

Question 1 (10 marks) Place your response on the attached ANSWER SHEET**Marks****Multiple choice**

- (i) Which one of the following has three significant figures? 1
- (A) 2.568 (B) 0.5803 (C) 583 000 (D) 5.830
- (ii) Which one of the following is equal to $\left(\frac{1}{16}\right)^{\frac{1}{2}}$? 1
- (A) $\frac{1}{4}$ (B) 8 (C) 4 (D) $\frac{1}{8}$
- (iii) If $d^2 = 8^2 + 9^2 - 2 \times 8 \times 9 \times \cos 30^\circ$, find d correct to one decimal place? 1
- (A) 4.5 (B) 26.6 (C) 66.8 (D) 11.1
- (iv) Which one of the following represents $0.5\dot{6}$, in its simplest form. 1
- (A) $\frac{56}{99}$ (B) $\frac{14}{25}$ (C) $\frac{51}{90}$ (D) $\frac{17}{30}$
- (v) A sports store has a sale discounting everything by 40%. If I purchase a football for \$230, which one of the following represents the original price, to the nearest dollar? 1
- (A) \$575 (B) \$383 (C) \$92 (D) \$138
- (vi) Which one of the following is NOT true? 1
- (A) $|-a| = |a|$ (B) $|a + b| \leq |a| + |b|$
(C) $\sqrt{a} = \pm a$ (D) $|a - b| = |b - a|$

- (vii) Expand and simplify $2x^2 + 3xy - 2x(x - 4y)$. 1
- (A) $11xy$ (B) $4x^2 - 5xy$ (C) $-4x^2 - 11xy$ (D) $-11xy$
- (viii) Which one of the following equals $\sqrt{25a^9}$? 1
- (A) $5a^3$ (B) $25a^3$ (C) $25a^{4.5}$ (D) $5a^{4.5}$
- (ix) Which one of the following is the factorised form for $12 - x - x^2$? 1
- (A) $(4 - x)(3 - x)$ (B) $(4 + x)(3 - x)$
(C) $(4 - x)(4 + x)$ (D) $(3 + x)(4 + x)$
- (x) $\sqrt{12} + \sqrt{24}$ when simplified gives 1
- (A) 6 (B) $2\sqrt{3} + 6\sqrt{2}$
(C) $2\sqrt{3} + 2\sqrt{6}$ (D) $4\sqrt{3} + 4\sqrt{6}$

Question 2 (10 marks) **Start this question on a NEW PAGE.** **Marks**

BASIC ARITHMETIC

- (a) Simplify $\frac{2\frac{1}{5}-1\frac{3}{4}}{5\frac{1}{3}+3\frac{2}{7}}$ **2**
- (b) Evaluate
- (i) $|-2-3|$ **1**
- (ii) $\sqrt{8^2+6^2}$ **1**
- (iii) $(-1)^0$ **1**
- (c) Write $25^{-\frac{3}{2}}$ as a fraction in its simplest form. **1**
- (d) Peter scored 56 out of 70 for his Maths test. What percentage is this? **2**
- (e) Express the following in scientific notation correct two 1 significant place.
 $(2.5 \times 10^3) \times (5.7 \times 10^{-5})$ **2**

Question 3 (20 marks)	<u>Start this question on a NEW PAGE.</u>	Marks
ALGEBRA and SURDS		
(a) Expand		3
(i) $(3p-5)^2$	(ii) $(7y-1)(7y+1)$	
(b) Expand and simplify		4
(i) $4\sqrt{3}(\sqrt{3}-\sqrt{6})$	(ii) $(2-\sqrt{5})(\sqrt{5}+2)$	
(c) Factorise fully		
(i) $x^2 - 7x + 12$		1
(ii) $5 - 20x^2$		2
(iii) $6x^2 + 11x - 35$		2
(iv) $x^3 + 27$		1
(v) $2a^3b - 16b^4$		2
(d) Simplify the following algebraic fractions		3
$\frac{2x}{2x-4} - \frac{x}{x+2}$		
(e) If $\frac{8}{7-3\sqrt{5}} = a + b\sqrt{5}$, find the values of a and b .		3

