Math 261 - Lab 10 **Introduction to Derivatives** **Name:** _____

Show all work for credit. Also, give exact answers unless otherwise noted.

1. The position function s of a particle moving along a coordinate line ℓ is given by $s(t) = 8t + \frac{2}{t}$, $0.25 \leq t \leq 8$ where the position, s, is in meters and the time, t, is in seconds.

   (a) Find the average velocity of the particle over each of the following three time intervals: *Approximate by rounding to the nearest hundred thousandth.*
   $[4, 4.1]$ $[4, 4.01]$ $[4, 4.001]$

   (b) Find the velocity of the particle at any time t (i.e., find $v(t)$).

   (c) When is the velocity of the particle 6 meters per second?

   (d) Find the velocity at 4 seconds.

   (e) In what direction is the particle moving at 4 seconds?

   (f) When does the particle reverse directions?

   (g) Find the acceleration of the particle at time t, $a(t)$.

2. The position of a particle along a straight-line path is given by $s(t) = t + 2\cos(t)$, $0 < t < 2$ where the position is in meters and the time is in seconds. Find the position and acceleration of the particle at the times when it is **stopped**. *Determine the exact values - do not use a calculator.*

3. Find the derivative of each of the following functions. Simplify your answers completely.

   (a) $y = x^3 + \sin x \cos x$

   (b) $y = \tan x + \sec x$

   (c) $g(x) = \left(x^2 + x - \sqrt{x}\right) \tan x$

   (d) $y = \sqrt[3]{x^2} \sin x$

   (e) $s(t) = \dfrac{\cos x}{1 + \sin x}$

   (f) Find y'' if $y = \csc x$