Question 5 **(25 marks)**

(a) Solve the equation $x = \sqrt{x+6},\ x \in \mathbb{R}$.

(b) Differentiate $x - \sqrt{x+6}$ with respect to x.

(c) Find the co-ordinates of the turning point of the function $y = x - \sqrt{x+6},\ x \geq -6$.

Question 5 **(25 marks)**

(a) Solve the equation $x=\sqrt{x+6},\ x\in\mathbb{R}$.

$$x=\sqrt{x+6}$$
$$\Rightarrow x^2=x+6$$
$$\Rightarrow x^2-x-6=0$$
$$\Rightarrow (x+2)(x-3)=0$$
$$\Rightarrow x=-2,\quad x=3$$
$$x=-2:\quad -2\neq\sqrt{-2+6}=\sqrt{4}=2 \ \times$$
$$x=3:\quad 3=\sqrt{3+6}=\sqrt{9}=3 \ \checkmark$$

(a) Scale 10C (0, 4, 8, 10)

Low Partial Credit:
• Indication of squaring

High Partial Credit:
• Correct roots

Note: must indicate required root

(b) Differentiate $x-\sqrt{x+6}$ with respect to x.

$$f(x)=x-\sqrt{x+6}=x-(x+6)^{\frac{1}{2}}$$
$$f'(x)=1-\tfrac{1}{2}(x+6)^{-\frac{1}{2}}=1-\frac{1}{2\sqrt{x+6}}$$

(b) Scale 5B (0, 2, 5)
Partial Credit:
• Any correct differentiation
• Indication of (x + 6)^(1/2)

(c) Find the co-ordinates of the turning point of the function $y=x-\sqrt{x+6},\ x\geq -6$.

$$f'(x)=0\Rightarrow 1-\frac{1}{2\sqrt{x+6}}=0$$
$$\Rightarrow 2\sqrt{x+6}=1$$
$$\Rightarrow x+6=\tfrac{1}{4}$$
$$\Rightarrow x=-5\tfrac{3}{4}$$
$$f(-5\tfrac{3}{4})=-5\tfrac{3}{4}-\sqrt{\tfrac{1}{4}}=-6\tfrac{1}{4}$$
$$\left(-5\tfrac{3}{4},-6\tfrac{1}{4}\right)$$

(c) Scale 10C (0, 4, 8, 10)

Low Partial Credit:
• Differentiation equals 0

High Partial Credit:
• Finds x value.

Note (1): A linear equation from f'(x) gets low partial at most.
Note (2): Must put f'(x)= 0 in (c) to get any marks.
Note (3): f'(x) only and f''(x)only - no credit