Question 1 (10 Marks) **Marks**

a) Simplify $\dfrac{a^2-9}{(a+3)^2}$ **1**

b) Expand and simplify $(a+b)^2-(a-b)^2+(a-b)(a+b)$ **2**

c) Factorize completely x^4-16 **2**

d) Simplify $\dfrac{x^2+5x+6}{x^2-4}\div\dfrac{x^2-1}{x^2-x-2}$ **3**

e) Factorize completely $8x^3-27y^3$ **2**

Question 2 (10 Marks) ***Start a new page***

a) Solve $x^2+6x-1=0$ by completing the square, leaving your answer in simplest surd form. **2**

b) Express $x=0.\dot{3}\dot{6}$ as a rational number. **2**

c) The weekly wages of five carpenters and three apprentices amount to \$1880 and the wages of three carpenters and five apprentices amounts to \$1640. By constructing a pair of simultaneous equations, find the weekly wages of both a carpenter and an apprentice. **3**

d) Find the values of a and b if $a+b\sqrt{7}=\dfrac{1}{7+\sqrt{7}}$ **3**

Question 3 (10 Marks) ***Start a new page***

a) Let $f(x)=2x+5$

i) Find $g(x)$, the inverse of $f(x)$. **1**

ii) Show that $f(g(x))=g(f(x))$ **2**

b) Let $y=9x-x^3$

i) Sketch the graph of this function clearly showing all intercepts. **3**

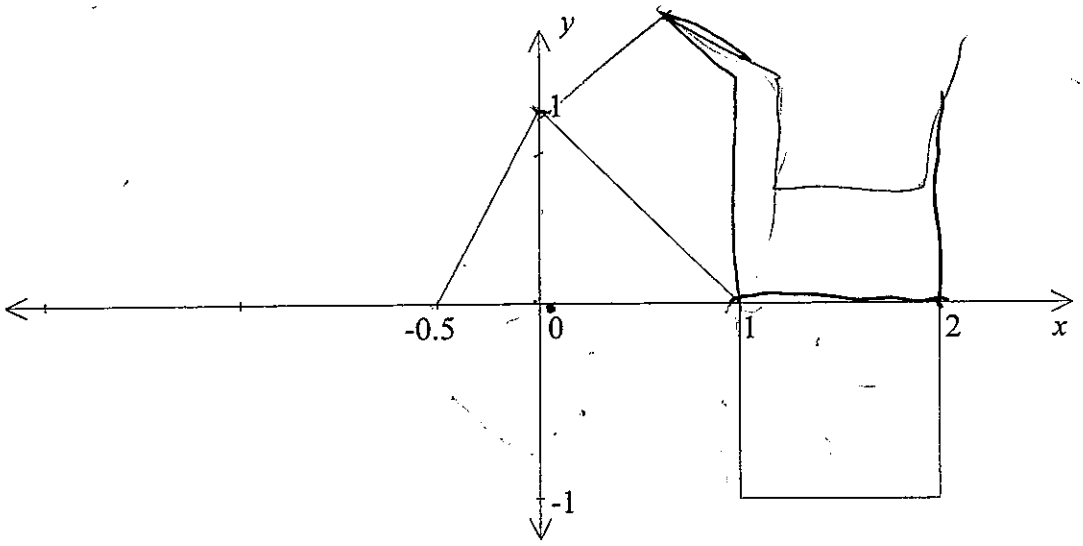
ii) From your graph, write down the region for which $9x-x^3<0$ **1**

c) Sketch $x+|y+1|=1$ indicating all important points. **3**

/Q4 ...Page 2

Question 4 (10 Marks) ***Start a new page*** **Marks**

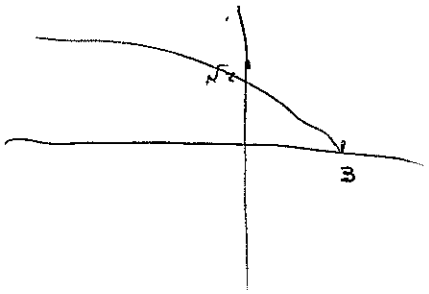
a) Graph $f\left(x-\frac{1}{2}\right)+1$, if $f(x)$ has the following graph. **2**



b) Sketch $y=\sqrt{3-x}$ **2**

c) Solve the inequation: $\frac{5}{x-4}\geq 1$. **3**

d) Prove whether the function $f(x)=e^{x}+\frac{1}{e^{x}}$ is odd, even or neither. **3**