Question 4 (20marks) **Start this question on a NEW PAGE.** **Marks**

EQUATIONS

- (a) Solve the following:
- (i) $3x = 7$ **1**
- (ii) $\frac{p}{3} - \frac{p+1}{4} = 1$ **2**
- (iii) $|2x-1| = 5$ **2**
- (b) Solve the following inequalities.
- (i) $-1 \leq \frac{x-2}{3} \leq 1$ (ii) $|a+5| \geq 4$ **4**
- (c) Solve $2x^2 - x - 1 = 0$ by factorising first. **2**
- (d) Solve $3x^2 + 9x - 1 = 0$ leaving your answers correct to 2 decimal places. **2**
- (e) Use the completing of the square method to solve $x^2 + 4x - 1 = 0$, leaving your answer in exact form. **2**
- (f) Solve $x^2 > 4x$ **2**
- (g) Solve the following simultaneous equations **3**
- $$5x - 4y = 9$$
- $$2y = x + 3$$

Question 5 (20marks) **Start this question on a NEW PAGE.** **Marks**
FUNCTIONS and GRAPHS

- (a) If $f(x) = x^3 - x + 7$ find $f(-1) + f(1)$. **2**
- (b) Sketch each of the following graphs on separate axes, showing all important features. **10**
- (i) $y = 2x - 1$
- (ii) $y = x^2 - 4x + 3$
- (iii) $f(x) = \sqrt{9 - x^2}$
- (iv) $g(x) = \frac{2}{x}$
- (v) $f(x) = |x - 1|$
- (c) Determine the domain and range for **4**
- (i) $f(x) = \sqrt{x + 4}$
- (ii) $g(x) = \frac{1}{9 - x^2}$
- (d) Show that $f(x) = x^3 + x$ is an odd function. **2**
- (e) Sketch $f(x) = \frac{|x|}{x}$ **2**

END OF PAPER

Question 1

$$(i) 583000 \quad (C)$$

$$(ii) \left(\frac{1}{16}\right)^{-\frac{1}{2}} = (4^{-2})^{-\frac{1}{2}} \\ = 4 \quad (C)$$

$$(iii) d^2 = 8^2 + 9^2 - 2 \times 8 \times 9 \cos 30 \\ \div 20.29234186 \\ d \div 4.504702194 \\ = 4.5 \text{ to 1dp} \quad (A)$$

$$(iv) \text{Let } x = 0.\dot{5}6 \\ = 0.56666\dots \text{---} \textcircled{1} \\ 10x = 5.666\dots \text{---} \textcircled{2} \\ 100x = 56.666\dots \text{---} \textcircled{3}$$

$$\textcircled{3} - \textcircled{2} \quad 90x = 51 \\ x = \frac{51}{90} \\ = \frac{17}{30} \\ \therefore 0.\dot{5}6 = \frac{17}{30} \quad (D)$$

$$(v) \begin{array}{l} 60\% \text{ is } \$230 \\ 1\% \text{ is } \frac{\$230}{60} \\ 100\% \text{ is } \frac{\$230}{60} \times 100 \\ = \$383.33 \\ = \$383 \quad (B) \\ \text{to the nearest dollar} \end{array}$$

$$(vi) \sqrt{a} = \pm a \quad (C)$$

$$(vii) 2x^2 + 3xy - 2x(x-4y) \\ = 2x^2 + 3xy - 2x^2 + 8xy \\ = 11xy \quad (A)$$

$$(viii) \sqrt{25a^9} = 5a^{4.5} \quad (D)$$

$$(ix) 12 - x - x^2 = -(x^2 + x - 12) \\ = -(x-3)(x+4) \\ = (-x+3)(x+4) \\ = (3-x)(x+4) \quad (B)$$

$$(x) \sqrt{12} + \sqrt{24} = \sqrt{4 \times 3} + \sqrt{4 \times 6} \\ = 2\sqrt{3} + 2\sqrt{6} \quad (C)$$

Question 2

$$a) \frac{2\frac{1}{5} - 1\frac{3}{4}}{5\frac{1}{3} + 3\frac{2}{7}} = \frac{\frac{9}{20}}{\frac{181}{21}} \\ = \frac{189}{3620}$$

$$b) (i) |-2-3| = |-5| \\ = 5$$

$$(ii) \sqrt{8^2 + 6^2} = \sqrt{64 + 36} \\ = \sqrt{100} \\ = 10$$

$$(iii) (-1)^0 = 1$$

$$c) 25^{-\frac{3}{2}} = \left(\frac{1}{\sqrt{25}}\right)^3 \\ = \left(\frac{1}{5}\right)^3 \\ = \frac{1}{125}$$

$$d) \text{ percentage} = \frac{56}{70} \times 100\% \\ = 80\%$$

\therefore The mark is 80%

$$e) (2.5 \times 10^3) \times (5.7 \times 10^{-5}) = 1.425 \\ = 1.4 \times 10^0 \\ \text{to 1 sig fig}$$

