MATH 201 Your name: _____

Learning target AD3, version 2

A wizard is developing a shrinking spell, but he needs to make sure it will work with his pointy hat, which is a cone whose height is three times its radius. Once he casts the spell, the height of his hat shrinks by 2 inches every second. How fast is the volume of his hat changing when the hat is just 3 inches tall? Give units on your answer.

Hints: Draw three pictures, label variables and constants, write down what you know and what you want to know, relate the variables, find the derivative wrt time, substitute and solve.

The volume of a cone is a third of the volume of the cylinder that contains it: $V = 1/3 \cdot \pi r^2 h$.

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Learning target AD5, version 2

If I were you, I'd do this one before AD4.

Consider the function $g(x) = -2x^3 + 18x^2 + 42x - 100$.

1. Make a first-derivative sign chart.

Hint: A first-derivative sign chart is a number line labeled with the critical numbers of $g(x)$, and then the sign of the first derivative on each chunk.

2. Use the sign chart to decide whether each local extremum is a local minimum or a local maximum.

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Learning target AD4, version 2

Find the absolute minimum and absolute maximum values of the function

$$g(x) = -2x^3 + 18x^2 + 42x - 100$$

on the interval $[-4, 4]$. Show all your work and explain all your thinking.

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Learning target AD8, version 2

If you take a regular 8.5" x 11" sheet of paper and cut squares out of the corners, you can fold up the flaps on all four sides to make a box (without a lid). How large should you cut the squares so that the resulting box has maximum volume?

Hints: Draw three pictures; label variables and constants; write a constraint equation; write an objective function that just has one variable; find any endpoints; do the finding extrema recipe.

The maximum volume is $\underbrace{\qquad}_{\text{number}}\ \underbrace{\quad}_{\text{units}}$,

and the dimensions of the box that make this work are $\underbrace{\qquad}_{\text{number}}\ \underbrace{\quad}_{\text{units}} \times \underbrace{\qquad}_{\text{number}}\ \underbrace{\quad}_{\text{units}} \times \underbrace{\qquad}_{\text{number}}\ \underbrace{\quad}_{\text{units}}$.

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Learning target AD9, version 2

For each of the limits below, decide whether it is an indeterminate form. Then, find the value of the limit, applying L'Hopital's rule if appropriate. Hint: Neither of the answers is 2.

1. $\lim_{x\to 0} \dfrac{x^2+4x-12}{x^2+2x-24}$

2. $\lim_{x\to -6} \dfrac{x^2+4x-12}{x^2+2x-24}$