END OF PAPER

Yr 11 EXT 1

Q1 a) $\frac{a^2-9}{(a+3)^2} = \frac{(a-3)(a+3)}{(a+3)^2} = \frac{a-3}{a+3}$ (1M) OK

b) $(a+b)^2 - (a-b)^2 + (a-b)(a+b)$ (1M)

$= a^2 + 2ab + b^2 - (a^2 - 2ab + b^2) + a^2 - b^2$

$= a^2 + 2ab + b^2 - a^2 + 2ab - b^2 + a^2 - b^2$

$= a^2 + 4ab - b^2$ (1M)

c) $x^4 - 16 = (x^2-4)(x^2+4)$ (1M) $= (x-2)(x+2)(x^2+4)$ (1M)

d) $\frac{x^2+5x+6}{x^2-4} \div \frac{x^2-1}{x^2-x-2} = \frac{(x+2)(x+3)}{(x+2)(x-2)} \times \frac{(x+1)(x-2)}{(x-1)(x+1)}$

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

1M Factorising 1M inverting 1M answer correct

e) $8x^3 - 27y^3 = (2x-3y)(4x^2+6xy+9y^2)$

1M correct terms 1M correct signs

Q2 a) $x^2 + 6x - 1 = 0$

$x^2 + 6x + 9 = 1 + 9$ (1M)

$(x+3)^2 = 10$

$x + 3 = \pm\sqrt{10}$

$x = -3 + \sqrt{10}, -3 - \sqrt{10}$ (1M)

b) Let $x = 0.363636\ldots$ (1M)

$\therefore 100x = 36.363636\ldots$

$\therefore 99x = 36$

$x = \frac{36}{99} = \frac{4}{11}$ (1M)

c) wages of carpenter = c wages of apprentice = a

(1M) $\begin{cases} 5c + 3a = 1880 & \times 5 \\ 3c + 5a = 1640 & \times 3 \end{cases}$

(1M) $\begin{cases} 25c + 15a = 9400 \\ 9c + 15a = 4920 \end{cases}$

$16c = 4480$

$c = 280 \therefore a = 160$ (1M)

d) $a + b\sqrt{7} = \frac{1}{7+\sqrt{7}} \times \frac{7-\sqrt{7}}{7-\sqrt{7}}$ (1M) $= \frac{7-\sqrt{7}}{42}$ (1M)

$\therefore a = \frac{1}{6}$ $b = -\frac{1}{42}$. (1M)

3 a) $f(x) = 2x + 5$

$y = 2x + 5$ $\quad \therefore x = 2y + 5 \quad \therefore y = \frac{x-5}{2}$

(i) $\therefore g(x) = \frac{x-5}{2}$ (1M)

(ii) $f(g(x)) = f\left(\frac{x-5}{2}\right) = 2\left(\frac{x-5}{2}\right) + 5 = x$ (1M)

$g(f(x)) = g(2x+5) = \frac{2x+5-5}{2} = x$ (1M)

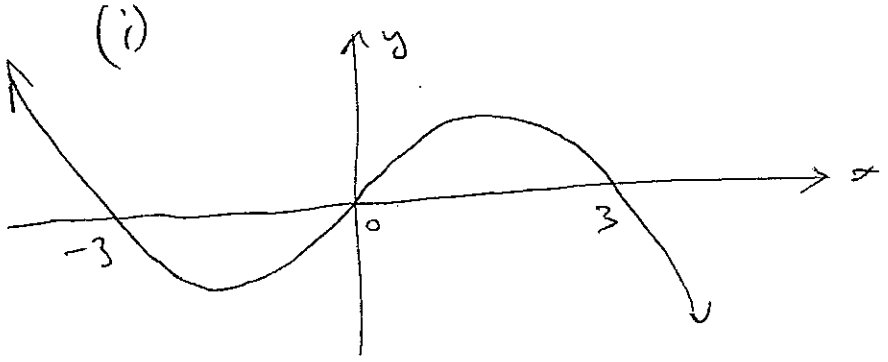
b) $y = 9x - x^3$ $\quad -x^3 \searrow$

$= x(9 - x^2) = x(3-x)(3+x)$ (1M)

x intercepts or $0, 3, -3$.