Question 3

$$a) \text{ (i) } (3p-5)^2 = (3p-5)(3p-5) \\ = 9p^2 - 30p + 25$$

$$\text{(ii) } (7y-1)(7y+1) = 49y^2 - 1$$

$$b) \text{ (i) } 4\sqrt{3}(\sqrt{3}-\sqrt{6}) = 4 \times 3 - 4\sqrt{18} \\ = 12 - 4\sqrt{9 \times 2} \\ = 12 - 12\sqrt{2}$$

$$\text{(ii) } (2-\sqrt{5})(\sqrt{5}+2) = 2\sqrt{5} + 4 - 5 - 2\sqrt{5} \\ = -1$$

$$c) \text{ (i) } x^2 - 7x + 12 = (x-3)(x-4)$$

$$\text{(ii) } 5 - 20x^2 = 5(1 - 4x^2) \\ = 5(1-2x)(1+2x)$$

$$\text{(iii) } 6x^2 + 11x - 35 \quad P = 6x - 35 \\ = 6x^2 + 21x - 10x - 35 \quad = -210 \\ = 3x(2x+7) - 5(2x+7) \quad S = 11 \\ = (2x+7)(3x-5) \quad F = 21, -10$$

$$iv) x^3 + 27 = x^3 + 3^3 \\ = (x+3)(x^2 - 3x + 9)$$

$$v) 2a^3b - 16b^4 = 2b(a^3 - 8b^3) \\ = 2b[a^3 - (2b)^3] \\ = 2b(a-2b)(a^2 + 2ab + 4b^2)$$

$$d) \frac{2x}{2x-4} - \frac{x}{x+2} = \frac{2x}{2(x-2)} - \frac{x}{x+2} \\ = \frac{2x(x+2) - 2x(x-2)}{2(x-2)(x+2)} \\ = \frac{2x^2 + 4x - 2x^2 + 4x}{2(x-2)(x+2)} \\ = \frac{8x}{2(x-2)(x+2)}$$

$$e) \frac{8}{7-3\sqrt{5}} = a + b\sqrt{5}$$

$$\frac{8}{7-3\sqrt{5}} = \frac{8}{7-3\sqrt{5}} \times \frac{7+3\sqrt{5}}{7+3\sqrt{5}} \\ = \frac{8(7+3\sqrt{5})}{49 - 9 \times 5} \\ = \frac{8(7+3\sqrt{5})}{4} \\ = 2(7+3\sqrt{5}) \\ = 14 + 6\sqrt{5}$$

