MATH 140
FALL 2015
EXAM 3

NAME:

1. [10 pts.] Use the Closed Interval Method to find the absolute extreme values of

$$f(x) = 2x^3 - 15x^2 + 24x$$

on $[0, 5]$.

2. Let $f(x) = \dfrac{x^2 + 12}{2x + 1}$.

   (a) [5 pts.] Find the domain and intercepts of f.

   (b) [5 pts.] Find the asymptotes of f.

   (c) [5 pts.] Find the critical points of f.

   (d) [10 pts.] Use the Monotonicity Test to find intervals of increase and decrease, and use either the First Derivative Test or Second Derivative Test to find all local extrema.

   (e) [10 pts.] Use the Concavity Test to find intervals where f is concave up or down, and identify inflection points.

3. [10 pts.] Of all boxes with a square base and a volume of 100 m^3, use optimization to find the dimensions of the one having the smallest surface area.

4. [10 pts.] Use linear approximation to approximate the change in the volume of a sphere when its radius changes from 5 cm to 5.1 cm. (The volume of a sphere of radius r is $\frac{4}{3}\pi r^3$.)

5. [10 pts.] Suppose f is continuous on $[-2, 14]$ and differentiable on $(-2, 14)$. Also suppose that $f(14) = 7$ and $f'(x) \leq 10$ for all $x \in (-2, 14)$. What is the smallest possible value for $f(-2)$?

6. [10 pts. each] Use L'Hôpital's Rule to evaluate each limit.

   (a) $\displaystyle\lim_{x \to \pi/2^-} \left(\frac{\pi}{2} - x\right) \sec x.$

   (b) $\displaystyle\lim_{x \to 0} \frac{\tan x - x}{x^3}.$

7. [10 pts. each] Determine the following indefinite integrals.

   (a) $\displaystyle\int \left(\frac{5}{t^2} + 4t^2\right) dt.$

   (b) $\displaystyle\int (\sin 2y - \cos 6y)\, dy.$