Question 1   *(23 Marks)*   <u>Start this question on a new page.</u>   **Marks**

a) Calculate correct to 2 decimal places   **1**

$$5^{\frac{3}{2}} \times 8^{\frac{4}{5}} \times 3^2$$

b) Evaluate and express your answer using scientific notation   **2**

$$\frac{3\times10^7 - 2\times10^6}{4\times10^3 + 2\times10^3}$$

c) Simplify

   (i) $3xy^2 \times -4x^2$ **1**

   (ii) $\dfrac{a^3 b^7}{a^2 \left(b^3\right)^3}$ **1**

d) Evaluate $\left|-2\right| + \left|-5\right|$ **1**

e) Express $0.0\overset{.}{4}$ as a simplified fraction   **1**

f) Harry and Sally paid \$315.00 for a meal at a restaurant. This included   **2**
a 12 ½ % tip. What was the cost of the meal without the tip?

g) Expand and simplify completely

   (i) $3x(x-7) - 4x(x-7)$ **2**

   (ii) $4(2x+1)^2$ **2**

h) Factorise completely

   (i) $27x^3 - 8y^3$ **1**

   (ii) $3x^2 + 16x + 20$ **1**

   (iii) $(6x^2 - 6) + (12x^2 - 36x - 48)$ **3**

Question 1 continued   **Marks**

  i) Simplify as a single fraction in its simplest form:

     (i) $\dfrac{5x+3}{4}-\dfrac{2x-3}{5}$ **2**

     (ii) $\dfrac{x^2-14x+13}{(x+2)(x+3)}\times\dfrac{x^2+6x+9}{(x-1)^2}$ **3**

Question 2   *(21 marks)*   <u>Start this question on a new page.</u>

  a) Simplify completely   **2**

       $\sqrt{48}-\sqrt{44}+\sqrt{75}$

  b) Simplify with a rational denominator   **2**

       $\dfrac{\sqrt{5}+2}{\sqrt{5}-3}$

  c) Solve $2x^2-8x+5=0$ leaving your answer as an exact value   **2**

      in its simplest form.

  d) Solve the following simultaneous equations: $6x+3y=0$ **3**
                                                           $7x-4y=-5$

  e) Find x if $4^{3-x}=8^x$ **2**

  f) If $A=P(1+r)^n$, find r if: A = 3345, P = 2500 and n = 4   **2**

      Answer correct to 2 decimal places

Question 2 continued   **Marks**

  g) Solve the following:

     $|2x-5|=7$ **2**

  h) Solve and graph on the number line

     (i) $2 \le 4(x-2) < 8$ **3**

     (ii) $|3x-2| \le 5$ **3**

Question 3   *(28 marks)*   <u>Start this question on a new page.</u>

  a) Sketch each of the following curves on a separate diagram.   **10**
     Clearly show all important features, including x and y intercepts,
     asymptotes, maximum and minimum values where necessary.

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

     (ii) $x^2 + y^2 = 25$

     (iii) $y = 3^x$

     (iv) $y = |x-4|$

     (v) $y = \dfrac{5}{x-3}$

  b) State the domain and range of   **4**

     (i) $y = \sqrt{4-x^2}$

     (ii) $y = 4^x$

  c) Using the graphs from part (a) determine whether the following graphs are
     functions or relations:

     (i) $y = x^2 + 3$ **1**

     (ii) $x^2 + y^2 = 25$ **1**

Question 3 continued   **Marks**

   d) Sketch the following piecemeal function: **4**

$$f(x) = \begin{cases} 3 & x \geq 5 \\ -x & 0 \leq x < 5 \\ x+5 & x < 0 \end{cases}$$

   e) Determine whether the function $f(x) = x^4 - 3x^2 + 2$ is odd, even   **2**

      or neither.

   f) Given $f(x) = x^3 + 7x + 5,\ find\ f(-1)$ **1**

   g) Given $g(x) = x^2 - 6$ find values for x for which $g(x) = 3$ **1**

   h) Shade the region on the number plane where $y \geq x^2 - 2\ and\ y > 6 + 3x$ **4**

      hold simultaneously. Indicate any points of intersection.

