

Question 1

a(1) $x^2 = 10 - 3x$

$x^2 + 3x - 10 = 0$

$(x+5)(x-2) = 0 \checkmark m$

$x = -5 \checkmark^a$ or $x = 2 \checkmark^a$ ③

(2) $3x^2 + 2x - 4 = 0$

$x = \frac{-2 \pm \sqrt{(2)^2 - 4(3)(-4)}}{2(3)} \checkmark m$

$2(3)$

$x = 0, 9 \checkmark^a$ or $x = -1, 5 \checkmark^a$ ③

(3) $5 \cdot 3^{x+1} = 45$

$3^{x+1} = 9 \checkmark^a$

$3^{x+1} = 3^2$

$x+1 = 2 \checkmark m$

$x = 1 \checkmark^a$ ③

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

$2^{2x+1} - 4^x$

$\frac{2^x(2-1) \checkmark m}{2^{2x}(2-1) \checkmark^a} = 4$

$2^{2x}(2-1) \checkmark^a$

$\frac{1}{2^{1/x}} = 4$

$2^{-x} = 2^2 \checkmark^a$

$\therefore x = -2 \checkmark^a$ ⑤

(5) $-x^2 + x + 20 \leq 0$

$x^2 - x - 20 \geq 0 \checkmark m$

$(x+4)(x-5) \geq 0 \checkmark^a$

$\frac{+}{-4} \quad \frac{-}{5} \quad \frac{+}{+}$

$x \leq -4 \checkmark^a$ or $x \geq 5 \checkmark^a$ ④

(6) $4x^2 + 8x = 12$

$x^2 + 2x = 3$

$(x+1)^2 = 3 + 1 \checkmark^m$

$x+1 = \pm 2 \checkmark m$

⑤

$\therefore x = 1 \checkmark^a$ or $x = -3 \checkmark^a$

(7) $(x^2+2)^2 - x^2 - 2 = 6$

$(x^2+2)^2 - (x^2+2) = 6 \checkmark^a$

Let $k = (x^2+2)$

$k^2 - k - 6 = 0 \checkmark m$

$(k-3)(k+2) = 0$

$k = 3$ or $k = -2$

$x^2+2 = 3 \checkmark m$ or $x^2+2 = -2$

$x^2 = 1$

$x^2 = -4$

$\therefore x = \pm 1 \checkmark^a$

non-real \checkmark^a ⑤

(b) $y = x^2 - x - 6$ ①

$2x - y = 2$

$2x - 2 = y$ ②

① = ②

$x^2 - x - 6 = 2x - 2 \checkmark m$

$x^2 - 3x - 4 = 0$

$(x-4)(x+1) = 0 \checkmark m$

$x = 4 \checkmark^a$ or

$x = -1 \checkmark^a$

$y = 2(4) - 2$

$y = 2(-1) - 2$

$y = 6 \checkmark^a$

$y = -4 \checkmark^a$

(4; 6)

(-1; -4) ⑥

Question 2

$$\left. \begin{aligned} (a) \quad a &= 1879 \\ b &= 3898 \\ c &= 731 \\ d &= 8120 \\ e &= 10\,730 \end{aligned} \right\} \begin{array}{l} \sqrt{m} \\ \sqrt{a} \\ \sqrt{a} \\ \textcircled{3} \end{array}$$

$$(b) \quad P(FA) = \frac{6101}{10730} \sqrt{a} \textcircled{1}$$

[4]

Question 3

$$\begin{aligned} (1) \quad 1+i &= \left(1 + \frac{0,072}{12}\right)^{12} \sqrt{m} \\ 1+i &= 1,074\dots \\ \therefore i &= 7,44\% \text{ p.a. } \sqrt{a} \textcircled{3} \end{aligned}$$

$$\begin{aligned} (2) \quad A &= 120\,000 (1 + 0,0744)^3 \sqrt{m} \\ &= 148\,826,15 \sqrt{a} \end{aligned}$$

