

NAME \_\_\_\_\_ ID \_\_\_\_\_

MATHEMATICS 249

MIDTERM

Winter 2003

SHOW ALL WORK. Marks for each problem are to the left of the problem number.  
NO CALCULATORS PLEASE.

[4] 1. Find  $\lim_{x \rightarrow \infty} \left( \frac{2 - 5x^2}{22 - x^2 + 5x} \right)$ .

[5] 2. Find  $\lim_{x \rightarrow 5} \left( \frac{5 - x}{x^2 - 2x - 15} \right)$ .

[5] 3. Find and simplify  $\lim_{x \rightarrow -3} \left( \frac{4 - \sqrt{7 - 3x}}{x^2 + 3x} \right)$ .

[5] 4. Find and simplify  $\frac{d}{dx} \left( \sqrt{\sin^3 x - 4} \right)$ .

[5] 5. Find and simplify  $\frac{d}{dx} (x^{3/5} - \tan(x^5 - 3))$ .

[5] 6. Find and simplify  $\frac{d}{dx} \left( \frac{2 - 3x}{(x + 1)^2} \right)$ .

[5] 7. USE THE DEFINITION OF DERIVATIVE to find  $\frac{d}{dx}(x - x^2)$ .

[5] 8. Use implicit differentiation to find and simplify  $dy/dx$  where  $2xy^2 = x^2 - y^3$ .

[6] 9. Find the equation of the tangent line to the graph of  $y = 4x^3 + x^{-1}$  at the point where  $x = -1$ .

[5] 10. An object moves along a straight line so that its position (in metres) at any time  $t > 0$  (in seconds) is given by the function  $s(t) = kt^3 + t^{-1}$ , where  $k$  is a constant. The instantaneous velocity of the object at time  $t = 1/2$  is 5 metres per second. Find  $k$ . Then find the acceleration of the object at time  $t = 1/2$ .