

## Practice final

1) Find the following limits

$$(a) \lim_{x \rightarrow 0} \frac{\sin(2x)}{x} \rightarrow \frac{0}{0}$$

*l'Hôpital's*

$$\rightarrow = \lim_{x \rightarrow 0} \frac{2 \cos(2x)}{1} = 2$$

$$(b) \lim_{x \rightarrow 3} \frac{x^2 - 4}{x^2 - 2} = \frac{3^2 - 4}{3^2 - 2} = \frac{5}{7}$$

$$(c) \lim_{x \rightarrow \infty} \frac{x}{e^x} \rightarrow \frac{\infty}{\infty}$$

*by l'Hôpital's*

$$\rightarrow = \lim_{x \rightarrow \infty} \frac{1}{e^x} = \lim_{x \rightarrow \infty} e^{-x} = 0$$

2) Find the derivative of each of the following functions

(a)  $f(x) = \ln(x^2) + 3x^2$

$$\begin{aligned} f'(x) &= \frac{1}{x^2} \cdot 2x + 3(2x) \\ &= \frac{2}{x} + 6x \end{aligned}$$

(b)  $g(x) = \frac{x^2}{\sin(x)}$

$$g'(x) = \frac{(\sin(x))(2x) - x^2(\cos(x))}{\sin^2(x)}$$

(c)  $h(x) = e^{3x} \sin(x^2)$

$$h'(x) = 3e^{3x} \sin(x^2) + e^{3x} (\cos(x^2) \cdot 2x)$$

(d)  $w(t) = \sqrt{\frac{t^2+3}{\tan(t)}} = \left(\frac{t^2+3}{\tan(t)}\right)^{1/2}$

$$w'(t) = \frac{1}{2} \left(\frac{t^2+3}{\tan(t)}\right)^{-1/2} \cdot \left(\frac{(\tan(t))(2t) - (t^2+3)(\sec^2(t))}{\tan^2(t)}\right)$$