

MATH2250 - Calculus I for Science and Engineering

Assignment 1 - Due Thursday, October 3, 2019

1 Derivatives from First Principles

Given the function $P(t) = \frac{t-3}{t}$, **from first principles** calculate:

a) $P'(-3)$ b) $\left. \frac{dP}{dt} \right|_{t=1}$ and c) $\frac{dP}{dt}$

d) Verify your results in the above parts by using the derivative rules.

2 More Limits

Evaluate the following limits if they exist, justifying your answers. If the limit does not exist, explain why.

i) $\lim_{x \rightarrow -3} \frac{x^2 + x - 6}{x^2 + 4x + 3}$ ii) $\lim_{s \rightarrow 0} \sin(3s) \csc(2s)$ iii) $\lim_{r \rightarrow 9} \frac{r-9}{\sqrt{r}+3}$ iv) $\lim_{v \rightarrow \pi} \frac{\cos^3(v) + 1}{v - \pi}$

3 Derivatives

Calculate the following derivatives. Simplify your final results, where applicable.

i) $\frac{d^2}{dx^2}[e^{\cos(x)}]$ ii) $\frac{ds}{dw}$ where $\frac{s^2}{w^2+1} = -3e^{2w}$ iii) $\frac{dy}{dx}$ where $\sin(xy) = x$

iv) $\frac{d}{dz} \left[\tan \left(\frac{1}{z} \right) \right]$ v) $\frac{d^2 W}{dz^2}$ where $W(z) = \log(1+z^2)$ vi) $\frac{d^{13} g}{dx^{13}}$ where $g(x) = \frac{1}{1-x}$

4 Tangent Lines

- a) Determine the equation of the tangent line to $p(x) = \frac{3}{1 + \log(x)}$ at $x = 1$
- b) Determine the equation of the tangent line to $x = \tan(y)$ at $(0, 0)$
- c) Determine the equation of the tangent line to $x^3y + x^2 + \log(y^2) = x + y$ at:
i) $(1, 1)$ and ii) $(1, -1)$

5 Table Derivatives

Below is a list of properties of the functions $f(x)$ and $g(x)$.

x	-4	-1	0	2	4	5
$f(x)$	2	3	-1	-6	3	1
$f'(x)$	5	$-1/3$	-1	2	1	-2
$g(x)$	-1	6	$1/2$	16	-2	0
$g'(x)$	4	-4	0	-1	0	$\log(2)$

Using this information, evaluate the listed quantities, simplifying fully.

i) $H'(5)$ where $H(x) = 2g(x) - 6f(x)$ ii) $K'(-1)$ where $K(x) = f(x) \cdot [g(x)]^2$

iii) $L'(4)$ where $L(x) = \left(\frac{g(x)}{f(x)}\right)^3$ iv) $Q'(-4)$ where $Q(x) = \sqrt{g(f(x))}$