

## Calculus 1 Tutorial Questions – 22 Feb 2023

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1) Find the derivatives of:

i.  $x^4$

ii.  $7x^3$

iii.  $x^{-1}$

iv.  $x^1$

2) Find the derivative of:

i.  $f(x) = 5x^2 + 7x + 3$

ii.  $g(x) = 2x^3 + 4x^2 + x + 5$

iii.  $y = 8x + 4$

3) Find the slope of line  $y = 8x + 4$  using differentiation

4) Product rule:  $y = (4 + 3x^2)(6x + 4x^2)$  Find  $\frac{dy}{dx}$

5) Quotient rule:  $y = \frac{(5+6x)}{2x^2}$  Find  $\frac{dy}{dx}$

6) Chain rule:  $y = (2 + 3x)^4$  Find  $\frac{dy}{dx}$

7) Find the following limits:

i.  $\lim_{x \rightarrow 1} \left( \frac{x^2 + x - 2}{x - 1} \right)$

ii.  $\lim_{n \rightarrow \infty} \left( \frac{2n^2 - 3n + 2}{6n^2 + 5n - 6} \right)$

8) Find the derivative of  $f(x) = 5 - 2x$  by first principles.

9) Fill in the table:

$f(x)$	$f'(x)$
$\sin^{-1}\left(\frac{x}{a}\right)$	
$\cos^{-1}\left(\frac{x}{a}\right)$	
$\tan^{-1}\left(\frac{x}{a}\right)$	

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### 10) 2014 Paper 1 Q4

- (a) Differentiate the function  $2x^2 - 3x - 6$  with respect to  $x$  from first principles.
- (b) Let  $f(x) = \frac{2x}{x+2}$ ,  $x \neq -2$ ,  $x \in \mathbb{R}$ . Find the co-ordinates of the points at which the slope of the tangent to the curve  $y = f(x)$  is  $\frac{1}{4}$ .

### 11) 2016 Paper 1 Q6

- (a) Differentiate the function  $(2x + 4)^2$  from first principles, with respect to  $x$ .
- (b) (i) If  $y = x \sin\left(\frac{1}{x}\right)$ , find  $\frac{dy}{dx}$ .
- (ii) Find the slope of the tangent to the curve  $y = x \sin\left(\frac{1}{x}\right)$ , when  $x = \frac{4}{\pi}$ .  
Give your answer correct to two decimal places.

### 12) 2017 Paper 1 Q3

- (a) Differentiate  $\frac{1}{3}x^2 - x + 3$  from first principles with respect to  $x$ .
- (b)  $f(x) = \ln(3x^2 + 2)$  and  $g(x) = x + 5$ , where  $x \in \mathbb{R}$ .  
Find the value of the derivative of  $f(g(x))$  at  $x = \frac{1}{4}$ .  
Give your answer correct to 3 decimal places.