Maths IB_2

Pre-Test 1b

7 October 2024

`Subjets` : *First Principle & rules of derivation*

ANSWERS

Problem 1

[7 marks]

Let us consider the function $f : x \mapsto 3x^2$

Using the *First Principle*: $f'(x_0) = \lim\limits_{h \to 0} \frac{f(x) \quad f(x_0)}{x \quad x_0}$
show that $f'(x_0) = 6x_0$

$$f'(x_0) = \lim_{x \to x_0} \frac{f(x) \quad f(x_0)}{x \quad x_0} = \lim_{x \to x_0} \frac{3x^2 \quad 3x_0^2}{x \quad x_0} = \lim_{x \to x_0} \frac{3(x \quad x_0)(x + x_0)}{x \quad x_0} = \lim_{x \to x_0} \frac{3(x + x_0)}{} = 6x_0$$

Problem 2

[42 marks]

For the following functions, find

i) the derivative,

ii) the *gradient* of the *tangent* and of the *normal* to the curve at $x = x_0$,

#	function	x_0	derivative	gradient *tangent* at $x = x_0$
1	$\frac{x^3}{3} \quad 4x$	2	$x^2 \quad 4$	0
2	$18\sqrt{x}$	9	$\frac{18}{\sqrt{x}}$	6
3	$\frac{32}{\sqrt{x}} = x^{\quad \frac{1}{2}}$	4	$\frac{32}{2} x^{\quad \frac{1}{2} \quad 1} = \quad 16 \frac{1}{\sqrt{x^3}}$	1
4	$(7x+3)\sin(x)$	$\frac{\pi}{2}$	$7 \cdot \sin(x) + (7x+3)\cos(x)$	7
5	$\sin(x)\cos(x)$	$\frac{\pi}{2}$	$\cos^2(x) \quad \sin^2(x)$	1
6	$\frac{x \quad 1}{x+1}$	0	$\frac{2}{(x \quad 1)^2}$	2
7	$\frac{x^2 \quad 1}{x^2+1}$	0	$\frac{4x}{(x^2+1)^2}$	0
8	e^x	0	e^x	1
9	$x\ln(x)$	1	$1 \cdot \ln(x) + x\frac{1}{x} = \ln(x) + 1$	1
10	$\cos(x^2)$	$\sqrt{\pi}$	$2x\sin(x^2)$	0