OR

$$\begin{aligned} A &= 120\,000 \left(1 + \frac{0,072}{12}\right)^{36} \sqrt{m} \\ &= 148\,836,19 \sqrt{a} \textcircled{3} \end{aligned}$$

$$(b) \quad \begin{array}{ccccccc} T_0 & & T_3 & & T_5 & & T_7 \\ 2\,000\,000 & & (300\,000) & & 50\,000 & & \\ \hline & & \frac{0,14}{2} & & & & \end{array}$$

$$\begin{aligned} A &= 2\,000\,000 \left(1 + \frac{0,14}{2}\right)^{14} \sqrt{m} - 300\,000 \left(1 + \frac{0,14}{2}\right)^8 \sqrt{a} \\ &\quad + 50\,000 \left(1 + \frac{0,14}{2}\right)^4 \sqrt{a} \\ \therefore A &= 24\,707\,152,25 \sqrt{a} \textcircled{5} \end{aligned}$$

[10]

②

Question 4

- a (1) Shifted up 1 unit \sqrt{a}
 (2) Shifted 2 units to the right \sqrt{a}
 (3) Reflected over the y-axis \sqrt{a} ③

$$(b) \quad h(x) = \frac{k}{x+2} + 4 \sqrt{a}$$

subs (2; 9)

$$5 = \frac{k}{2+2} + 4$$

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

$$\therefore k = 4 \sqrt{a}$$

$$\therefore h(x) = \frac{4}{x+2} + 4 \textcircled{3}$$

[6]

Question 5

- a (1) B(230; -60) ①
 (2) C(125; 132) ②

(b) Answer Booklet

[13]

Question 6

$$\begin{aligned} (a) \quad f(x) &= a \cdot b^x - 3 \sqrt{a} \\ -2 &= a \cdot b^0 - 3 \sqrt{m} \quad \text{subs (0, -2)} \\ \therefore a &= 1 \sqrt{a} \\ -1 &= b - 3 \sqrt{m} \quad \text{subs (1, -1)} \\ b &= 2 \sqrt{a} \\ \therefore f(x) &= 2^x - 3 \textcircled{4} \end{aligned}$$

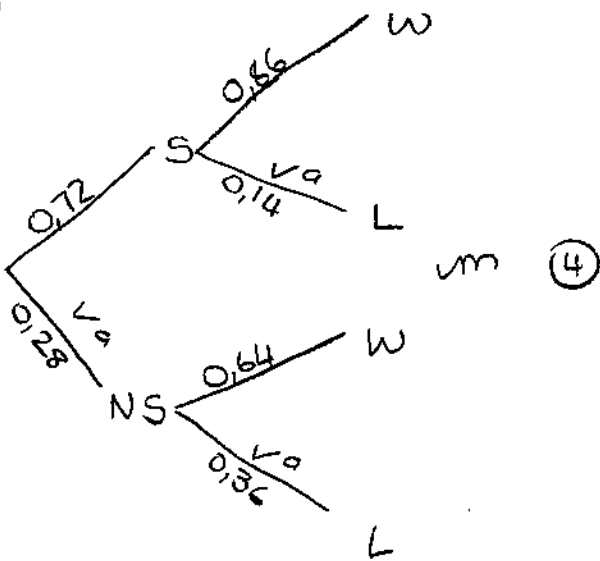
$$\begin{aligned} (b) \quad h(x) &= 2 \cdot 2^x - 3 = 2^{x+1} - 3 \sqrt{a} \\ \therefore &\text{ Shifted 1 unit to the left } \textcircled{1} \end{aligned}$$

[5]

Section B

Question 7

a(1)



$$(2) P(W) = (0,72 \times 0,86) + (0,28 \times 0,64)$$

$$= \frac{499}{625} = 0,7984 = 79,8\%$$

$$(b) P(1 \text{ six}) = 1 - \left(\frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} \times \frac{5}{6}\right)$$

$$= \frac{671}{1296} = 0,5177 = 51,8\%$$

(c) Answer Booklet

[22]

