

# MATH 105, Sections A&B

## Test #1

Friday 10/06/06

1. (20 points) Find the domain of the given function.

$$f(x) = \sqrt{\frac{-x}{1-x}} \cdot \frac{\sqrt{x+3}}{\sqrt{5-x}}$$

2. (20 points) Let  $f(x) = 2x^5 - \frac{5}{9}x^9$ .

- Where is  $f(x)$  increasing?
- Where is  $f(x)$  decreasing?
- Where does  $f(x)$  have local extrema?
- Where is  $f(x)$  concave up?
- Where is  $f(x)$  concave down?
- Where does  $f(x)$  have inflection points?

3. (20 points) Let  $f(x) = 17 + 30x - 9x^2 - 4x^3$ . Find the global extreme values of  $f(x)$  on  $[-2, -1] \cup [0, 2]$ .

4. (20 points) Let  $f(x) = x - \sqrt{x}$ .

- Find an equation of the tangent line to the graph of  $y = f(x)$  at  $x = 4$ .
- Is there a point on the graph of  $y = f(x)$  such that the tangent line at this point is

$$y = \frac{5}{6}x - \frac{3}{2}?$$

If yes, find the point(s); if no, prove that there is no such point.

5. (20 points) Let  $f(x) = \begin{cases} 3bx^3 - 2 & \text{if } x \geq 1 \\ x^2 - ax^4 & \text{if } x < 1 \end{cases}$ . Find the values of  $a$  and  $b$  such that  $f(x)$  is continuous and differentiable at  $x = 1$ .

6. (20 points) A particle moves along a straight line such that its acceleration is  $a(t) = 12t^2 - 16$ . The experiment shows that at  $t = 1$  we have the following data: the velocity of the particle is 3, and it's 5 units far from the origin in the positive direction.

- Find at what time(s) the velocity is 15.
- Find a function that describes the position of the particle at time  $t$ .