

## Question 1

1.1.1  $x^2 - 2x = 24$

$$\therefore x^2 - 2x - 24 = 0$$

$$\therefore (x - 6)(x + 4) = 0 \checkmark$$

$$\therefore x = 6 \checkmark \text{ or } x = -4 \checkmark \quad (3)$$

1.1.2  $2x^2 - 3x - 7 = 0$

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-7)}}{2(2)} \checkmark$$

$$\therefore x = 2,77 \checkmark \text{ or } x = -1,27 \checkmark \quad (\text{rounding penalty } -1) \quad (3)$$

1.1.3  $\sqrt{x+5} = x-1$

$$\therefore (\sqrt{x+5})^2 = (x-1)^2$$

$$\therefore x+5 = x^2 - 2x + 1 \checkmark$$

$$\therefore x^2 - 3x - 4 = 0 \checkmark$$

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

$$\therefore x = 4 \text{ or } x = -1 \checkmark$$

$$\text{Check: } x = 4 \checkmark \quad (5)$$

1.1.4  $\frac{-4x+15}{2} \geq 2x^2$

$$\therefore -4x + 15 \geq 4x^2$$

$$\therefore 0 \geq 4x^2 + 4x - 15 \checkmark$$

$$\therefore 0 \geq (2x+5)(2x-3) \checkmark$$

$$\begin{array}{ccccccc}
 & & + & & 0 & & - & & 0 & & + \\
 & & | & & | & & | & & | & & | \\
 \hline
 & & -\frac{5}{2} & & & & & & \frac{3}{2} & & \\
 & & | & & | & & | & & | & & 
 \end{array}$$

$$\therefore -\frac{5}{2} \leq x \leq \frac{3}{2} \checkmark \checkmark \quad (4)$$

$$\begin{aligned}
1.2 \quad & x^2 - 7x + 6 = -x + 1 \checkmark \\
& \therefore x^2 - 6x + 5 = 0 \checkmark \\
& \therefore (x - 5)(x - 1) = 0 \checkmark \\
& \therefore x = 5 \quad \text{or} \quad x = 1 \checkmark \\
& \therefore y = -4 \quad \text{or} \quad y = 0 \checkmark
\end{aligned} \tag{5}$$

$$\begin{aligned}
1.3 \quad & \frac{1}{x} + \frac{1}{x+3} = \frac{1}{2} \checkmark \\
& \therefore 2(x + 3) + 2x = x(x + 3) \\
& \therefore 2x + 6 + 2x = x^2 + 3x \checkmark \\
& \therefore x^2 - x - 6 = 0 \checkmark \\
& \therefore (x - 3)(x + 2) = 0 \\
& \therefore x = 3 \quad \checkmark \quad \text{or} \quad x = -2 \quad \checkmark \\
& \therefore x = 3 \text{ ohms} \\
& \therefore \text{the two resistors are 3 ohms } \checkmark \text{ and 6 ohms } \checkmark
\end{aligned} \tag{7}$$

$$\begin{aligned}
1.4 \quad & (k - 2)(k - 3) = k^2 - 5k + 6 \quad \checkmark \\
& \therefore (k^2 - 5k + 2) + 4 \quad \checkmark \\
& = 0 + 4 \\
& = 4 \quad \checkmark
\end{aligned} \tag{3}$$

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## Question 2

$$2.1 \quad x^2 - 3x - 3 = 0$$

$$\Delta = (-3)^2 - 4(1)(-3)$$

$$= 21 \checkmark$$

$\therefore$  Roots are Real; Irrational and Unequal  $\checkmark\checkmark\checkmark$  (4)

$$2.2 \quad 2x^2 + 2x + b = x$$

$$\therefore 2x^2 + x + b = 0 \checkmark$$

$$\Delta \geq 0$$

$$\therefore (1)^2 - 4(2)(b) \geq 0$$

$$\therefore -8b \geq -1 \checkmark$$

$$\therefore b \leq \frac{1}{8} \checkmark \quad (5)$$

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### Question 3

$$\begin{aligned} 3.1 \quad \frac{15^x \cdot 75^{1-x}}{5^{-x+1}} &= \frac{(3 \cdot 5)^x \cdot (3 \cdot 5^2)^{1-x}}{5^{-x+1}} \\ &= \frac{3^x \cdot 5^x \cdot 3^{1-x} \cdot 5^{2-2x}}{5^{-x+1}} \checkmark \\ &= 3 \cdot 5 \checkmark \\ &= 15 \checkmark \end{aligned} \tag{3}$$