END OF PAPER

Question 1   *(23 Marks)*   <u>Start this question on a new page.</u>   **Marks**

    a)   531.09   **1**

    b) $\dfrac{14000}{3}$ 1 mark for each or 2 for correct final answer   **2**

        $= 4.667 \times 10^3$

    c)

        (i) $-12x^3 y^2$ **1**

        (ii) $\dfrac{a}{b^2}$ **1**

    d)   7   **1**

    e) $\dfrac{2}{45}$ **1**

    f)   315=112.5%   1 mark

        2.8=1%

        280= 100%   cost without tip is $280   **2**

    g)   Expand and simplify completely

        (i) $\begin{array}{l} 3x^2 - 21x - 4x^2 + 28x \\ = -x^2 + 7x \ or \ 7x - x^2 \end{array}$ 1 mark correct expansion   **2**

        (ii) $4(4x^2 + 4x + 1)$ 1 mark correct expansion

             $16x^2 + 16x + 4$ **2**

    h)   Factorise completely

        (i) $\left(3x - 2y\right)\left(9x^2 + 6xy + 4y^2\right)$ **1**

        (ii) $\left(x + 2\right)\left(3x + 10\right)$ **1**

$$6x^2 - 6 + 12x^2 - 36x - 48 \qquad 1 \text{ mark } exp\,ansion$$

(iii)

$$= 18x^2 - 36x - 54$$

$$= 18\left(x^2 - 2x - 3\right) \qquad 1 \text{ mark } HCF$$

$$= 18(x-3)(x+1) \qquad 1 \text{ mark } factori\sin g$$

③ 3

Question 1 continued

$$\frac{5x+3}{4} - \frac{2x-3}{5}$$

i)

$$\frac{5(5x+3) - 4(2x-3)}{20}$$

2

$$= \frac{25x + 15 - 8x + 12}{20} \qquad 1 \text{ mark correct } exp\,ansion$$

$$= \frac{17x + 27}{20} \qquad 1 \text{ mark}$$

(i)

$$\frac{(x-13)(x-1)}{(x+2)(x+3)} \times \frac{(x+3)^2}{(x-1)^2} \qquad 2 \text{ mark } factori\sin g$$

$$= \frac{(x-13)(x+3)}{(x+2)(x-1)} \qquad 1 \text{ mark simplifying}$$

3

Question 2   *(21 marks)*   <u>Start this question on a new page.</u>

a)   2

$$4\sqrt{3} - 2\sqrt{11} + 5\sqrt{3} \qquad 1 \text{ mark simplifying}$$

$$= 9\sqrt{3} - 2\sqrt{11} \qquad 1 \text{ mark collecting like terms}$$

b)   2

$$\frac{\sqrt{5} + 2}{\sqrt{5} - 3} \times \frac{\sqrt{5} + 3}{\sqrt{5} + 3}$$

$$= \frac{5 + 3\sqrt{5} + 2\sqrt{5} + 6}{5 - 9} \qquad 1 \text{ mark}$$

$$= \frac{11 + 5\sqrt{5}}{-4} \qquad 1 \text{ mark}$$

c)   **2**

$$2x^2 - 8x + 5 = 0$$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{8 \pm \sqrt{8^2 - 4.2.5}}{2.2} \qquad 1\ mark$$

$$= \frac{8 \pm \sqrt{24}}{4}$$

$$= \frac{8 \pm 2\sqrt{6}}{4}$$

$$= \frac{4 \pm \sqrt{6}}{2} \qquad 1\ mark$$

d)

$$6x + 3y = 0 \ldots\ldots\ldots(1) \times 4$$

$$7x - 4y = -5 \ldots\ldots(2) \times 3$$

$$24x + 12y = 0 \ldots\ldots(3)$$

$$21x - 12y = -15 \ldots(4) \qquad 1\ mark$$

$$45x \ldots\ldots = -15 \ldots(3+4)$$

$$x = \frac{-1}{3}$$

subst with eqn 1

Check if ✓

$$6\frac{1}{3} + 3y = 0$$

$$3y = -2$$

$$y = \frac{-2}{3}$$

$$x = \frac{1}{3}\ and\ y = \frac{+2}{3} \qquad 1\ mark\ each$$

$$2^{2(3-x)} = 2^{3x}$$

$$6 - 2x = 3x \qquad 1\ mark$$

e) $6 = 5x$ **2**

$$x = \frac{6}{5} \qquad 1\ mark$$

$3345 = 2500(1+r)^4$ 1 *subst*

$1.338 = (1+r)^4$

f) $\sqrt[4]{1.338} = 1+r$ **2**

$1.075508949 = 1+r$

$r = \cancel{0.75508949}$ 0.075508949

$r = 0.76 \ (2d.p)$ 1 *mark*

0.08.

