MATH 131
Quiz 5
October 24, 1997

Name Key

$\bar{X} = 26.6/30$
$m = 26$

1. Find $\frac{dy}{dx}$ for each of the following:

a. $y = x^2 \ln x$

$$\frac{dy}{dx} = x^2 \frac{1}{x} + 2x \ln x = x + 2x \ln x$$

b. $y = e^x + e^{2x}$

$$e^x + 2e^{2x}$$

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c. $x^3 + x^2y - 3y^2 = 3$

$$3x^2 + x^2\frac{dy}{dx} + 2xy - 6y\frac{dy}{dx} = 0$$

$$x^2\frac{dy}{dx} - 6y\frac{dy}{dx} = -3x^2 - 2xy$$

$$\frac{dy}{dx} = \frac{-3x^2 - 2xy}{x^2 - 6y} \quad \text{or} \quad \frac{3x^2 + 2xy}{6y - x^2}$$

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2 don't put parens

2. What is the equation of the tangent line to the curve $x^2y + y^2 + x = 3$ at the point $(1,1)$?

$$x^2\frac{dy}{dx} + 2xy + 2y\frac{dy}{dx} + 1 = 0$$

$$1\frac{dy}{dx} + 2 + 2\frac{dy}{dx} + 1 = 0$$

$$3\frac{dy}{dx} = -3$$

$$\frac{dy}{dx} = -1$$

$$y - 1 = -(x - 1)$$

$$y - 1 = -x + 1$$

$$y = -x + 2$$

3. Ohm's law for electrical circuits is $V = IR$, where V is voltage (in volts), I is current (in amps.) and R is resistance (in ohms.) In this case the voltage is constant. If resistance is decreasing at .2 ohm per second when the resistance is 20 ohms and the current is 30 amps, then how is the current changing?

$$V = IR$$

$$\frac{dR}{dt} = -.2 \quad R = 20 \quad I = 30$$

$$\frac{dI}{dt} = ?$$

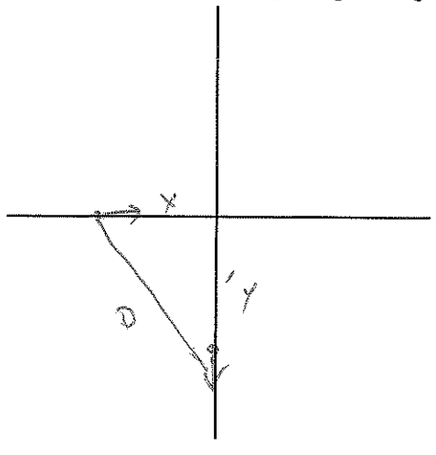
$$0 = I\frac{dR}{dt} + R\frac{dI}{dt}$$

$$0 = 30(-.2) + 20\frac{dI}{dt}$$

$$\frac{dI}{dt} = \frac{6}{20} = .3 \text{ amp/sec}$$

must

4. A drug dealer is 5 miles south of BG driving south on I-75 at 80 mi/hr. In pursuit, a state trooper is 3 miles west of BG on US 6 traveling east at 100 mi/hr. Is the trooper getting closer to the fleeing drug dealer? — How fast



$$D^2 = x^2 + y^2$$

$$2D\frac{dD}{dt} = 2x\frac{dx}{dt} + 2y\frac{dy}{dt}$$

$$2D\frac{dD}{dt} = 6(-100) + 10(80)$$

$$= -600 + 800$$

$$= 200$$

$\frac{dD}{dt} > 0$ NO!

$$\frac{dD}{dt} = \frac{200}{2\sqrt{10^2 + 8^2}} = \frac{100}{\sqrt{34}} = 17.15$$