$$\begin{aligned} 3.2 \quad 7^{2x+1} + 7^{2x} &= 56 \checkmark \\ \therefore 7^{2x}(7 + 1) &= 56 \checkmark \\ \therefore 7^{2x} &= 7 \checkmark \\ \therefore 2x &= 1 \checkmark \\ \therefore x &= \frac{1}{2} \checkmark \end{aligned} \tag{5}$$

$$\begin{aligned} 3.3 \quad \frac{5}{2 + \sqrt{3}} &= \frac{5}{2 + \sqrt{3}} \times \frac{2 - \sqrt{3}}{2 - \sqrt{3}} \checkmark \\ &= \frac{10 - 5\sqrt{3}}{4 - 3} \\ &= 10 - 5\sqrt{3} \checkmark \\ a &= 10; b = -5 \text{ and } c = 3 \end{aligned} \tag{5}$$

[13]

## Question 4

$$4.1.1 \quad -4 \quad -2 \quad 2 \quad 8$$

$$2 \quad 4 \quad 6$$

$$2 \quad 2 \quad \checkmark$$

$$2a = 2 \quad 3a + b = 2 \quad \therefore a + b + c = -4$$

$$\therefore a = 1 \checkmark \quad \therefore 3(1) + b = 2 \quad \therefore 1 - 1 + c = -4$$

$$\therefore b = -1 \checkmark \quad \therefore c = -4 \checkmark$$

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

$$4.1.2 \quad T_{20} = (20)^2 - 20 - 4 \checkmark$$

$$= 376 \checkmark \quad (2)$$

## 4.2

$$x \quad y \quad 16 \quad 24$$

$$y - x \quad 16 - y \quad 8$$

$$16 - 2y + x \quad y - 8 \quad \checkmark$$

$$\therefore 16 - 2y + x = y - 8 \quad \checkmark \quad \frac{y}{x} = x$$

$$\therefore x + 24 = 3y \quad y = x^2 \checkmark$$

$$\therefore x + 24 = 3x^2 \quad \checkmark$$

$$\therefore 3x^2 - x - 24 = 0$$

$$\therefore (3x + 8)(x - 3) = 0$$

$$\therefore x = -\frac{8}{3} \quad \text{or} \quad x = 3 \quad \checkmark$$

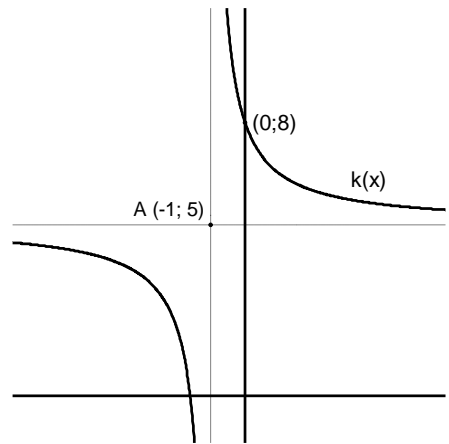
$$\therefore y = \frac{64}{9} \quad \checkmark \quad \text{or} \quad y = 9 \quad \checkmark \quad (7)$$

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**Question 5**

5.1  $p = -1$  and  $q = 5$ .

5.2  $y = x + 6$  or  $y = -x + 4$



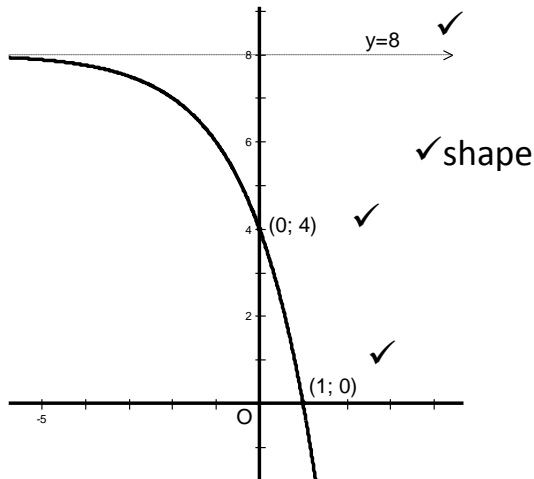
(2)

(2)

[4]

**Question 6**

6.1



(4)

6.2  $t(x) = 2 \cdot 2^{x+1} - 10$

$\therefore y > -10$

(2)

[6]

