

Question 1

1.1.  $(x-7)(x+4) = 0$   
 $\therefore x = 7$  or  $x = -4$  ✓

1.2.  $2x^2 \geq 50$  ✓  
 $\therefore x^2 \geq 25$  ✓  
 $x \geq 5\sqrt{2}$  or  $x \leq -5\sqrt{2}$  ✓

1.3.  $2^{2x-1} \cdot 3^2 = 2^1 \cdot 3^x$   
 $\frac{2^{2x-1}}{3^x} \sqrt{=} = \frac{2^1}{3^x}$  ✓  
 $\therefore x-1 = 1$  and  $x = 2$   
 $x = 2$  ✓

Question 2

2.  $b^2 - 4ac = 29$  ✓  
 $(-7)^2 - 4(1)(c) = 29$   
 $-4c = -20$  ✓  
 $c = 5$  ✓

3.  $3x - 10 = 3x$  ✓  
 $-22c = 10$   
 $2c = -5$  ✓ ... ①  
 $y^2 + 2c = 20$  ... ②  
 Replace ① in ②  
 $\therefore y^2 + (-5) = 20$  ✓  
 $\therefore y^2 = 25$  ✓  
 $\therefore y = \pm 5$  ✓

Question 2

1.1.  $r = \frac{T_5}{T_4} = \frac{96}{48} = 2$  ✓ [2]

1.2.  $T_4 = a \cdot 2^3 = 48$  ✓  
 $\therefore a = 6$

$\therefore T_n = 6 \cdot 2^{n-1}$  ✓ [3]

2.1.  $\frac{13}{27}$  ✓ [1]

2.2. Numerators:  $T_n = -5 + (n-1)6$   
 $= 6n - 11$  ✓

Denominators:  $T_n = 3^{n-1}$  ✓  
 General  $T_n = \frac{6n-11}{3^{n-1}}$  ✓ [3]

2.3.  $T_n = T_{10} = \frac{6(10)-11}{3^{10-1}} = \frac{49}{19683}$  ✓ [2]

2.4)  $6n - 11 > 100$  ✓  
 $n > 18,5$  ✓  
 $\therefore T_{19} > 100$  ✓ [3]

③

Question 3

3.1 a)  $2w - 4 - (w - 3) = 23 - w - (2w - 4)$  ✓  
 $w - 1 = -3w + 27$

$4w = 269$  ✓  
 $w = 6\sqrt{7}$

[2]

b)  $d = T_2 - T_1$  ✓  
 $= 2(6) - 4 - (8 - 3) = 6$  ✓

[2]

3.2  $\begin{matrix} 3 & 7 & 17 & 33 \\ 4 & 10 & 16 & \end{matrix}$  ✓

$2a = 6$  ✓  $3a + b = 4$   $a + b + c = 3$   
 $a = 3$  ✓  $3(3) + b = 4$   $3 - 5 + c = 3$  ✓  
 $b = -5$   $c = 5$

$T_n = an^2 + bn + c = 3n^2 - 5n + 5$  ✓  
 $\therefore T_{50} = 7255$  ✓

[6]

Question 4

4.1.  $S_n = a(r^n - 1)$  ;  $a = \frac{1}{15}$ ,  $r = 3$

$\frac{1}{15} \frac{3^m - 1}{3 - 1}$  ✓  $\frac{1}{15} \sqrt{= 24\frac{1}{5}}$

$\frac{1}{15} \frac{(3^m - 1)}{2} - \frac{1}{15} = \frac{121}{5}$

$\therefore 3^{m-1} = \left(\frac{121}{5} + \frac{1}{15}\right) \times \frac{2}{1} \times \frac{15}{1}$

