PreCalc BC **8- Extrema** **Name:**

1. a) Identify and classify all the extrema in the function $y = x^5 - 4x^3 + 3$.
   Be sure to use signs analysis.
   b) Use you calculator to produce a sketch of the function. Label the extrema with coordinates.

2. Find the derivatives of the following:

   a) $f(x) = \log_2(x)$ b) $g(x) = \dfrac{x^3 - 5}{x^2}$ c) $h(x) = (2x + 3)^3$

3. Consider the function $f(x) = x^2 + 1/x$ *(for $x > 0$)*
a) Does $f'(x)$ ever equal zero? Does this correspond to a maximum or a minimum?
b) Does $f''(x)$ ever equal zero? What does this tell you about the function?

4. CALCULATOR BASED QUESTION
The position of a particle is given by $s(t) = e^t - t^3$, for $0 \le t \le 5$

a) When does the particle return to its starting point?
b) When is the particle at rest?
c) For what interval of time is the particle's velocity negative?
d) When is the particle's acceleration equal to zero?
e) What is happpening to the velocity when the acceleration is zero?

5. A bullet fired straight up from the surface of the moon would have a height of $h(t) = 832t - 2.6t^2$ *(h in feet, t in secs).*
a) How long does it take for the bullet to return to the surface?
b) When is the bullet's acceleration greatest?.

6. Imagine that the vertical position of a roller coaster over a 6 second interval is given by $s(t) = 20\sin(t) + 20$, where s is in feet and t is in seconds.
a) How high does the roller coaster go?
b) What is the roller coaster's greatest downward velocity? How high is the roller coaster when this occurs?
c) What is the roller coaster's greatest downward acceleration? How high is the roller coaster when this occurs?

7. For each evaluate the first and second derivatives at x = 2. verify with nDeriv.

a) $f(x) = e^{x+\pi}$ b) $g(x) = \ln(5\sqrt{x^3})$ c) $h(x) = (2x - 1)(x^2 - 3)$

8. Sketch a smooth curve through the origin with the properties that $f''(x) < 0$ for $x < 0$ and $f''(x) > 0$ for $x > 0$.