

# Math 2215 - Calculus 1

Exam #3 - 2017.10.23

Name: \_\_\_\_\_

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**Instructions:** Please work out each problem in full detail. No points are given for a correct answer.

1. Approximate  $\sqrt[3]{0.99}$  and  $\sqrt[3]{1.04}$  using the linearization of  $f(x) = \sqrt[3]{1+x}$ . Are these approximations overestimates or underestimates?

2. Determine the global maximum and global minimum of  $g(x) = x\sqrt{1+x}$  on its domain.

3. For this problem, let  $h(x) = \frac{x}{(1 + 3x^2)^{2/3}}$ .

(a) Compute the domain of  $h(x)$ .

(b) Determine any horizontal or vertical asymptotes.

(c) Compute the roots and the  $y$ -intercept.

(d) Compute  $h'(x)$ , and verify that  $h'(x) = \frac{1 - x^2}{(1 + 3x^2)^{5/3}}$ .

(e) Locate all critical points of  $h(x)$ .

(f) Determine the intervals of increase and decrease of  $h(x)$ .

(g) Classify all the critical points from (e) using your answer to part (f).

(h) Compute  $h''(x)$ , and verify that  $h''(x) = \frac{4x(x^2 - 3)}{(1 + 3x^2)^{8/3}}$ .

(i) Determine the intervals of concavity for  $h(x)$ .

(j) Using your answer to part (i), state the inflection points of  $h(x)$ .

(k) Use all the information from parts (a)–(j) to sketch a graph of  $h(x)$ .

4. Corn syrup is pouring onto your floor at a rate of  $1 \text{ in}^3/\text{sec}$  into a completely circular puddle which is uniformly  $1/2''$  thick. The closest wall is 3 feet away. At what rate is the radius of the corn syrup spill growing when it finally reaches the wall?