## Math 180 Calculus 1

Final Exam - August 8, 2014

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

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1: Let 
$$f(x) = -x^3 + x^2 - x + 1$$
.

**a:** Find and classify all critical points of f(x).

**b**: Find the intervals on which f(x) is increasing and decreasing.

c: Find the intervals on which f(x) is concave up and concave down, and locate any inflection points.

**2:** Use a linear approximation to estimate the value of  $\sqrt{2}$  using  $a = \frac{100}{49}$ .

**3:** Compute 
$$\lim_{x \to 0} \frac{x^3}{e^x - e^{-x} - 2\sin x}$$
.

4: Compute 
$$\int_{-\pi}^{\pi} \sin^3(x) dx$$

**5:** Compute the following integrals:

a: 
$$\int \frac{\ln(x)}{x} dx$$
  
b: 
$$\int \frac{\sqrt{x} + 3x - 1}{x} dx$$
  
c: 
$$\int \frac{1}{4 + 16x^2} dx$$

**6:** Let  $h(x) = x^{\ln(x)}$ . Find h'(x).

7: Find the point on the parabola  $y = x^2$  that is closest to the point (3, 0).

8: A streetlight is mounted on top of a 15 ft-tall pole. A 6 ft tall person is walking away from the pole with a speed of 5 ft/sec in a straight path. How fast is the tip of the tip of the person's shadow moving when they are 40 ft away from the pole?

9: Find the area between the function  $\frac{1}{x}$  and the x-axis from x = 1 to x = e.