$\therefore 3^m = 729$  ✓  
 $= 3^6$   
 $= 6$  ✓

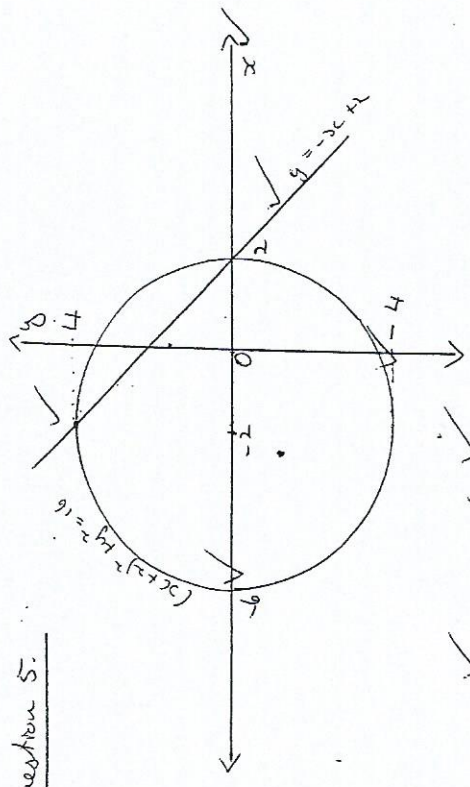
[4]

④

4.2.  $T_4 = \frac{1}{15}(3)$  ✓  $k$  starts at 2  
 $= \frac{2}{5}$  ✓

[3]

Question 5:



5.2.  $(-2, 4)$  and  $(2, 0)$

Question 6

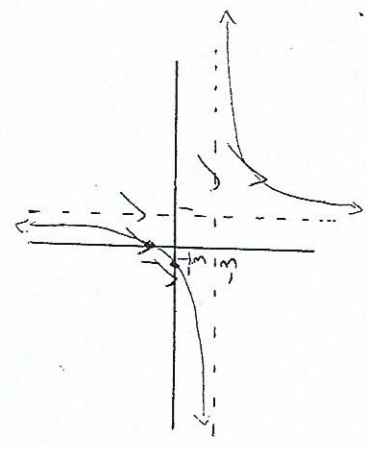
6.1.  $y = -3$  ✓;  $xc = 1$  ✓

[2]

6.2.  $xc \in \mathbb{R}$ ,  $xc \neq 1$  ✓

[1]

6.3.



$x$ -int:  $\frac{-4}{2c-1} - 3 = 0$   
 $2c - 1 = -\frac{4}{3}$   
 $2c = -\frac{4}{3} - 3 = 1$

$y$ -int:  $y = \frac{-4}{-1} - 3 = 1$

[5]

6.4. Current common coordinates:  $(1; -3)$

[4]

New:  $y = 2c + 3$  ... ①  
 $y = -x + 1$  ... ②

① - ②:  $0 = 2c + 2$   
 $\therefore 2c = -2$  ;  $y = \sqrt{2} \Rightarrow 2$  left, 5 up.

[5]

Question 7

7.1.  $C = (0; 5)$  ✓ [1]  
 7.2.  $x = -2$  ✓ [1]

7.3.  $y = a(x-p)^2 + q$   $p = -2$   
 $y = a(x+2)^2 + q$   
 Sub in:  $(0; 5)$   
 $5 = a(0+2)^2 + q$  ✓  
 $5 = 4a + q$  ... (1)

Sub in:  $(1; 0)$   
 $0 = a(1+2)^2 + q$  ✓  
 $0 = 9a + q$  ✓  
 $\therefore q = -9a$  ... (2)

Sub in:  $(2; 1)$  in (1)  
 $5 = 4a + (-9a)$   
 $5 = -5a$   
 $\therefore a = -1$  ✓

Dep  $a = -1$  in (2)  
 $\therefore q = -9(-1) = 9$  ✓

$\therefore y = -(x+2)^2 + 9$  ✓ [6]

7.4.  $f(x) = g(x)$  ✓  
 $-x^2 - 4x + 5 = -2x - 3$   
 $-x^2 - 2x + 8 = 0$  ✓  
 $x^2 + 2x - 8 = 0$  ✓  
 $\therefore (x+4)(x-2) = 0$  ✓  
 $\therefore x = -4$  or  $x = 2$

Dep  $x = 2$  in  $g(x)$   
 $\therefore y = -2(2) - 3$   
 $= -4 - 3$   
 $= -7$   
 $\therefore D = (2; -7)$  ✓ [4]