g) $|2x-5| = 7$ **2**

$2x-5 = 7$

$2x = 12$

$x = 6$

$-(2x-5) = 7$

$-2x+5 = 7$

$-2x = 2$

$x = -1$

~~Check: $|2 \times 6 - 5| = 7$ ok~~ $|2 \times -1 - 5| = 7$ 1 mark each

h) Solve and graph on the number line

(i) $2 \le 4(x-2) < 8$ **3**

$2 \le 4x - 8 < 8$

$10 \le 4x < 16$ 1 mark each value

$\dfrac{5}{2} \le x < 4$
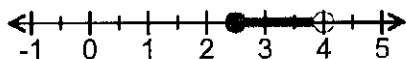
1 mark correct graph of solutions given

(ii)

3

$$3x - 2 \leq 5 \qquad\qquad -3x + 2 \leq 5$$
$$3x \leq 7 \qquad\qquad \textbf{or } -3x \leq 3$$
$$x \leq \frac{7}{3} \qquad\qquad x \geq -1$$

Check values: $\left|3(\frac{7}{3}) - 2\right| \leq 5$ ok $\qquad \left|3(-1) - 2\right| \leq 5$ ok $\qquad$ 1 mark each
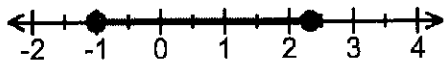
1 mark correct graph for solution $-1 \leq x \leq \frac{7}{3}$

Question 3   *(28 marks)*   <u>Start this question on a new page.</u>

a) 2 marks for each graph   **10**

    Clearly show all important features, including x and y intercepts,

    asymptotes, maximum and minimum values where necessary.

    (i) $y = x^2 + 3$ max turning point at $(0,3) = y$ int.
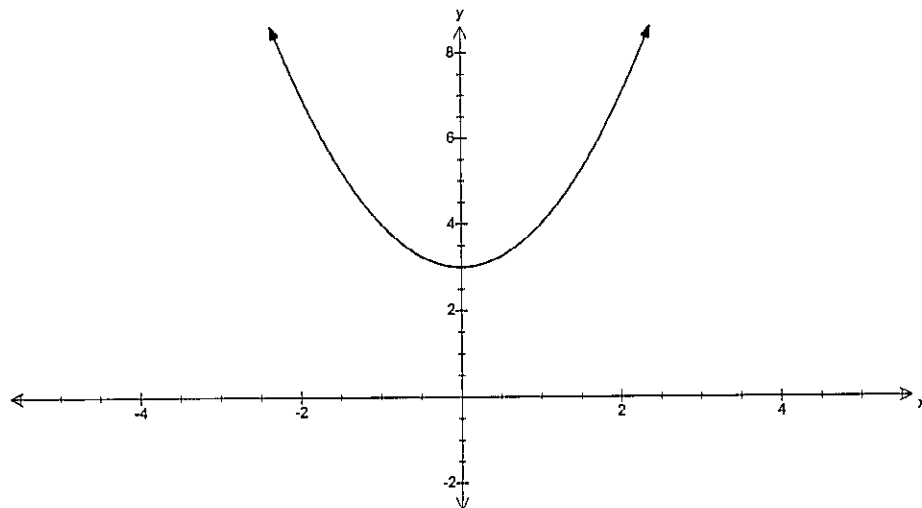
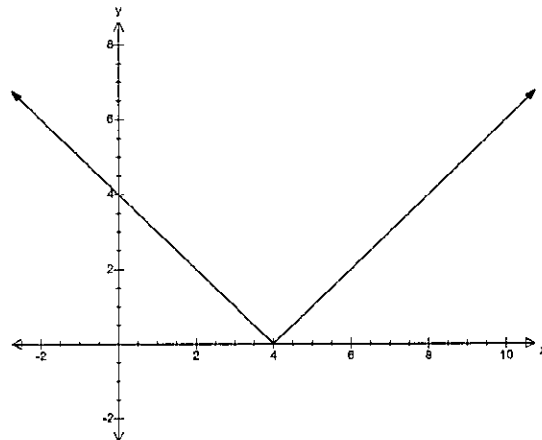(ii) $x^2 + y^2 = 25$ x int (-5,0) and (0,-5) y int (0,-5) and (0,5)
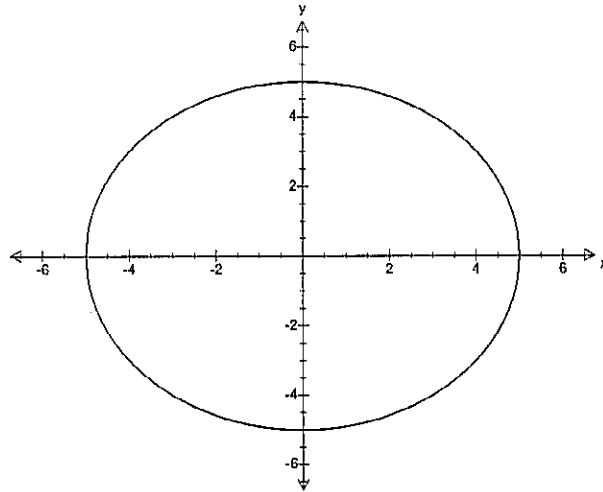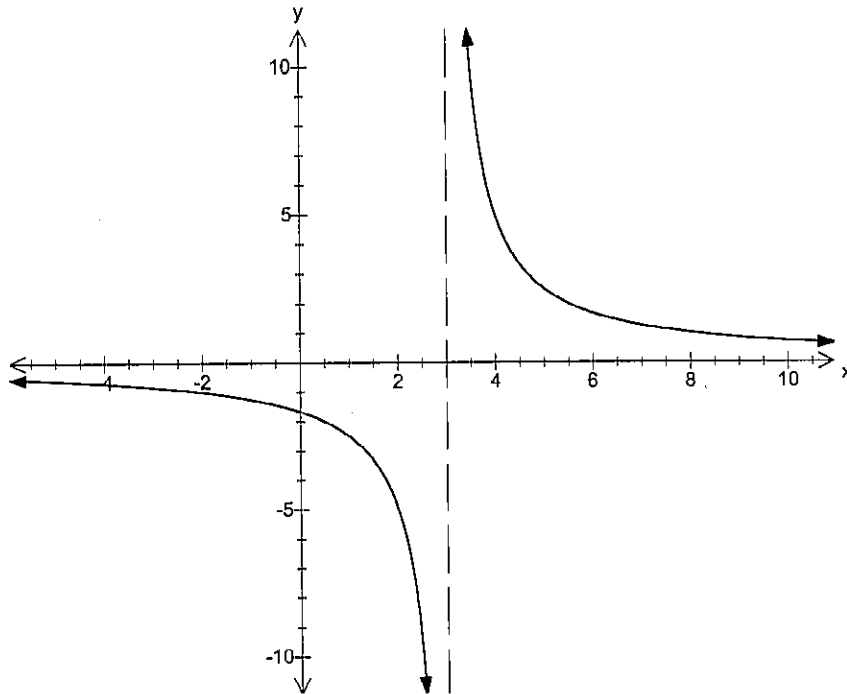

