MTH 151
Exam 2
Fall 2012

Show all work in a neat and organized fashion. Clearly indicate your answers.
100 points possible.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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1. (12 pts.) Use the Candidates Test (i.e., Closed Interval Method), showing all work, to find the absolute maximum and absolute minimum values of f on the given interval.

$$f(x) = x^3 + 7x^2 - 5x, \quad [-6, 4]$$

2. (24 pts.) Differentiate each function. You do not have to simplify your answers.

(a) $y = \sqrt{x}\,\sin x$

(b) $y = \dfrac{x^5 - 1}{x^5 + 1}$

(c) $y = (x^2 + x^4)^6$

(d) $y = \tan^2(\cos x)$

3. (12 pts.) (a) Somebody used the product rule and got this. Simplify it.

(Just simplify. Do not take the derivative.)

$$3(2x-1)^2(2)(x+3)^{1/2} + (2x-1)^3(\tfrac{1}{2})(x+3)^{-1/2}$$

(b) Somebody used the quotient rule and got this. Simplify it.

(Just simplify. Do not take the derivative.)

$$\frac{3(x+2)^2(x-3)^2 - (x+2)^3(2)(x-3)}{(x-3)^4}$$

4. (6 pts.) Find the limit. Neatly show work that justifies the answer, using only methods we have studied.

$$\lim_{x \to 0} \frac{\sin 4x}{\sin 9x}$$

5. (12 pts.) Consider

$$y = 4x - 3x^2.$$

(a) Find dy.

(b) Evaluate dy when $x = 5$ and $dx = 0.8$.

(c) Compute Δy when $x = 5$ and $\Delta x = 0.8$.

6. (12 pts.) Use implicit differentiation to find y' and y''.

$$x^5 + y^5 = 1$$

(You don't have to simplify. You do have to express your answers in terms of x and y.)

7. (12 pts.) A particle moves according to a law of motion $s = f(t)$, where t is measured in seconds and s in feet.

$$f(t) = -\sin\left(\frac{\pi t}{4}\right), \quad 0 \le t \le 10$$

Important: A supplemental page shows the graphs of $f(t)$, $f'(t)$, and $f''(t)$. You may use the graphs to answer parts (c), (d), and (e).

(a) Find the velocity at time t.

(b) What is the velocity after 3 seconds?

(Decimal approximation to 3 decimal places or exact, either way.)

(c) For $0 \le t \le 10$, when is the particle at rest?

(d) For $0 \le t \le 10$, when is the particle moving in the positive direction.

(e) For $0 \le t \le 10$, when is the particle speeding up? slowing down?

8. (12 pts.) Westport is 3 miles west of Easthaven. Jay leaves Westport, traveling north at 5 mi/hr. At the same time, Kay leaves Easthaven, traveling south at 4 mi/hr. After 0.5 hr, at what rate is the distance between Jay and Kay increasing?

(Suggestion: in your drawing, add auxiliary lines to obtain a single, larger right triangle.)