

1. Evaluate each of the following using trigonometric identities,  $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$  and  $\lim_{x \rightarrow 0} \frac{\cos x - 1}{x} = 0$ .

a)  $\lim_{x \rightarrow 0} \frac{\sin^3 2x}{\sin^3 3x}$

b)  $\lim_{x \rightarrow 0} \frac{\cos x - 1}{\sin x}$

2. Differentiate with respect to  $x$ .

a)  $y = \frac{1}{3} \cot 9x$

b)  $y = \frac{x^2}{\cos x}$

c)  $\tan y = x^2$

3. Find the equation of the tangent line to  $y = \cot^2 x$  when  $x = \frac{\pi}{4}$ .

4. Find the local maximum and minimum for  $f(x) = x - 2 \sin x$  on the interval  $[0, 2\pi]$ .  
Justify using regions of increase and decrease or the second derivative test.