

NICKS & TRICKS

LCOL Guide to – Calculus

- Here are the basics of differentiation – don't forget about page 25 of your log book!

Basics of differentiation



Function – $f(x)$	Derivative $f'(x)$
x^n	nx^{n-1}
x^3	$3x^{3-1} = 3x^2$
x^5	$5x^4$
x^{10}	$10x^9$
x^1	$1x^0 = 1$

- Calculus is very useful for practical questions as well.

Remember: differentiating any equation will give you the equation for its **rate of change!**

and to find the **maximum or minimum** of any function, differentiate and put = 0!

Worked Example

(i) Differentiate the function $f(x) = 4x^3 - 3x^2 + x - 7$, where $x \in \mathbb{R}$, with respect to x .

$$f'(x) = 12x^2 - 6x + 1$$

(ii) Find the slope of the tangent to the graph of $f(x) = 4x^3 - 3x^2 + x - 7$ at the point $(1, -5)$.

Remember $f'(x)$ is our slope!

$$12(1)^2 - 6(1) + 1 = 7$$

(iii) Hence find the equation of the tangent to the graph at this point.

$$y + 5 = 7(x - 1)$$

$$7x - y - 12 = 0$$

(iv) The function $g(x) = 2x^2 + px + q$, where $p, q \in \mathbb{Z}$, and $x \in \mathbb{R}$. Given that $g(2) = 6$ and $g'(3) = 9$, find the value of p and the value of q . Note: $g'(3)$ is the value of the derivative of $g(x)$ at $x=3$.

$$g(2) = 2(2)^2 + p(2) + q$$

$$8 + 2p + q = 6$$

$$2p + q = -2$$

$$g'(3) = 4(3) + p = 9$$

$$\Rightarrow p = -3$$

Sub $p = -3$

$$\Rightarrow 2(-3) + q = -2$$

$$q = 4$$

$$p = -3 \quad q = 4$$

2018 Question – 12 mins – Time yourself!

Question 5

(25 marks)

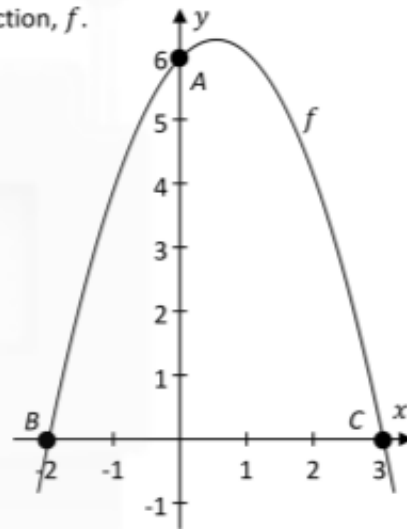
The diagram on the right shows the graph of a quadratic function, f .

- (a) Write down the co-ordinates of A , B , and C .

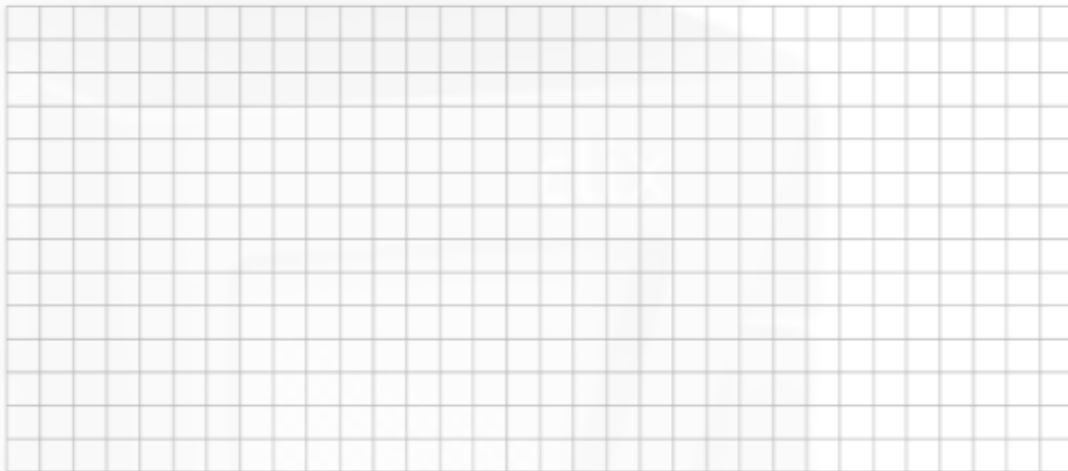
$$A = (\quad , \quad)$$

$$B = (\quad , \quad)$$

$$C = (\quad , \quad)$$



- (b) Show that the function can be written as $f(x) = -x^2 + x + 6$.



- (c) Show, using calculus, that the maximum point of $f(x)$ is $(0.5, 6.25)$.