Question 8

$$a(1) \quad 4 = \sqrt{(x+1)^2 - 4}$$

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

$$x^2 + 2x + 1 - 20 = 0$$

$$x^2 + 2x - 19 = 0$$

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

$$(2) k = 0; x = 1 \text{ or } x = -3$$

$$(3) k = -4; x = -1$$

③

$$(b) (2 - 3\sqrt{x})(2 + 3\sqrt{x}) = 13$$

$$4 - 9x = 13$$

$$9x = -9$$

$$x = -1$$

$\sqrt{-1}$ is non-real
(or any acceptable answer)

④

[13]

Question 9

$$(a) g(x) = x + 2$$

$$0 = x + 2$$

$$x = -2 \quad \therefore B(-2; 0)$$

$$(b) y = a(x+2)(x+12)$$

$$\text{subs } (-13; -11) \quad -11 = a(-13+2)(-13+12)$$

$$-11 = 11a$$

$$\therefore a = -1$$

$$y = -(x+2)(x+12)$$

$$\therefore y = -x^2 - 14x - 24$$

$$(c) TP: x = \frac{-(-14)}{2(-1)} = -7$$

$$y = -(-7)^2 - 14(-7) - 24 = 25$$

$$\therefore E(-7; 25)$$

$$F \rightarrow y = -7 + 2 = -5$$

$$\therefore F(-7; -5)$$

$$\therefore EF = 25 - (-5) = 30 \text{ units}$$

$$EF = -x^2 - 14x - 24 - (x+2)$$

$$= -x^2 - 15x - 26$$

$$\text{subs } x = -7 = -(-7)^2 - 15(-7) - 26$$

$$\therefore EF = 30 \text{ units}$$

$$(d) x \leq -13 \text{ or } x \geq -2$$

$$x \in (-\infty; -13] \cup [-2; \infty) \quad (2)$$

$$(e) x < -12$$

$$x \in (-\infty; -12) \quad (2)$$

$$(f) k < 22 \quad (1)$$

[5]

Question 10

$$(a) 2150000 \quad (1)$$

(b) reducing balance \checkmark (1)

$$(c) 110940 = 150000(1-i)^2 \quad \checkmark$$

$$0,7396 = (1-i)^2$$

$$\frac{43}{50} = 1-i$$

$$i = 0,14$$

$$\therefore i = 14\% \quad (3)$$

$$(d) A = 150000(1-0,14)^7 \quad \checkmark$$

$$= 252189,17 \quad \checkmark$$

[8]

Question 11

$$(1) 4k + 12x = 180 \quad \checkmark$$

$$k = 45 - 3x \quad (2)$$

$$(2) V = k \cdot x^2 \quad \checkmark$$

$$= (45 - 3x)x^2 \quad \checkmark$$

$$= 45x^2 - 3x^3 \quad (2)$$

$$(b) 45x^2 - 3x^3 = 0 \quad \checkmark$$

$$3x^2(15-x) = 0$$

$$x = 15 \text{ cm} \quad \checkmark \quad (2)$$

[6]

Question 12

$$a(1) \begin{matrix} 3 & 6 & 10 & 15 & 21 \\ \swarrow & \swarrow & \swarrow & \swarrow & \\ 3 & 4 & 5 & 6 & \\ \swarrow & \swarrow & \swarrow & \swarrow & \\ 1 & 1 & 1 & 1 & \end{matrix} \quad \checkmark \quad (1)$$

$$(2) 2a = 1$$

$$\therefore a = \frac{1}{2} \quad \checkmark$$

$$3\left(\frac{1}{2}\right) + b = 3$$

$$\therefore b = \frac{3}{2} \quad \checkmark$$

$$\frac{1}{2} + \frac{3}{2} + c = 3$$

$$c = 1 \quad \checkmark$$

$$\therefore T_n = \frac{1}{2}n^2 + \frac{3}{2}n + 1 \quad \checkmark \quad (4)$$

$$b(1) 10; 14; 18 \quad \checkmark \quad (2)$$

$$(2) 2a = 4 \quad \checkmark$$

$$\therefore a = 2 \quad \checkmark \quad (2)$$

$$(3) 3(2) + b = 10$$

$$b = 4 \quad \checkmark$$

$$2 + 4 + c = 1$$

$$c = -5 \quad \checkmark$$

$$\therefore T_n = 2n^2 + 4n - 5 \quad \checkmark \quad (4)$$

[13]

