

Math 141- Midterm Exam #2 - October 22, 2014

1. (50 points) Find $\frac{dy}{dx}$. You do not need to simplify your answers.

a. $y = xe^{\cos x}$

b. $y = \log_3(x)$

c. $y = \ln(x^2 + 2x + 1)$

d. $y = \frac{\sin x}{e^x}$

e. $y = x^{\sec x}$

f. $y = x^2 \sin x \cos x$

g. $y = \sqrt{2 + \tan(1 + x^3)}$

h. $xy^2 + 5x^2 - 2y = 10$

i. $y = \sqrt{\frac{(x^2+1)^5 e^x}{x^2+2}}$

j. $y = \sin^{-1}(4x)$.

2. **(10 points)** Suppose I deposit \$1000 in a bank account with continuously compounding interest. After three years time I now have \$1300. What is the annual rate *in percent*? (it is ok to leave your answer in terms of \ln .)

3. **(10 points)** Estimate $\ln(0.99)$ using a linear approximation to an appropriate function.

4. (10 points) Suppose $xy + e^y = e$.

- a. Find the equation of the tangent line at the point on the curve where $x = 0$.
- b. Find y'' at that same point.

5. (10 points) A spotlight on the ground shines on a wall 12m away. If a man 2m tall walks from the spotlight toward the building at a speed of 1.6 m/s, how fast is the length of his shadow on the building decreasing when he is 4m from the building? (Hint: use similar triangles)

6. (**10 points**) The equation $x^2 - xy + y^2 = 3$ represents a “rotated ellipse”, that is an ellipse whose axes are not parallel to the coordinate axes. Find the points where this ellipse intersects the x axis (you should get two points). Show that the tangent lines at these points are parallel.