(iii) $y = 3^x$ y int (0,1)
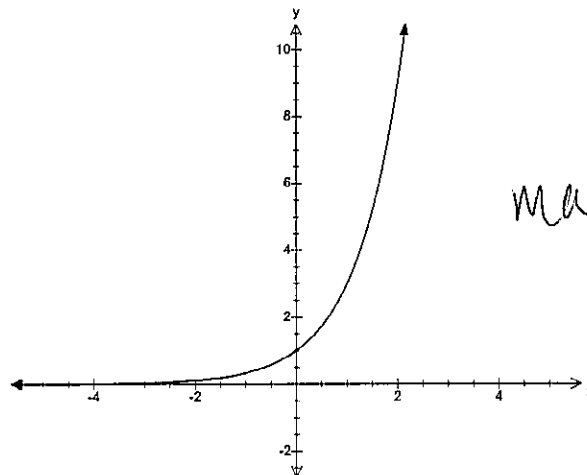
mark one other point

(iv) $y = |x - 4|$ x int (4,0) and y int (0,4)

(v) $y = \dfrac{5}{x-3}$ vert ass ($x=3$)

b) State the domain and range of   **4**

   (i) Domain: $-2 \le x \le 2$ Range: $0 \le y \le 2$ 1 mark each

   (ii) Domain: all real x Range: $y \ne 0$ 1 mark each

c) Using the graphs from part (a) determine whether the following graphs are functions or relations:

