

Increasing and Decreasing Functions

Starter

1. (Review of AS material)

Solve the inequality $2x^2 - 11x - 6 \geq 0$, expressing your answer in set notation:

Working: Solve $2x^2 - 11x - 6 = 0$ to find the roots.

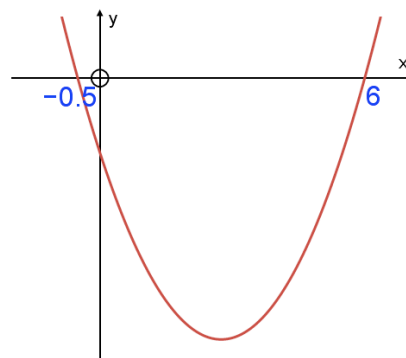
$$(2x + 1)(x - 6) = 0$$

$$\text{Roots are } x = -\frac{1}{2} \text{ and } x = 6$$

Coefficient of x^2 is positive so concave-up
 $\geq 0 \Rightarrow$ above the x -axis

$$\text{So } x \leq -\frac{1}{2} \text{ and } x \geq 6$$

$$\left\{ x : x \leq -\frac{1}{2} \right\} \cup \left\{ x : x \geq 6 \right\}$$



E.g. 1 Find the region(s) of increasing function of $y = x(x^2 - 3)$. Express your solution in set notation.

Working: $y = x(x^2 - 3) = x^3 - 3x$

$$\frac{dy}{dx} = 3x^2 - 3$$

$$\text{Increasing function} \Rightarrow \frac{dy}{dx} > 0$$

$$3x^2 - 3 > 0$$

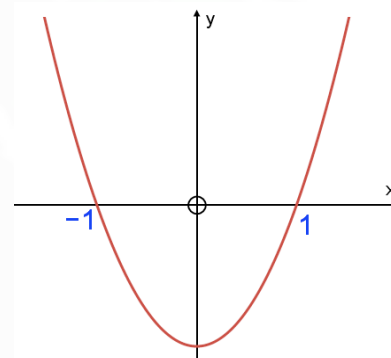
Solve $3x^2 - 3 = 0$ to find the roots

$$x = \pm 1$$

Coefficient of x^2 is positive so concave-up
 $> 0 \Rightarrow$ above the x -axis

$$x < -1 \text{ and } x > 1$$

$$\{x : x < -1\} \cup \{x : x > 1\}$$



E.g. 2* Find the region(s) of decreasing function of $y = x + \frac{4}{x}$. Express your solution in set notation.

Working: $y = x + \frac{4}{x} = x + 4x^{-1}$
 $\frac{dy}{dx} = 1 - 4x^{-2} = 1 - \frac{4}{x^2}$
Decreasing function $\Rightarrow \frac{dy}{dx} < 0$

So $1 - \frac{4}{x^2} < 0$

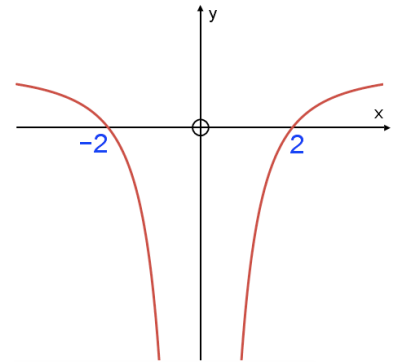
Solve $1 - \frac{4}{x^2} = 0$ to find the roots

$1 = \frac{4}{x^2} \Rightarrow x^2 = 4 \Rightarrow x = \pm 2$

$< 0 \Rightarrow$ below the x -axis
Since $x \neq 0$ the regions are

$-2 < x < 0$ and $0 < x < 2$

$(\{x : x > -2\} \cap \{x : x < 0\}) \cup (\{x : x > 0\} \cap \{x : x < 2\})$



Video: [Increasing and decreasing functions](#)
Video: [Increasing and decreasing functions EQ](#)

[Solutions to Starter and E.g.s](#)

Exercise

p264 13E Qu 7i, 10, 13, 15-17