

Circle One:

Name: _____

11:00-11:55 (325)

3:30-4:20 (333)

Math211-2, Fall 2007

Quiz #3: 09-26-07

No Calculators. There are four problems.

1. (2 Points) Solve $e^{3\ln x} = 8$ for x .

We can put the 3 on top of the x , and the e and \ln undo each other:

$$8 = e^{3\ln x} = e^{\ln x^3} = x^3.$$

we conclude that $x = 8^{1/3} = 2$.

2. (2 Points)

a. What is the definition of the derivative?

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

b. Use the definition of the derivative to find $f'(x)$ where $f(x) = x^2$.

$$f'(x) = \lim_{h \rightarrow 0} \frac{(x+h)^2 - x^2}{h} = \lim_{h \rightarrow 0} \frac{2xh + h^2}{h} = \lim_{h \rightarrow 0} (2x + h) = 2x.$$

3. (3 Points) Find the equation of the tangent line to the graph of $y = \frac{1}{2}x^2 + \frac{1}{x^2}$ when $x = -1$. (Note: You may use derivative rules to solve this problem).

We need a point on the line. When $x = -1$, $y = \frac{1}{2} + 1 = \frac{3}{2}$. The point $(x_1, y_1) = (-1, \frac{3}{2})$ is a point on the tangent line.

We need the slope, m of the tangent line. To find this, we use the derivative: $y' = x - 2x^{-3}$. When $x = -1$, $m = y' = 1$.

Plug these values into point slope form: $y - y_1 = m(x - x_1)$. We get $y - \frac{3}{2} = x + 1$.

4. (3 Points) Wisconsin's quarterback Tyler Donovan throws a longball to receiver Luke Swan. Suppose the vertical height y (feet) of the ball can be modeled with

$$y(t) = -4t^2 + 16t + 5$$

where t is the number of seconds the ball has been in the air. Find the vertical height and speed of the ball at the end of 3 seconds. Is the ball is on its way up or down?

To find the height of the ball, plug in $t = 3$ to the equation: $y(3) = 17$ feet.

To find the speed of the ball, we first look at the velocity: $v(t) = y'(t) = -8t + 16$. Plugging in $t = 3$, we find that $y(3) = -8$ feet per second. The speed at this time speed = $|v(3)| = 8$ feet per second.

The ball is on its way down because the velocity is negative.