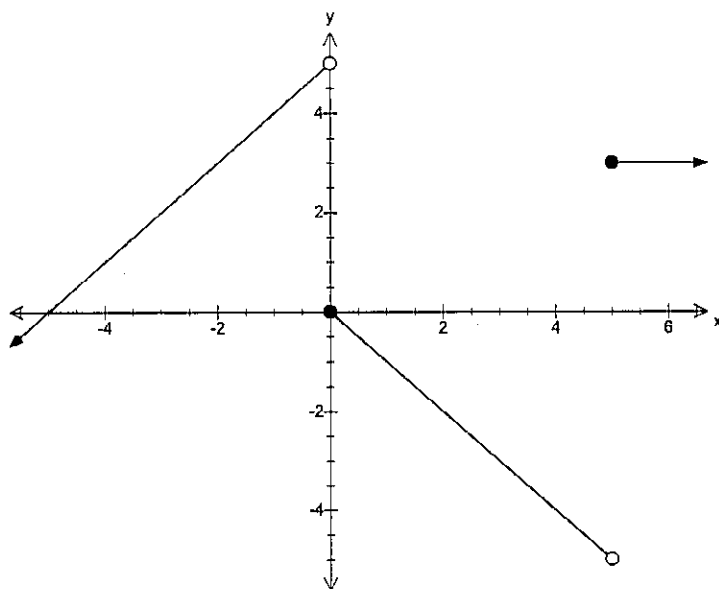   (i) function   **1**

   (ii) relation   **1**

SOLUTIONS

d) Sketch the following piecemeal function: **4**

$$f(x) = \begin{cases} 3 & x \geq 5 \\ -x & 0 \leq x < 5 \\ x+5 & x < 0 \end{cases} \quad \text{1 for each graph and 1 for correct limits}$$

e)   **2**

$$f(-x) = (-x)^4 - 3(-x)^2 + 2$$
$$f(-x) = x^4 - 3x^2 + 2 \qquad 1 \, mark$$
$$f(x) = f(-x) \qquad Even \qquad 1 \, mark$$

f)
$$f(-1) = (-1)^3 + 7(-1) + 5$$
$$f(-1) = -3$$
1

g)
$$g(x) = 3 = x^2 - 6$$
$$x^2 = 9$$
$$x = \pm 3$$
1

h) Shade the region on the number plane where $y \geq x^2 - 2$ *and* $y > 6 + 3x$ **4**
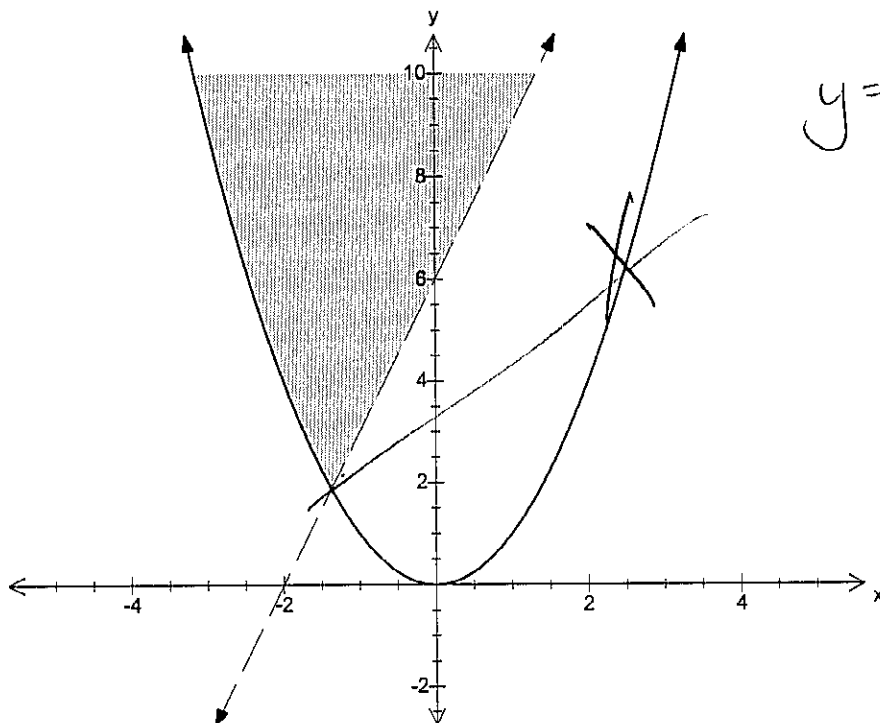
points of intersection $x = 1.701$ $y = 0.8953$

1 for each graph

1 for shading | $dotted/solid$ line   .

~~1 for point of intersection~~

$y = x^2 - 2$
needs to be
typed in .