$$\therefore a = 14 \quad b = 6$$

Question 4

a) i) $3x = 7$

$$x = \frac{7}{3}$$

$$x = 2\frac{1}{3}$$

ii) $\frac{p}{3} - \frac{p+1}{4} = 1$

$$4p - 3(p+1) = 12$$

$$4p - 3p - 3 = 12$$

$$p = 15$$

(iii) $|2x-1| = 5$

$$2x-1 = 5 \text{ or } 2x-1 = -5$$

$$2x = 6$$

$$x = 3$$

$$2x = -4$$

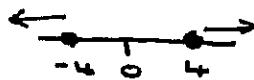
$$x = -2$$

b) i) $-1 \leq \frac{x-2}{3} \leq 1$

$$-3 \leq x-2 \leq 3$$

$$-1 \leq x \leq 5$$

ii) $|a+5| \geq 4$



$$a+5 \leq -4 \quad \text{or} \quad a+5 \geq 4$$

$$a \leq -9$$

$$a \geq -1$$

c) $2x^2 - x - 1 = 0$ $P = -2$

$$2x^2 - 2x + x - 1 = 0$$
 $S = -1$

$$2x(x-1) + 1(x-1) = 0$$
 $F = -2, 1$

$$(2x+1)(x-1) = 0$$

$$x = -\frac{1}{2}, 1$$

d) $3x^2 + 9x - 1 = 0$

$$a = 3, b = 9, c = -1$$

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

$$= \frac{-9 \pm \sqrt{9^2 - 4 \times 3 \times -1}}{2 \times 3}$$

$$= \frac{-9 \pm \sqrt{81 + 12}}{6}$$

$$= \frac{-9 \pm \sqrt{93}}{6}$$

$$\therefore x = \frac{-9 + \sqrt{93}}{6}, x = \frac{-9 - \sqrt{93}}{6}$$

$$\approx 0.107275126$$

$$\approx 0.11 \text{ to 2dp}$$

$$\approx -3.107275126$$

$$\approx -3.11 \text{ to 2dp}$$

e) $x^2 + 4x - 1 = 0$

$$x^2 + 4x = 1$$

$$x^2 + 4x + \left(\frac{4}{2}\right)^2 = 1 + \left(\frac{4}{2}\right)^2$$

$$(x+2)^2 = 5$$

$$x+2 = \pm\sqrt{5}$$

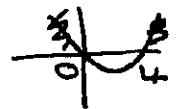
$$x = -2 \pm \sqrt{5}$$

f) $x^2 > 4x$

$$x^2 - 4x > 0$$

$$x(x-4) > 0$$

$$x < 0 \text{ or } x > 4$$



$$g) \quad 5x - 4y = 9 \quad \text{--- ①}$$

$$2y = x + 3 \quad \text{--- ②}$$

sub ② in ①

$$5x - 2(2y) = 9$$

$$5x - 2(x + 3) = 9$$

$$5x - 2x - 6 = 9$$

$$3x = 15$$

$$x = 5$$

sub ②

$$2y = x + 3$$

$$2y = 5 + 3$$

$$2y = 8$$