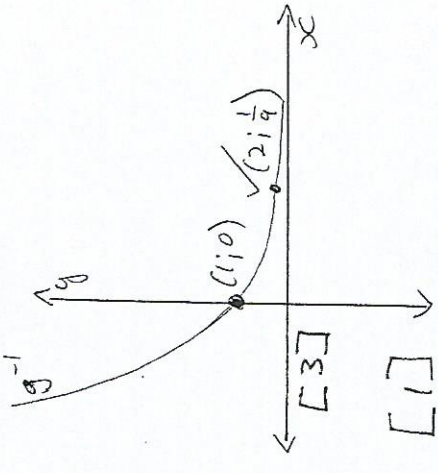
7.5.  $y = -f(x)$   
 $= -(-x^2 - 4x + 5)$   
 $y = x^2 + 4x - 5$  ✓

New TP:  $(-2; -9)$  [2]

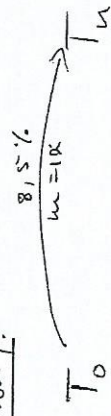
Question 8  
 8.1.  $A = (1; 0)$  ✓ [1]

8.2.  $g(x) = \log_{\frac{1}{3}} x$   
 $y = \log_{\frac{1}{3}} x$   
 $(x \leftrightarrow y): x = \log_{\frac{1}{3}} y$  ✓  
 $\therefore (\frac{1}{3})^x = y$  ✓

8.3.  $x \in \mathbb{R}$  ✓



Question 9.



$x = 7000$

9.1.  $1 + i_{\text{eff}} = (1 + \frac{0,085}{12})^{12} - 1$  ✓  
 $= (\frac{2417}{2400})^{12} - 1$   
 $= 5,84\%$  ✓

9.2.  $P = x \left[ \frac{1 - (1+i)^{-n}}{i} \right]$

$375\ 000 = 2000 \left[ \frac{1 - (1 + \frac{i}{12})^{-n \cdot 12}}{\frac{0,085}{12}} \right]$  ✓

$\frac{375\ 000}{2000} \times \frac{0,085}{12} - 1 = -\left(\frac{2417}{2400}\right)^{-n \cdot 12}$

$\frac{139}{224} = \left(\frac{2417}{2400}\right)^{-n \cdot 12} \Rightarrow -n \cdot 12 = \log_{\frac{2417}{2400}} \left(\frac{139}{224}\right)$  ✓

(5)

(6)

8

10.2.  $f'(x) = 4x + 2x^3$  ✓ [3]

10.3.  $y = x^{12} - 2x^6 + 1$  ✓  
 $\frac{dy}{dx} = 12x^{11} - 12x^5$  ✓  
 $= 12x^5(x^6 - 1)$  ✓  
 $= 12x^5(\sqrt[6]{y})$  ✓ [3]

10.4  $f(x) = 2x^3 - 2x^2 + 4x - 1$  ✓  
 $f'(x) = 6x^2 - 4x + 4$  ✓  
 $f''(x) = 12x - 4$  ✓  
 $f$  is concave up when  $f''(x) > 0$  ✓  
 $\therefore 12x - 4 > 0$  ✓  
 $12x > 4$  ✓  
 $x > \frac{1}{3}$  ✓ [4]

7

-112 = -67,603 ✓  
 112 = 67,603 ✓  
 68 marks ✓ [5]

9.3.  $375000 = 7000 \left[ \frac{1 - \left(1 + \frac{0.085}{12}\right)^{-67}}{\frac{0.085}{12}} \right] + y \left(1 + \frac{0.085}{12}\right)^{-68}$  ✓

$\therefore y = \left( 375000 - 7000 \left[ \frac{1 - \left(1 + \frac{0.085}{12}\right)^{-67}}{\frac{0.085}{12}} \right] \right) \times \left(1 + \frac{0.085}{12}\right)^{68}$  ✓  
 $= 4232,38$  ✓ [5]

9.4.  $F = P(1-i)^n$  ✓  
 $\frac{280000}{\sqrt[3]{375000}} - 1 = -i$  ✓  
 $i = 9,28\%$  ✓ [4]

