Math 124 Section (Pezzoli)
Winter 2018
Midterm #2

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Name ______________

TA: ______________

Section: ______________

- Your exam contains 4 problems. The entire exam is worth 50 points.
- You have 80 minutes to complete this exam.
- This exam is closed book. You may use one $8\frac{1}{2}$" $\times$ 11" sheet of notes (both sides). Do not share notes.
- The only calculator allowed is the TI 30x IIS.
- In order to receive credit, you must **show all of your work**. If you do not indicate the way in which you solved a problem, you may get little or no credit for it, even if your answer is correct.
- Place $\boxed{\text{a box around your answer}}$ to each question.
- If you need more room, use the backs of the pages and indicate that you have done so.
- Raise your hand if you have a question.
- This exam has 5 pages, including this cover sheet. Please make sure that your exam is complete.
- Give exact answers or approximate your answers to three decimal digits.

Problem #1(15 pts) ______

Problem #2(10 pts) ______

Problem #3(13 pts) ______

Problem #4(12 pts) ______

TOTAL (50 pts) ______

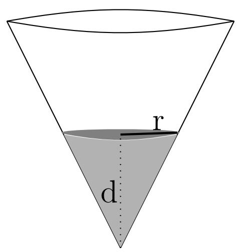
1. Compute the derivatives of the following functions. You do not need to simplify.

   (a) $f(x) = \sin(\sqrt{3-5x}) \cdot \arctan(2x)$ ($arctan(2x)$ means the same as $tan^{-1}(2x)$)

   (b) $g(x) = (2x+5)^{x \ln x}$

   (c) $h(r) = \tan(\frac{r}{ar+k})$ (a and k are non zero parameters)

2. A container in the shape of a circular cone of radius 5 ft and height 10 ft is leaking water at a constant rate of 2 ft ^{3} / hr. Let r be the radius of the top of the water, so the area of the top of the water is $A = \pi r^2$. At what rate is this area A changing when the depth d of the water in the container is 3 ft ? (Recall that the volume of a cone of radius x and height h is $V = \frac{1}{3}\pi x^2 h$).



3. Consider the curve given by the parametric equations

$$x = t^3 + 1 \quad y = \frac{30}{t^2} \quad t > 0$$

(a) Find the equation(s) of the tangent line(s) to the curve above that pass through the point $P(1, 2)$.

(b) Suppose the parametric equations above give the location at time t seconds of an object moving in the plane. Recall that the speed of the object is given by $\sqrt{(x'(t))^2 + (y'(t))^2}$. At time $t = 1$ is the speed of the object increasing or decreasing ? Justify your answer.

4. The pressure P and volume V of a gas are related by the equation:

$$(P + \frac{a}{V^2})(V - b) = c \quad a, b, c \text{ are constants}$$

(a) Find $\frac{dV}{dP}$ (your formula may contain P,V, a,b,c).

(b) Assume that $a = 200, b = 0.2$ and that when the pressure P is 20 atm the volume V of the gas is 10 ml. Use linear approximation to find the volume of the gas if the pressure decreases to 19 atm. Approximate your answer to three decimal digits.