ANSWER BOOKLET

NAME: Memo

QUESTION 5 b

(b) Given: $f(x) = \frac{-2}{x+1} - 3$

(1) Calculate the coordinates of the y -intercept of f . (1)

$$y = \frac{-2}{0+1} - 3$$

$$y = -5$$

$$\therefore (0; -5) \checkmark^a$$

(2) Calculate the coordinates of the x -intercept of f . (2)

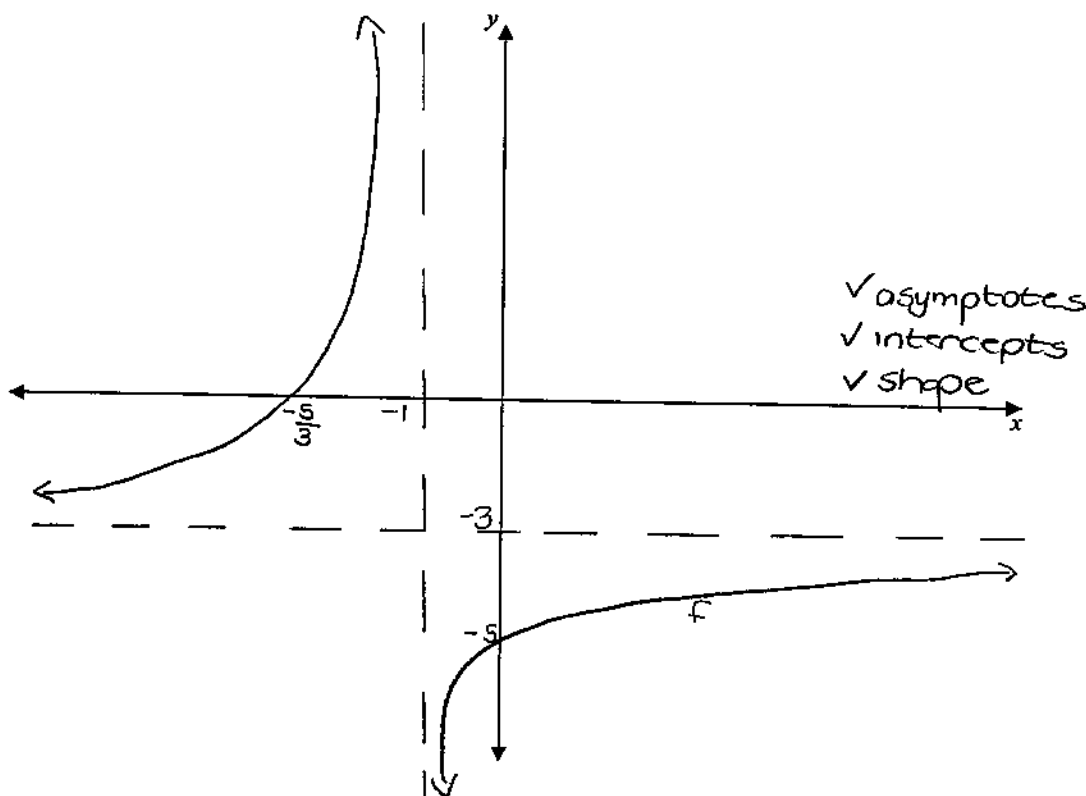
$$0 = \frac{-2}{x+1} - 3 \checkmark^m$$

$$3x + 3 = -2$$

$$3x = -5$$

$$x = -\frac{5}{3} \therefore \left(-\frac{5}{3}; 0\right) \checkmark^a$$

(3) Sketch the graph of f , showing clearly the asymptotes and the intercepts with the axes below. (3)



