

1. [4 marks] Solve  $\sqrt{15-2x} - x = 0$

Square both sides

$$\sqrt{15-2x} = x$$

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

$$0 = x^2 + 2x - 15$$

$$0 = (x+5)(x-3)$$

$$x = -5, 3 \quad \text{CHECK!}$$

$$x = -5 : \sqrt{25} - (-5) = 0? \quad \text{No}$$

$$x = 3 : \sqrt{9} - 3 = 0 \quad \checkmark$$

Answer :  $\{3\}$

2. [3 marks] Solve  $-1 < 4 - \frac{x}{3} \leq 5$

$$-5 < -\frac{x}{3} \leq 1$$

Multiply by  $-3$  :

$$15 > x \geq -3$$

$$\text{or } -3 \leq x < 15$$

3. [3 marks] Find the distance between the points (8, -2) and (3, 4)

$$\begin{aligned}d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\&= \sqrt{(3 - 8)^2 + (4 - (-2))^2} \\&= \sqrt{(-5)^2 + 6^2} \\&= \sqrt{25 + 36} \\&= \sqrt{61}\end{aligned}$$

4. [3 marks] Find all  $x$ -intercepts and  $y$ -intercepts for  $4x^2 + 9y = 36$ .

$x$ -intercepts : set  $y=0$

$$\begin{aligned}4x^2 &= 36 \\x^2 &= 9 \\x &= \pm 3\end{aligned}$$

$(-3, 0)$  and  $(3, 0)$

$y$ -intercept : set  $x=0$

$$\begin{aligned}9y &= 36 \\y &= 4 \\(0, 4)\end{aligned}$$

5. [5 marks] Find the centre and radius of the following circle:

$$x^2 - 12x + y^2 + 8y + 3 = 0$$

$$\left(\frac{-12}{2}\right)^2 = 36 \quad \left(\frac{8}{2}\right)^2 = 16$$

$$x^2 - 12x + 36 + y^2 + 8y + 16 = -3 + 36 + 16$$

$$(x-6)^2 + (y+4)^2 = 49 \quad \leftarrow r^2$$

$$\text{Centre} = (6, -4)$$

$$\text{Radius} = \sqrt{49} = 7$$

6. [4 marks] Find four points on the following ellipse:  $\frac{(x-4)^2}{9} + \frac{(y+7)^2}{16} = 1$

$$\text{Sub } x=4: \quad \frac{(y+7)^2}{16} = 1$$

$$(y+7)^2 = 16$$

$$y+7 = \pm 4$$

$$y = -7 \pm 4$$

$$\boxed{(4, -11) \text{ and } (4, -3)}$$

$$\text{Sub } y=-7: \quad \frac{(x-4)^2}{9} = 1$$

$$(x-4)^2 = 9$$

$$x-4 = \pm 3$$

$$x = 4 \pm 3$$

$$\boxed{(1, -7) \text{ and } (7, -7)}$$

7. [1 mark] Let  $f(x) = x^3 + 4x$ . Is  $f(x)$  even, odd or neither?

$$\begin{aligned} f(-x) &= (-x)^3 + 4(-x) \\ &= -x^3 - 4x \\ &= -(x^3 + 4x) \\ &= -f(x) \end{aligned} \quad \boxed{\text{ODD}}$$

8. [4 marks] Let  $f(x) = x^2 - 3x$ . Find and simplify  $\frac{f(x+h) - f(x)}{h}$

$$\begin{aligned} &\frac{f(x+h) - f(x)}{h} \\ &= \frac{(x+h)^2 - 3(x+h) - (x^2 - 3x)}{h} \\ &= \frac{x^2 + 2xh + h^2 - 3x - 3h - x^2 + 3x}{h} \\ &= \frac{2xh + h^2 - 3h}{h} \\ &= \frac{h(2x + h - 3)}{h} \\ &= 2x + h - 3 \end{aligned}$$

9. [3 marks] Let  $f(x) = \begin{cases} 5+x, & -3 \leq x < 0 \\ \sqrt{x}, & x \geq 0 \end{cases}$

a) Find  $f(-3)$ ,  $f(-1)$ ,  $f(0)$  and  $f(4)$ .

$$f(-3) = 2$$

$$f(-1) = 4$$

$$f(0) = 0$$

$$f(4) = 2$$

b) Graph  $f(x)$

