

DEPARTMENT OF MATHEMATICS AND STATISTICS
UNIVERSITY OF MASSACHUSETTS
MATH 131 Spring 2004
EXAM #2

Your Section Number: _____

Your Instructor's Name: _____

Print Your Name: _____

Sign Your Name: _____

This exam consists of 5 questions. It has 5 numbered pages.

On this exam, you may use a calculator and a page of your own notes, but no books.

It is not sufficient just to write the answers. You must show how you arrive at your answers unless instructed otherwise. Please *box* or *circle* your final answer for each part of each problem.

Please leave the spaces below empty!

1. (20) _____

2. (20) _____

3. (20) _____

4. (20) _____

5. (20) _____

TOTAL (100)

1. Please classify the following statements as *True* or *False*. Write out the word completely; do not simply write *T* or *F*. There is no partial credit for this problem, and it is not necessary to show your work for this problem.

(a) (4 pts) If $f(x) = \sin(x)$, then the 98th derivative is $f^{(98)}(x) = -\sin(x)$.

(b) (4 pts) If the radius of a circle is increasing at 2 cm/sec, then when the radius is equal to 4 the area is increasing at a rate of 8 cm²/sec.

(c) (4 pts) The derivative of $\tan^{-1}(x^2)$ is $\frac{1}{1+x^4}$.

(d) (4 pts) If $y = 2^x$, then $y' = 2^x \ln 2$.

(e) (4 pts) The function $\ln x$ is the inverse function for e^x , which means that $e^{\ln x} = x$ for all x in the domain of e^x .

2. A particle moves in a line so that its position at time t is given by $s(t) = t^3 - 12t + 3$, where $t \geq 0$.

(a) (5 points) Find the velocity function.

(b) (5 points) Find the acceleration function.

(c) (5 points) When is the particle at rest? When is the particle moving forward (that is, in the positive direction)? When is it moving backward?

(d) (5 points) Find the total distance travelled by the particle as t ranges from 0 to 3.

3. Let E be the graph of $\frac{x^2}{2} + x = y^3 - y - \frac{1}{2}$.

(a) (14 points) Compute $\frac{dy}{dx}$.

(b) (6 points) Are there any points where the graph E has a *horizontal* tangent line? If so, find all such points (i.e., find the x and y coordinates of the points, not just the x coordinates). If not, explain why not.

4. (20 points) A woman starts walking west at 2 miles per hour from a point P . Ten minutes later a man starts walking south at 4 miles per hour from the same point P . How fast is the distance between the man and the woman changing 20 minutes after the man started walking?

5. Let $f(x) = x^{\ln x}$.

(a) (10 points) Compute $f'(x)$.

(b) (10 points) Find an equation for the tangent line to the graph of $f(x)$ at $x = e$.