbolas and exponentials shouldn't run parallel to the asymptotes.

(i) $y = \sqrt{25-x^2}$

(ii) $y = 3^x + 2$



(iii) $y = -(x-2)^2 + 3$

(iv) $y = \frac{1}{x-4} - 1$

vertex at $x-2=0$
 $x=2$ $y=3$

x -intercept $x \pm y = 0$
 $0 = -(x-2)^2 + 3$
 $x-2 = \pm\sqrt{3}$
 $x = 2 \pm \sqrt{3}$

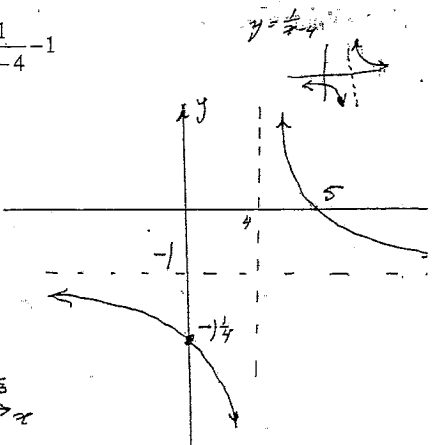
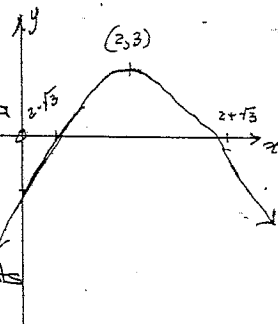
y -intercept at $x=0$
 $y = -(0-2)^2 + 3$
 $= -4 + 3$
 $= -1$

1 mark for concave down parabola

1 mark for vertex and y -intercept

No mark deducted for incorrect x -intercepts or x -intercepts missing

(missing)



x -intercept $y=0 = \frac{1}{x-4} - 1$
 $\frac{1}{x-4} = 1$
 $1 = x-4$
 $x = 5$

y -intercept $x=0$
 $y = \frac{1}{0-4} - 1$
 $= -\frac{1}{4} - 1$
 $= -1\frac{1}{4}$

1 mark for shape
1 mark for both asymptotes and intercepts

QUESTION FOUR (12 Marks) Start a new page

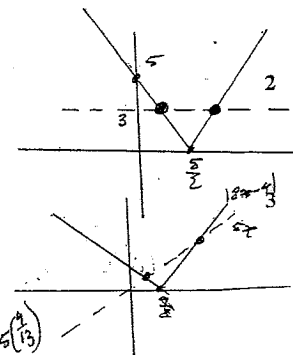
(a) (i) Solve for x if $|2x-5|=3$

Either $2x-5=3$ OR $-(2x-5)=3$
 $2x=8$ OR $2x-5=3$
 $x=4$ OR $2x=2$
 $x=1$

(ii) Solve for x if $|8x-9|=5x$

$8x-9=5x$ OR $-(8x-9)=5x$
 $3x=9$ OR $8x-9=5x$
 $x=3$ OR $13x=9$
 $x = \frac{9}{13}$

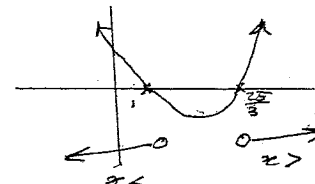
check $8(\frac{9}{13})-9 = \frac{72}{13}-9 = \frac{72-117}{13} = -\frac{45}{13}$
 $5(\frac{9}{13}) = \frac{45}{13}$
 $-\frac{45}{13} \neq \frac{45}{13}$



(b) By first factorizing the LHS, find the solution for $3x^2 - 28x + 25 > 0$ 2

$(3x-25)(x-1) > 0$

ANS $x < 1$ OR $x > \frac{25}{3}$



(c) If $f(x) = \begin{cases} x+1, & x \geq 0 \\ \frac{1}{x}, & x < 0 \end{cases}$ then $f(0)$ equals: 2

$f(x) = x+1$
 $f(0) = 0+1 = 1$

(d) Test if the function $f(x) = \frac{3x}{3+x^2}$ is odd, even or neither 2

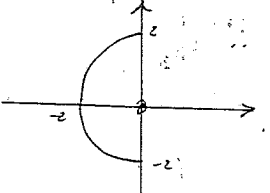
$f(-x) = \frac{3(-x)}{3+(-x)^2} = -\frac{3x}{3+x^2} = -f(x)$
 \therefore ODD

(e) Find the largest possible domain of $x = -\sqrt{4-y^2}$ 2

consider: $x^2 = 4-y^2$
 $x^2+y^2=4$
circle radius 2, centre origin



But $x = -\sqrt{\dots}$



$-2 \leq x \leq 0$

END OF PAPER