Question 10

10.1.  $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$  ✓  
 $= \lim_{h \rightarrow 0} \frac{(x+h)^3 - x^3}{h}$  ✓  
 $= \lim_{h \rightarrow 0} \frac{(x+h)(x^2 + 2xh + h^2) - x^3}{h}$  ✓  
 $= \lim_{h \rightarrow 0} \frac{x^3 + 3x^2h + 3xh^2 + h^3 - x^3}{h}$  ✓  
 $= \lim_{h \rightarrow 0} \frac{3x^2h + 3xh^2 + h^3}{h}$  ✓  
 $= \lim_{h \rightarrow 0} (3x^2 + 3xh + h^2)$  ✓  
 $= 3x^2$  ✓ [5]

(9)

Question 11

11.1.  $(x+3)(x+1)(x-2) = 0$  ✓  
 $(x+3)(x^2-x-2) = 0$   
 $x^3 + 2x^2 - 5x - 6 = 0$   
 $\therefore -2x^3 - 2x^2 + 5x + 6 = 0$   
 $\therefore a = -2$  ✓  
 $b = 5$  ✓  
 $c = 6$  ✓

11.2.  $f'(x) = -3x^2 - 4x + 5 = 0$

$\therefore 3x^2 + 4x - 5 = 0$  ✓  
 $(3x) (x) = 0$

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

$$= \frac{-4 \pm \sqrt{16 - 4(3)(-5)}}{2(3)}$$

$$= \frac{-4 \pm \sqrt{64}}{6}$$

$\therefore x = 0,79$  ✓ or  $x = -2,12$  ✓

Replace x values to get TP's ✓

[5]

11.3.  $-2,12 < x < 0,79$  ✓  
 or  
 $x \in (-2,12; 0,79)$  ✓  
 $x \in (-\infty; -2,12)$  ✓  
 $x \in (0,79; +\infty)$  ✓  
 $x \in \mathbb{R}$  ✓

Question 12

12.1.  $74 - 2x$  ✓

12.2. ~~Sales = (74 - 2x) \* 400~~

[1]

Question 13/12

(10)

12.2) Sales =  $(74 - 2x)(400 + 25(x-1))$  ✓  
 $= (74 - 2x)(375 + 25x)$  ✓  
 $= 27750 + 1100x - 50x^2$  ✓ [3]

12.3)  $\frac{d}{dx}(\text{Sales}) = -100x + 1100$  ✓

Has max at T.P.  
 $\therefore -100x + 1100 = 0$  ✓

$x = 11$  ✓  
 Year 11 the price will be:

$400 + 25(11-1) = 650$  ✓ [4]

Question 13.

$$13.1. \quad TOA = 2(5x^2 + 5xh + xh) = 34$$

$$\therefore 5x^2 + 5xh + xh = 17 \quad \checkmark$$

$$\therefore 5x^2 + 6xh = 17$$

$$h = \frac{17 - 5x^2}{6x} \quad \checkmark$$

$$\therefore Vol = Base \times h \quad \checkmark$$

$$= 5x^2 \times \left( \frac{17 - 5x^2}{6x} \right) \quad \checkmark \quad [5]$$

$$= \frac{5}{6}x(17 - 5x^2) = \frac{85x}{6} - \frac{25x^3}{6} \quad \checkmark$$

$$13.2) \quad \frac{d}{dx} \left( \frac{85x}{6} - \frac{25x^3}{6} \right) \quad \checkmark$$

$$= \frac{85}{6} - \frac{25}{2}x^2 = 0 \quad \checkmark$$

$$x^2 = \frac{17}{15}$$

$$x = \sqrt{\frac{17}{15}} \quad \checkmark$$

$$Length = 5 \times \sqrt{\frac{17}{15}}$$

$$= 5,32 \text{ m} \quad \checkmark$$

$$Breadth = \sqrt{\frac{17}{15}}$$

$$= 1,06 \text{ m} \quad \checkmark$$

$$h = \frac{17 - 5 \cdot \sqrt{\frac{17}{15}}^2}{6 \sqrt{\frac{17}{15}}}$$

$$= 1,77 \text{ m} \quad \checkmark$$

[5]

$$13.3) \quad Vol = 5,32 \times 1,06 \times 1,77 \quad \checkmark$$

$$= 9,98 \text{ m}^3 \quad \checkmark$$

[2]