MATH 160 Exam 2 **Name** ______________________________

CCU Dept. of Math/Stats

Sample A **Score** __________

1. (a) (10 points) Use implicit differentiation to find $\dfrac{dy}{dx}$.

$$y^4 - 4y^2 = x^4 - 5x^2$$

(b) (5 points) Find an equation of the line tangent to the graph of

$$y^4 - 4y^2 = x^4 - 5x^2$$

at the point $(0, -2)$.

2. Compute $\dfrac{dy}{dx}$ for the following functions.

(a) (10 points) $y = (\cos x)^x$. (**Show work**).

(b) (10 points) $y = \sqrt[4]{\dfrac{x^2+1}{x^2-1}}$.

3. (16 points) If a tank holds 5000 gallons of water, which drains from the bottom of the tank in 40 minutes, then Torricelli's Law gives the volume V of water remaining in the tank after t minutes as

$$V = 5000\left(1 - \frac{t}{40}\right)^2 \qquad 0 \le t \le 40$$

(a) Find the average rate at which water is draining from the tank the first 10 minutes.

(b) Find the rate at which water is draining from the tank at 10 minutes.

4. (a) (6 points) Given a function $y = f(x)$ and a point $(a, f(a))$ write the equation of the linearization of f at a.

$$L(x) = \underline{\hspace{4cm}}$$

(b) (10 points) Use a linear approximation to estimate $e^{.025}$. **(Show work).**

5. (18 points) If a stone thrown vertically upward from the top a 40 ft. building with an initial velocity of 40 ft/s, its height (in feet) after t seconds is $s(t) = 40 + 64t - 16t^2$.

   (a) What is the velocity of the stone after t seconds?

   (b) What is the maximum height reached by the stone?

   (c) What is the velocity of the stone after it has risen 88 feet?

6. (15 points) Choose **one** of the following two related rates problems. You must show all of your work to receive full credit. If you attempt both, **circle** the one that you want to have graded.

   (a) Two cars start moving from the same point. One travels south at 60 mi/h and the other travels west at 25 mi/h. At what rate is the distance between the cars increasing two hours later?

   (b) Water is leaking out of an inverted conical tank at a rate of 10,000 $\mathrm{cm}^3/\mathrm{min}$ at the same time that water is being pumped into the tank at a constant rate. The tank has height 6 meters and the diameter at the top is 4 meters. If the water level is rising at a rate of 20 cm/min when the height is 2 meters, find the rate at which water is being pumped into the tank. Note: $V = \frac{1}{3}\pi r^2 h$.