Math 31
Unit 5 Trigonometric, Exponential, & Logarithmic Functions
Final Hand in Assignment

1) Evaluate the following limits. Show all of your work.

   a) \( \lim_{x \to 0} \frac{\sin \frac{1}{2}x}{x} \)

   b) \( \lim_{x \to 0} \frac{\sin^2 x}{x \cos x} \)

2) Find the derivative \( \frac{dy}{dx} \) for each of the following.

   a) \( y = \sin 2x \cos 3x \)

   b) \( y = 9x \sin^3 (2x+1) \)
c) \[ y = \tan^3 3x \]

d) \[ y = \frac{\cot^2 2x}{1 + x^2} \]

e) \[ y = \sin(\tan 2x) \]

f) \[ y = 2\sec \sqrt{x} \]

g) \[ \cos y + \sin x = \cos y \sin x \]

h) \[ \tan(x + y) = \sec y - \sec x \]
3) As a rocket blasts off from the earth at 38 m/s, a tracking device 340 m from the launch site records the angle of elevation, $\theta$, to the rocket. Determine the rate of change in the angle of elevation 5 seconds after blast off.

![Diagram of rocket launch and angle of elevation]

$$\frac{d\theta}{dt} = ?$$

$340 \text{ m}$

4) Solve the following for $x$. Round your answers to the nearest hundredth if necessary.

a) $e^x = 1$

b) $x = e^{\ln 10}$

c) $x + 1 = 3\ln 2e$
5) Determine the derivative of each function given below. Simplify your answers.

a) \( y = 4e^{2x} \)

b) \( y = 5^{3x^3} \)

c) \( y = \ln(2x^3 + 1) \)

d) \( y = \log_3(\sin x) \)

e) \( y = (\ln x)(\log_3 x) \)

f) \( y = \cos(\ln x) \)
g) \( y = (4^{5x-1})(5^x) \)

h) \( y = (\log_2 8x)^3 \)

i) \( y = e^{\sin x} \)

j) \( y = \frac{\cos 2x}{e^{2x}} \)

6) Determine the equation of the tangent line to \( y = \ln x^3 \) when \( x = 6 \).