## Question 7

$$\begin{aligned}
 7.1 \quad h(x) &= -(x^2 - 4x) - 1 \\
 &= -(x^2 - 4x + 4) - 1 + 4 \quad \checkmark \\
 &= -(x - 2)^2 + 3 \quad \checkmark \quad \checkmark \quad (3)
 \end{aligned}$$

$$7.2 \quad k(x) = -(x - 3)^2 + 4(x - 3) - 1 + 1 \quad \checkmark$$

$$k(x) = -(x - 3)^2 + 4(x - 3) \quad \checkmark \text{ or}$$

$$k(x) = -x^2 + 10x - 21$$

$$\text{or } k(x) = -(x - 3 - 2)^2 + 3 + 1$$

$$= -(x - 5)^2 + 4 \quad \{\checkmark \quad \checkmark\} \quad (2)$$

[5]

## Question 8

$$8.1 \quad x^2 - x - 6 = 0$$

$$\therefore (x - 3)(x + 2) = 0$$

$$\therefore x = 3 \text{ or } x = -2 \quad \checkmark$$

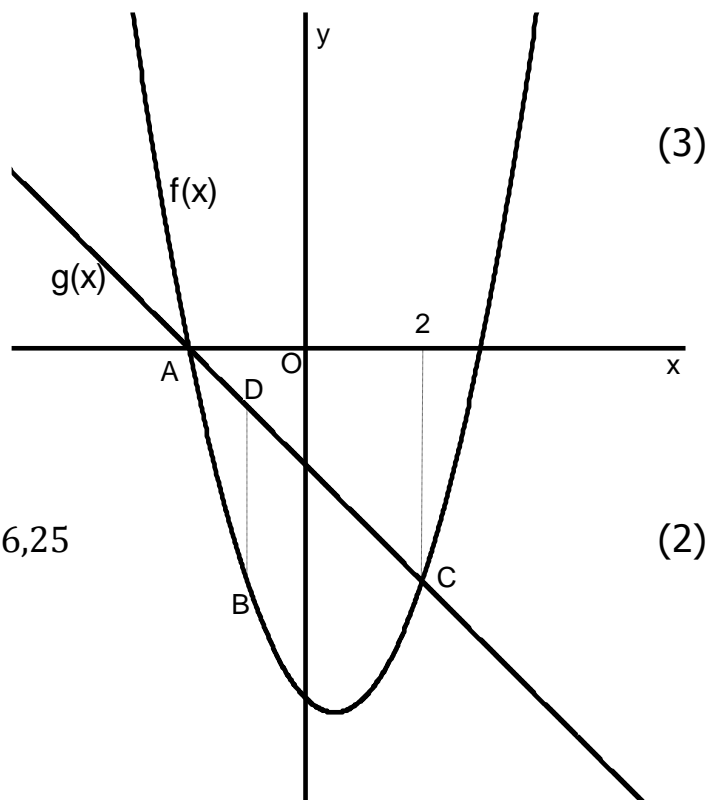
$$\therefore OA = 2 \text{ units} \quad \checkmark$$

$$8.2 \quad x = -\frac{(-1)}{2(1)}$$

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

$$y = \left(\frac{1}{2}\right)^2 - \frac{1}{2} - 6$$

$$= -6\frac{1}{4} \quad \checkmark \text{ or } -\frac{25}{4} \text{ or } -6,25 \quad (2)$$



$$\begin{aligned}
 8.3 \quad y &= (2)^2 - 2 - 6 \\
 &= -4 \\
 C(2; -4) & \quad (2)
 \end{aligned}$$

$$\begin{aligned}
 8.4 \quad m &= \frac{-4 - 0}{2 - (-2)} \checkmark \\
 &= -1 \checkmark \\
 -4 &= -1(2) + c \checkmark \\
 c &= -2 \checkmark \quad (4)
 \end{aligned}$$

$$\begin{aligned}
 8.5 \quad DB &= -x - 2 - (x^2 - x - 6) \checkmark \\
 &= -x^2 + 4 \checkmark \\
 x &= -\frac{(0)}{2(-1)} \checkmark \\
 &= 0 \checkmark \quad (4)
 \end{aligned}$$

$$8.6 \quad -2 < x < 2 \checkmark \quad (1)$$

$$\begin{aligned}
 8.7 \quad f(g(x)) &= (-x - 2)^2 - (-x - 2) - 6 \checkmark \\
 &= x^2 + 4x + 4 + x + 2 - 6 \\
 &= x^2 + 5x \checkmark \quad (4)
 \end{aligned}$$

[20]

**[TOTAL 100]**