Name:

Level 2 Further Maths

Increasing/Decreasing Functions

Corbettmaths

Ensure you have: Pencil or pen

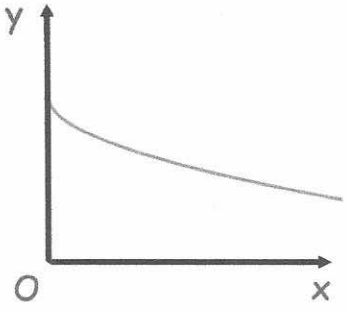
Guidance

1. Read each question carefully before you begin answering it.
2. Check your answers seem right.
3. Always show your workings

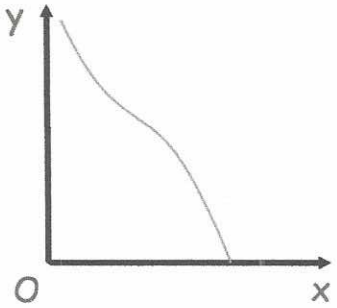
Revision for this topic

www.corbettmaths.com/more/further-maths/

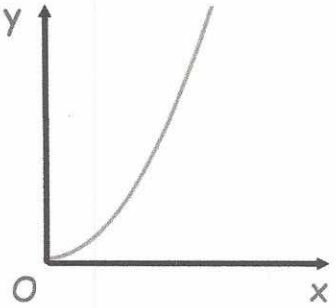
1. Shown below are three graphs.



Graph 1



Graph 2



Graph 3

Complete the following

	Increasing function	Decreasing function
Graph 1	☐	☑
Graph 2	☐	☑
Graph 3	☑	☐

(1)

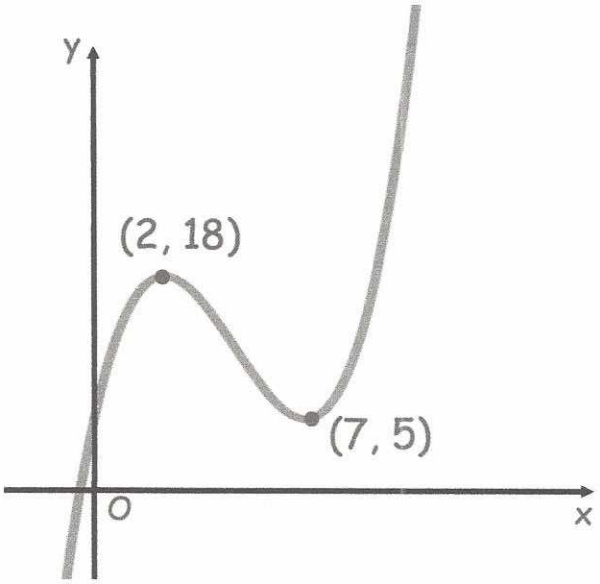
2. For what values of x is $y = x^2$ an increasing function?

$x > 0$

(1)

3. Shown below is the graph of $y = f(x)$

The point (2, 18) is a maximum point and the point (7, 5) is a minimum point.



Write down the range of values of x for which $f(x)$ is an decreasing function.

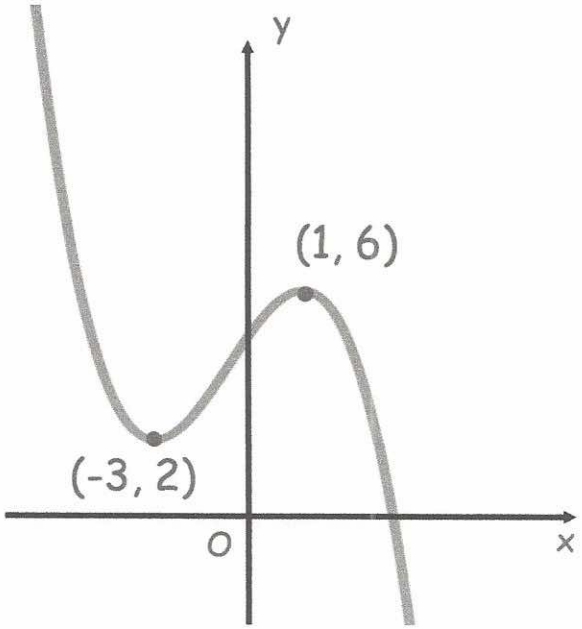
$2 < x < 7$

.....