- (4) One of the axes of symmetry of f is a decreasing function. Write down the equation of this axis of symmetry. (2)

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

$$\therefore y = -x - 4$$

- (5) If $g(x) = f(x-2) + 4$, determine the range of $g(x)$. (2)

$$y \in \mathbb{R}^+; y \neq 1$$

RETURN TO QUESTION PAPER FOR QUESTION 5

QUESTION 7 c

- (c) A survey was conducted using the Ante-Matric girls at Roedean, where there are 100 girls in the grade. The survey looked at the T.V. viewing preferences of the girls using the following programs: The Maths Learning Channel (LC), Grey's Anatomy (GA) and Hot Gym Boys (GB).

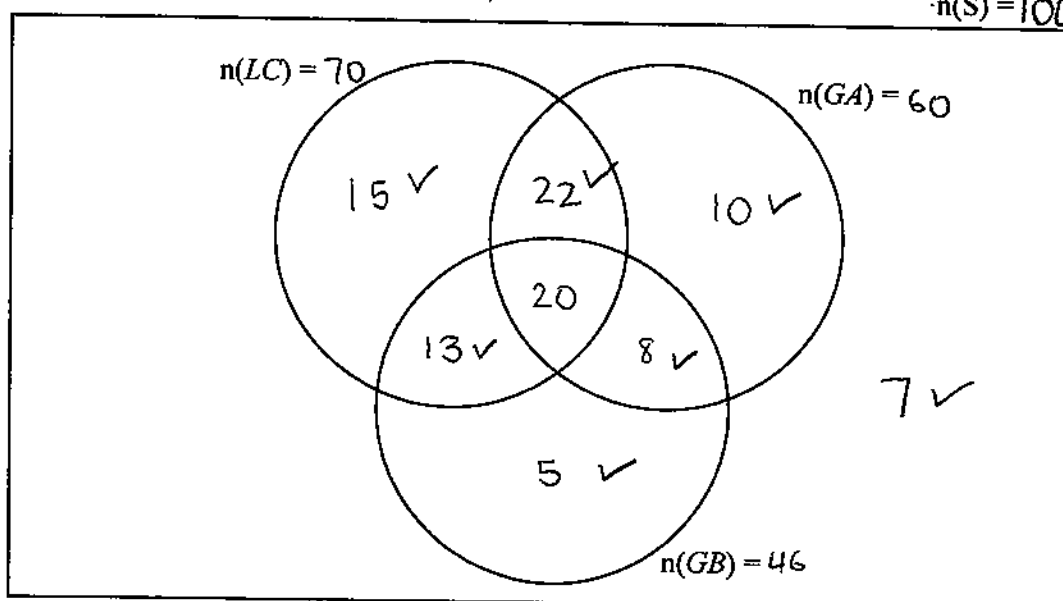
The viewing preference results are summarised as follows:

Learning Channel (LC): 70 Grey's Anatomy (GA): 60 Gym Boys (GB): 46

Only Learning Channel (LC): 15 Only Grey's (GA): 10 All three: 20

Learning Channel and Grey's: 42

- (1) Represent the given information using the Venn Diagram below. (7)



- (2) What is the probability that a randomly selected student will not watch any of the programs?

(2)

$$P(\text{none}) = \frac{7}{100} \checkmark \text{ca}$$

- (3) Are the events "Grey's" and "Gym Boys" independent? Give a mathematical motivation for your answer.

(3)

$$P(GA) \times P(GB) = \frac{60}{100} \times \frac{46}{100} = \frac{69}{250} = 0,276 = 0,3 \checkmark^a$$

$$P(GA \cap GB) = \frac{28}{100} = \frac{7}{25} = 0,28 = 0,3 \checkmark^a$$

$$\therefore \text{independent} \checkmark^a \quad P(GA) \times P(GB) = P(GA \cap GB)$$

RETURN TO QUESTION PAPER FOR QUESTION 7