Math 2310 - Test 2

Name:_____

Do not use a calculator and show all work.

1. Graph the derivative function of the graph of the function given below.

2. Compute the derivatives of the following functions:

$f(x) = x^2$	$f(x) = \sec(x^2)$
$f(x) = \ln(x^2 + 1)$	$f(x) = \frac{x+3}{x^3+1}$
$f(x) = \sin(\cos(x))$	$f(x) = \sin(x)\cos(x)$
$f(x) = \sin(\arctan(x))$	$f(x) = \frac{x-1+x^{3/2}}{x}$

3. Let $s(t) = -4.9t^2 + 98t + 11$ represent the height above the ground of a baseball I threw up in the air.

   (a) Compute the velocity as a function of time.

   (b) When is the velocity zero.

   (c) What is the maximum height of the ball.

4. Use logarithmic differentation to determine the equation of the tangent line for $f(x) = x^{3x}$ at the $x = 2$.

5. Use implicit differentiaion to determine the derivative $\frac{dy}{dx}$ for

$$e^{x^2 y} = y + x$$

6. An airplane travelling at 450 ft/sec is heading upward at an angle of 30° with the ground. How fast is the airplane rising?

7. A spherical ballon is being pumped with air ata a rate of 100 in^3/sec. How fast is the the radius increasing when the radius is 3 inches? How about when the radius is 10 inches?

TAKE HOME. There are many legends surrounding the first president of the United States, some true some maybe not so true. One such legend is that George Washington threw a rock from the ground to the top of the Natural Bridge in Virginia (look up pictures on google maps very pretty), a vertical distance of 215 feet. Ignoring air resistance and noting that a modern professional pitcher can throw a ball at 90 miles an hour, argue the possible validity of this legend (of course using calculus).

To start note that $s(t) = -16t^2 + v_0 t$ is the equation of the height (in feet) of an object thrown directly upward on earth, where v_0 is the initial velocity (in feet per second). Your job is to determine the initial velocity so that the maximum height is at least 215 feet. Then convert your initial velocity into miles per hour and compare to the 90 miles per hour.