

MATH 2900**Fall 2008****Exam 1**

Instructions: You have 50 minutes to complete your exam. The exam is closed book/notes and calculators are not allowed. You must show all work and reasoning on the paper provided for full credit. Please work in a clean, ordered and **honorable** fashion. If appropriate, put your final answer in the box provided.

Good Luck.

1. (10pts) True or False.

(a) ____ If $f(x)$ is continuous at $x = a$, then $f(x)$ is differentiable at $x = a$.

(b) ____ The derivative of $f(x)$ evaluated at $x = a$ is the slope of the tangent line to $f(x)$ at $x = a$.

(c) ____ $\lim_{x \rightarrow 0} \frac{\cos x}{x} = 1$.

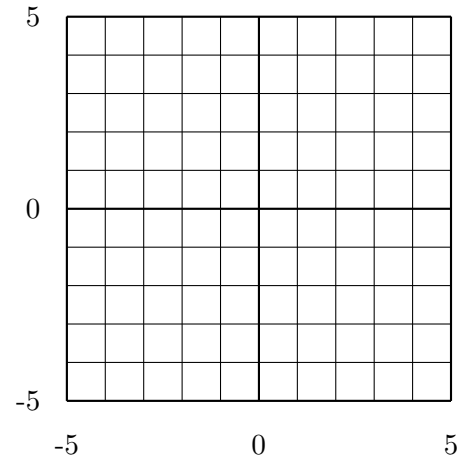
(d) ____ If y varies directly with x , then there is some positive constant m such that $y = m/x$.

(e) ____ If $p(x)$ is a polynomial, then it is continuous for all real numbers.

2. (10pts) Find all solutions to $\cos 3t = \sqrt{3}/2$.

3. (10pts) Consider the parabola $y = 3 - 2x - x^2$.

(a) Graph the parabola. Clearly label the vertex and all intercepts on the graph below.



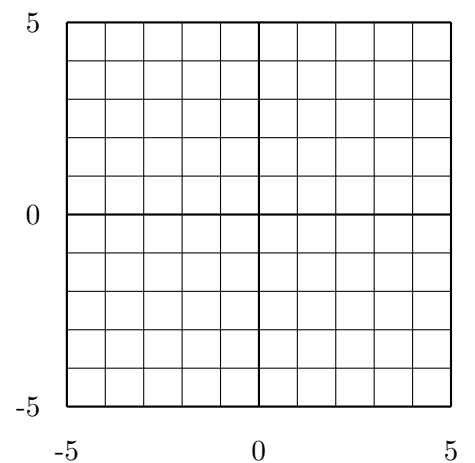
(b) Find the domain of $g(x) = 1/\sqrt{3 - 2x - x^2}$. Write answer in interval notation.

4. (15pts) Consider the rational function $G(x) = \frac{x - 2}{x^2 - 3x + 2}$.

(a) State the definition of the continuity of $G(x)$ at $x = a$.

(b) Where does $G(x)$ fail to be continuous?

(c) Graph $G(x)$.



5. (15pts) Compute the following limits.

(a) $\lim_{x \rightarrow 0} \frac{x}{|x|}$

(b) $\lim_{x \rightarrow 2} \frac{x^2 + x - 6}{x^2 - 4}$

(c) $\lim_{x \rightarrow \pi/3} \sin(x) + \tan x$

6. (15pts) Use the definition of derivative to find $f'(x)$ when $f(x) = \frac{1}{3x-1}$. Your first step should be a statement of the definition.

7. (10pts) Find the derivatives of the following functions using differentiation rules.

(a) $y = 3x^3 + \sqrt{x} - \frac{2}{\sqrt{x}}$

(b) $y = 2 \sin x - 3 \cos x - 10$

8. (15pts) The population of a city grows from an initial size of 100,000 to an amount P given by

$$P(t) = 100,000 + 1000t^2,$$

where t is in years.

(a) Find the average growth rate from $t = 0$ to $t = 10$.

(b) Find the (instantaneous) growth rate at $t = 10$.

(c) When will the city reach a population of 1 million people?

Scratch Paper

Scratch Paper