QUESTION ONE *(13 Marks)* **Marks**

(a) Simplify: $-3x^3 \times 4x^2$ **1**

(b) Factorise **1+2+2**

(i) $x^2 - 8x - 9$

(ii) $6x^3 - 54xy^2$

(iii) $(x+h)^3 - 1$

(c) Simplify: $\dfrac{3}{k^2-4} - \dfrac{2}{k^2-3k+2}$ **3**

(d) Solve for x: $\dfrac{5}{x} + \dfrac{3}{2x} = 2$ **2**

(e) If $s = \dfrac{1}{2}(u+v)t$, find u. **2**

QUESTION TWO *(13 Marks)* **Start a new page**

(a) Write 0.00000725 number in scientific notation. **1**

(b) Express $0 \cdot 2\dot{5}\dot{7}$ as a fraction in lowest terms. **2**

(c) Solve the following pair of simultaneous equations: **2**

$$3x - y = 5$$
$$5x + 3y = -8$$

(d) Express with a rational denominator: **2+2**

(i) $\dfrac{14}{\sqrt{7}}$

(ii) $\dfrac{3\sqrt{2}}{\sqrt{5}-\sqrt{2}}$

(e) If $x = \sqrt{5} - 2$, find the value of $\dfrac{x^2+2x}{x+3}$, expressing your answer with a rational denominator. **4**

Question Three on Page 2 ...

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

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

(i) $f(x) = \dfrac{1}{x+2}$ (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) $y = \dfrac{1}{x-4} - 1$

QUESTION FOUR *(12Marks)* **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 $f(x) = \begin{cases} x+1 & , \quad x \geq 0 \\ \dfrac{1}{x} & , \quad x < 0 \end{cases}$ then $f(0)$ equals: **2**

(d) Test if the function $f(x) = \dfrac{3x}{3+x^2}$ 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: $-3x^3 \times 4x^2$ — 1

$= -12x^5$

(b) Factorise (i) $x^2 - 8x - 9$ — 1+2+2

$= (x-9)(x+1)$

(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

$\frac{10}{2x} + \frac{3}{2x} = \frac{4x}{2x}$ $\quad 4x = 13$ $\quad x = \frac{13}{4}$ $\quad x = 3\frac{1}{4}$

(e) If $s = \frac{1}{2}(u+v)t$, find u. — 2

$2s = (u+v)t$ $\quad \frac{2s}{t} = (u+v)$ $\quad u = \frac{2s}{t} - v$

QUESTION TWO *(13 Marks)* **Start a new page**

(a) Write 0.00000725 number in scientific notation. — 1

$= 7.25 \times 10^{-6}$

(b) Express $0\cdot2\dot{5}\dot{7}$ as a fraction in lowest terms. — 2

$10 \times 0\cdot2\dot{5}\dot{7} = 2.575757....$

$1000 \times 0\cdot2\dot{5}\dot{7} = 257.5757....$

$\therefore 990 \times 0\cdot2\dot{5}\dot{7} = 255$ $\quad 0\cdot2\dot{5}\dot{7} = \frac{255}{990} = \frac{17}{66}$

(c) Solve the following pair of simultaneous equations: — 2

$3x - y = 5$ (i)

$5x + 3y = -8$ (ii) $\quad 3\left(\frac{1}{2}\right) - y = 5$

$9x - 3y = 15$ (i)x3 $\quad \left(\frac{3}{2}\right) - 5 = y$

$14x = 7$ add

$x = \frac{1}{2}$ $\quad y = \frac{-7}{2}$

(d) Express with a rational denominator:

(i) $\frac{14}{\sqrt{7}} = \frac{14\sqrt{7}}{\sqrt{7}\sqrt{7}} = \frac{14\sqrt{7}}{7} = 2\sqrt{7}$ — 2+2

(ii) $\frac{3\sqrt{2}}{\sqrt{5}-\sqrt{2}} = \frac{3\sqrt{2}(\sqrt{5}+\sqrt{2})}{(\sqrt{5}-\sqrt{2})(\sqrt{5}+\sqrt{2})} = \frac{3\sqrt{10}+6}{5-2} = \frac{3\sqrt{10}+6}{3} = \sqrt{10}+2$

-1 IF NOT CANCELLED

(e) If $x = \sqrt{5} - 2$, find the value of $\frac{x^2+2x}{x+3}$, expressing your answer with a rational denominator. — 4

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

$= \frac{5 - 4\sqrt{5} + 4 + 2\sqrt{5} - 4}{\sqrt{5}+1}$

$= \frac{5 - 2\sqrt{5}}{\sqrt{5}+1} \quad \frac{(\sqrt{5}-1)}{(\sqrt{5}-1)}$ ✓ Rationalize

$= \frac{5\sqrt{5} - 5 - 10 + 2\sqrt{5}}{5-1}$

$= \frac{7\sqrt{5} - 15}{4}$

Question Three on Page 2 ...

QUESTION THREE *(10Marks)* **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

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

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

① mark for shape

① mark for all intercepts

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

① mark for shape

① mark for asymptote and y-intercept

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

Vertex at $x-2=0$, $x=2$, $y=3$

x-inter at $y=0$

$0=-(x-2)^2+3$

$x-2=\pm\sqrt{3}$

$x=2\pm\sqrt{3}$

y-inter at $x=0$

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

$=-4+3$

$=-1$

① mark for concave down parabola

① mark for vertex and y-intercept

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

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

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

x-inter

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

$\frac{1}{x-4}=1$

$1=x-4$

$x=5$

y-inter

$x=0$

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

$=-1\frac{1}{4}$

① mark for shape

① mark for both asymptotes and intercepts

QUESTION FOUR *(12Marks)* **Start a new page**

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

Either $2x-5=3$ OR $-(2x-5)=3$

$2x=8$ $2x-5=-3$

$x=4$ $2x=2$

$x=1$

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

$8x-9=5x$ $-(8x-9)=5x$

$3x=9$ $8x-9=-5x$

$x=3$ $13x=9$

$x=\frac{9}{13}$

check $8(3)-9=15$ ✓ $5x=5(3)=15$

check $8(\frac{9}{13})-9=-\frac{4}{13}$ $|-\frac{4}{13}|\neq 5(\frac{9}{13})$

(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

$f(x)=x+1$

$f(0)=0+1$

$f(0)=1$

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

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

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

$f(-x)=-\left(\frac{3x}{3+x^2}\right)$

$f(-x)=-f(x)$

$\therefore$ Even

(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 rad 2

Centre origin

But $x=-\sqrt{\ }$

$\therefore -2\leq x\leq 0$

END OF PAPER