y intercept is $y = 0$

(i)



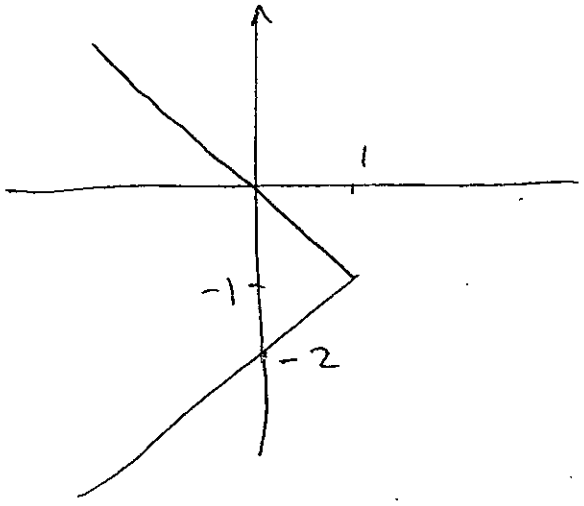
(2M)

(ii)

(ii) $9x - x^3 < 0$

$\therefore x > 3$ or $-3 < x < 0$ (1M)

c)



$x + |y+1| = 1$

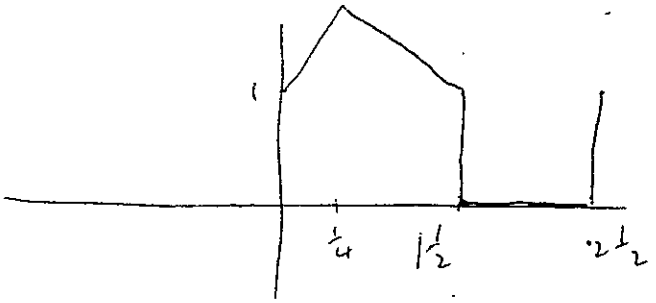
(1M) vertex coords correct

(1M) correct y intercepts

(1M) correct sketch

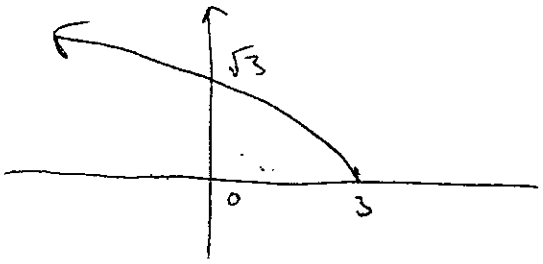
yr 11 EX 11

Q4 a)



1 each for vert/horiz shifts

b)



$y = \sqrt{3-x}$

$3 - x \geq 0$

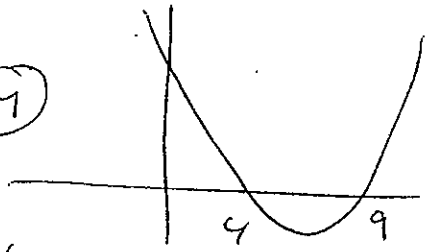
$x \leq 3$

c) $\frac{5}{x-4}(x-4)^2 \geq (x-4)^2$ ← (1M) $x \neq 4$

$(x-4)(x-4-5) \leq 0$

$(x-4)(x-9) \leq 0$ (1M)

D: $4 < x \leq 9$ (1M)



(I suggest we don't be too harsh about $x \leq 4$ at this stage. ↑)

d) $f(x) = e^x + \frac{1}{e^x}$

$f(-x) = e^{-x} + \frac{1}{e^{-x}}$ (1M)

$= \frac{1}{e^x} + e^x$ (1M)

$= f(x)$

$\therefore f(x)$ is even. (1M)