Worked Example:

Find the intervals where $f(x)$ is increasing, for the function: $f(x) = -4x^3 + 15x^2 + 18x + 3$

$$f'(x) = -12x^2 + 30x + 18$$

set $f'(x) = 0$ (to find stationary points)

$$-12x^2 + 30x + 18 = 0$$
$$-6(2x+1)(x-3) = 0$$
$$x = -\frac{1}{2} \qquad x = 3$$

$-6(2x^2 - 5x - 3) = 0$
$-6[2x^2 - 6x + x - 3] = 0$
$-6[2x(x-3) + (x-3)] = 0$

$\begin{array}{c} -6 \\ \hline -6 \quad +1 \\ -5 \end{array}$

$f'(x)$

$-\frac{1}{2}$ 3

Test any point in each interval (choose easy points)

Test $x = -1$
$$f'(-1) = -12(-1)^2 + 30(-1) + 18$$
$$= -24$$

Test $x = 0$
$$f'(0) = +18$$

Test $x = 4$
$$f'(4) = -12(4)^2 + 30(4) + 18$$
$$= -54$$

Completed Diagram

$-$ .... $+$ .... $-$ .... $f'(x)$

$-\frac{1}{2}$ 3