$$y = 4$$

Question 5

$$a) \quad f(x) = x^3 - x + 7$$

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

$$= -1 + 1 + 7$$

$$= 7$$

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

$$= 7$$

$$\therefore f(-1) + f(1) = 7 + 7$$

$$= 14$$

$$b) (i) \quad x\text{-intercept} \Rightarrow y = 0$$

$$y = 2x - 1$$

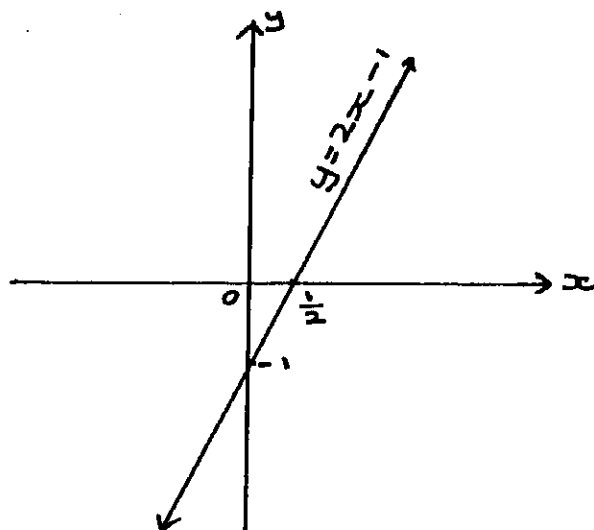
$$0 = 2x - 1$$

$$2x = 1$$

$$x = \frac{1}{2}$$

$$x \text{ intercept } \left(\frac{1}{2}, 0\right)$$

$$y \text{ intercept } (0, -1)$$



$$ii) \quad y = x^2 - 4x + 3$$

$$= (x - 3)(x - 1)$$

x intercepts $(3, 0)$ $(1, 0)$

y intercept $(0, 3)$

equation of the axis of symmetry is $x = -\frac{b}{2a}$

$$x = \frac{4}{2}$$

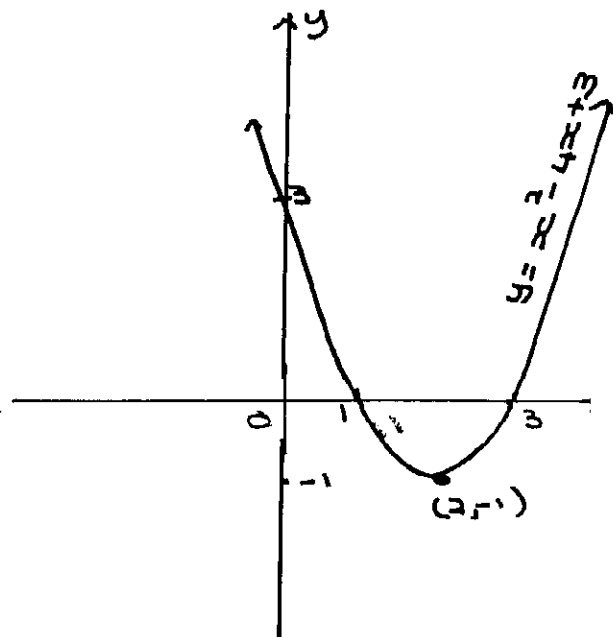
$$x = 2$$

sub into $y = x^2 - 4x + 3$

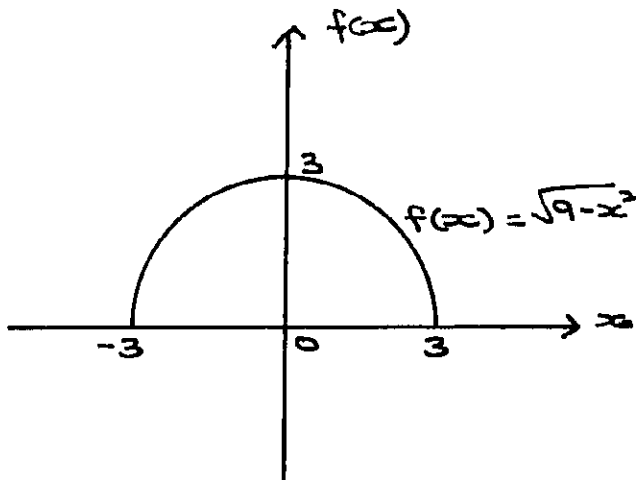
$$= 2^2 - 4(2) + 3$$

$$= -1$$

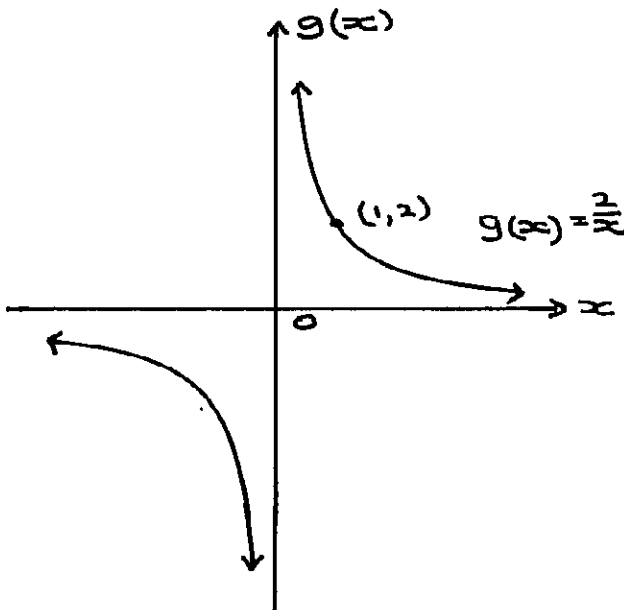
\therefore vertex is $(2, -1)$



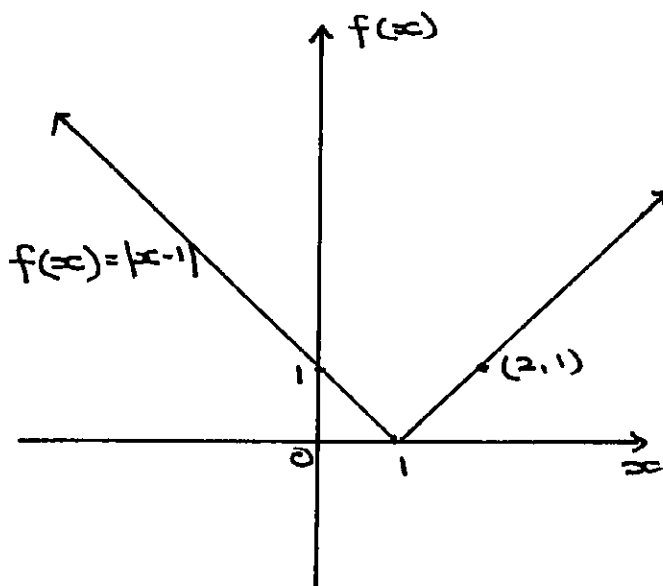
$$\text{iii) } f(x) = \sqrt{9-x^2}$$



$$\text{iv) } g(x) = \frac{2}{x}$$



$$\text{v) } f(x) = |x-1|$$



$$\text{c) i) } f(x) = \sqrt{x+4}$$

$$x+4 \geq 0$$

$$x \geq -4$$

\therefore domain $x \geq -4$

$$\text{ii) } g(x) = \frac{1}{9-x^2}$$

$$9-x^2 \neq 0$$

$$(3-x)(3+x) \neq 0$$

$$x \neq 3, -3$$

domain \mathbb{R} except $x=3, -3$

or domain $x \neq 3, x \neq -3$

$$\text{d) } f(x) = x^3 + x$$

$$f(-x) = (-x)^3 - x$$

$$= -x^3 - x$$

$$-f(-x) = -(-x^3 - x)$$

$$= x^3 + x$$

$$\therefore f(x) = -f(-x)$$

$\therefore f(x) = x^3 + x$ is odd

$$\text{e) } f(x) = \frac{|x|}{x} \quad x \neq 0$$

$$f(x) = \frac{x}{x} \quad x > 0$$

$$= 1$$

$$f(x) = \frac{-x}{x} \quad x < 0$$

$$= -1$$

