

NAME _____ TA'S NAME _____

STUDENT ID _____ SECTION _____

Math 124 (Collingwood)
Autumn 2004

Midterm 2
November 16, 2004

Point totals are indicated. Unless stated otherwise, you must show your work to receive credit. Scientific calculators allowed. No notes. No graphing calculators.

1. _____ /12

2. _____ /8

3. _____ /13

4. _____ /9

5. _____ /8

Total _____ /50

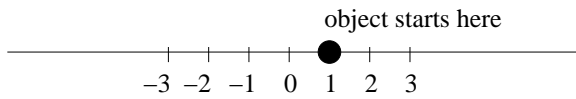
1. (12pts) Calculate the following derivatives. You need not show your work. You need not carry out any algebra simplification. BOX YOUR FINAL ANSWER. We will only grade the answer you box.

(a) $y = \frac{40t^5 - \sqrt{t}}{t^4 + 1}, \quad \frac{dy}{dt} =$

(b) $f(x) = 3xe^{\sin(2x^2-3x)}, \quad f'(x) =$

(c) $f(x) = \sin^2(e^{2x^2-3x}), \quad f'(x) =$

2. (8pts) An object is moving along number line and its location at time t seconds is given by the function $d(t) = 3t^3 - 5t^2 + 2t + 1$ cm.



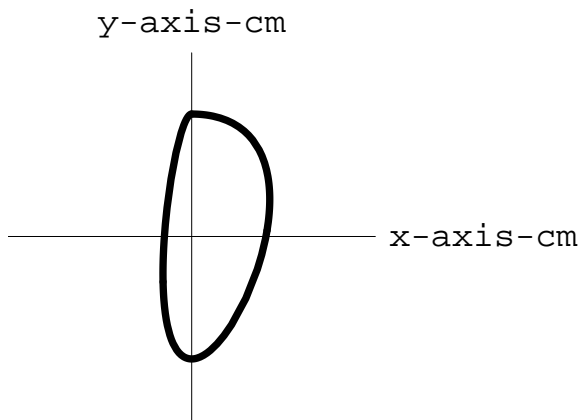
- (a) What are the velocity and acceleration of the object at time t ? You must include UNITS for full credit.

- (b) What is the maximum acceleration of the object during the time interval $[0, 1]$? Explain.

3. (13 points) An object is moving with parametric equations

$$\begin{aligned}x(t) &= e^{-t} \sin(\pi t), \\y(t) &= \cos(\pi t)\end{aligned}$$

The location of the object at time t seconds is $P(t) = (x(t), y(t))$ and the path followed during the first 2 seconds is pictured below. Units on the axes are centimeters (cm).



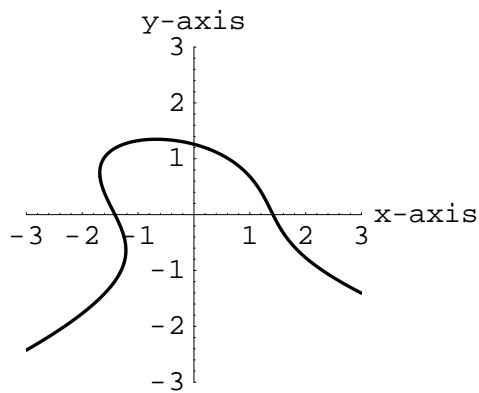
(a) Find the horizontal and vertical velocity of the object at time t .

(b) Is the object moving faster at time $t = 0$ or at time $t = 1$? Explain.

3. (continued)

(c) Find the locations where the tangent line to the path is vertical.

4. (9 points) The equation $x^2 + xy + y^3 = 2$ has the graph pictured:



(a) Find y' using implicit differentiation.

(b) The point $P = (0, \sqrt[3]{2})$ is on the curve. Let Q be the point on the curve whose x -coordinate is 0.1. Using linear approximation at P , estimate the y -coordinate of Q . In other words, if $Q = (0.1, y_o)$, estimate y_o using linear approximation. Your estimate MUST BE LEFT IN EXACT FORM for full credit.

5. (8 points) Gravel is being dumped from a conveyor belt at a rate of $30 \text{ ft}^3/\text{min}$, and its coarseness is such that it forms a pile in the shape of a cone whose base diameter and height are always equal. How fast is the height of the pile increasing when the pile is 10 ft high? (Note: The volume of a cone of height h having a base of radius r is given by the formula: $V = \frac{1}{3}\pi r^2 h$.)