(2)

4. Shown below is the graph of $y = f(x)$

The point (−3, 2) is a minimum point and the point (1, 6) is a maximum point.



Write down the range of values of x for which $f(x)$ is an increasing function.

$-3 < x < 1$

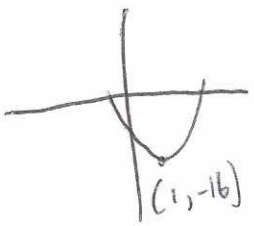
.....

(2)

5. For what values of x is $y = x^2 - 2x - 15$ an increasing function?

$y = (x-1)^2 - 1 - 15$

$y = (x-1)^2 - 16$



or $\frac{dy}{dx} = 2x - 2$

$0 = 2x - 2$

$x = 1$

$y = -16$

∴ turning point at $(1, -16)$

$x > 1$

.....

(3)

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6. Find the range of values of x for which the function

$$f(x) = 3 + 10x - 8x^2$$

is decreasing.

$\frac{dy}{dx} = 10 - 16x$

$0 = 10 - 16x$

$16x = 10$

$x = \frac{10}{16}$

$x = \frac{5}{8}$

turning point when $x = \frac{5}{8}$

$x > \frac{5}{8}$

.....

(4)

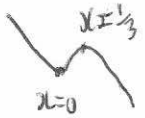
7. Find the values of x for which $y = 10 + 2x^2 - 4x^3$ is a decreasing function.

$\frac{dy}{dx} = 4x - 12x^2$

$0 = 4x - 12x^2$

$0 = 4x(1 - 3x)$

$x = 0$ or $x = \frac{1}{3}$



$x < 0$ or $x > \frac{1}{3}$

.....

(4)

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8. Find the values of x for which $y = 75x - 5x^3$ is an increasing function

$\frac{dy}{dx} = 75 - 15x^2$

$0 = 75 - 15x^2$

$15x^2 = 75$

$x^2 = 5$

$x = \pm\sqrt{5}$

$-\sqrt{5} < x < \sqrt{5}$

.....

(4)

9. Given $f(x) = 3x^3 - 9x^2 + 10x + 1$

Show $f(x)$ is a increasing function for all values of x

$\frac{dy}{dx} = 9x^2 - 18x + 10$

$9x^2 - 18x + 10$

$= 9[x^2 - 2x] + 10$

$= 9[(x-1)^2 - 1] + 10$

$= 9(x-1)^2 - 9 + 10$

$= 9(x-1)^2 + 1$

$(x-1)^2 \geq 0$

$9(x-1)^2 \geq 0$

$9(x-1)^2 + 1 > 0$ **(4)**

$\therefore \frac{dy}{dx}$ always positive

So f(x) increasing for all values of x

10. Given $f(x) = -x^3 + 3x^2 - 7x - 1$

Show $f(x)$ is a decreasing function for all values of x

$$\frac{dy}{dx} = -3x^2 + 6x - 7$$

$$= -3[x^2 - 2x] - 7$$

$$= -3[(x-1)^2 - 1] - 7$$

$$= -3(x-1)^2 + 3 - 7$$

$$= -3(x-1)^2 - 4$$

$(x-1)^2 \geq 0$

$-3(x-1)^2 \leq 0$

$-3(x-1)^2 - 4 < 0$

$\therefore \frac{dy}{dx}$ is always negative **(4)**

so $f(x)$ is decreasing for all values of x