Calculus Related Rates HW Day 3 2014

19c) (Some of this information is from part a from yesterday's assignment)

$x = 12 \quad \frac{dx}{dt} = 5$

$y = 5 \quad \frac{dy}{dt} = -12$

$c = 13 \quad \frac{dc}{dt} = 0$

$\tan\theta = \frac{y}{x}$

$\sec^2\theta \frac{d\theta}{dt} = \frac{x\frac{dy}{dt} - y\frac{dx}{dt}}{x^2}$

$$\left(\frac{13}{12}\right)^2 \frac{d\theta}{dt} = \frac{12(-12) - 5(5)}{12^2}$$

$$\frac{d\theta}{dt} = -1 \text{ radians/sec}$$

21b) (Some of this information is from part a from yesterday's assignment)

$x = 8 \quad \frac{dx}{dt} = -2.5$

$y = 6 \quad \frac{dy}{dt} = 0$

$c = 10 \quad \frac{dc}{dt} = -2$

$\tan\theta = \frac{x}{y}$

$\sec^2\theta \frac{d\theta}{dt} = \frac{y\frac{dx}{dt} - x\frac{dy}{dt}}{y^2}$

$$\left(\frac{10}{6}\right)^2 \frac{d\theta}{dt} = \frac{6(-2.5) - 8(0)}{6^2}$$

$$\frac{d\theta}{dt} = -0.15 \text{ radians/sec}$$

31a) Right in front of you $(\theta = 0)$

$x = 0 \quad \frac{dx}{dt} = -264 \quad \tan\theta = \frac{x}{y}$

$y = 132 \quad \frac{dy}{dt} = 0 \quad \sec^2\theta \frac{d\theta}{dt} = \frac{y\frac{dx}{dt} - x\frac{dy}{dt}}{y^2}$

$$(1)^2 \frac{d\theta}{dt} = \frac{132(-264) - 0(0)}{132^2}$$

$$\frac{d\theta}{dt} = -2 \text{ radians/sec}$$

31b) Half a second later

$x = 132 \quad \frac{dx}{dt} = -264 \quad \tan\theta = \frac{x}{y}$

$y = 132 \quad \frac{dy}{dt} = 0$

$c = 186.676 \quad \sec^2\theta \frac{d\theta}{dt} = \frac{y\frac{dx}{dt} - x\frac{dy}{dt}}{y^2}$

$$\left(\frac{186.676}{132}\right)^2 \frac{d\theta}{dt} = \frac{132(0) - 132(-264)}{132^2}$$

$$\frac{d\theta}{dt} \approx 1 \text{ radian/sec}$$

33)

$x = 60 \quad \frac{dx}{dt} = ? \quad \tan\theta = \frac{y}{x}$

$y = 80 \quad \frac{dy}{dt} = 0$

$c = 100 \quad \sec^2\theta \frac{d\theta}{dt} = \frac{x\frac{dy}{dt} - y\frac{dx}{dt}}{x^2}$

$$\left(\frac{100}{60}\right)^2 \left(\frac{0.27}{180}\pi\right) = \frac{60(0) - 80\frac{dx}{dt}}{60^2}$$

$$\frac{dx}{dt} \approx \frac{47.124}{-80} \approx -0.589 \text{ ft/min} \approx -7.1 \text{ in/min}$$

34)

$x = 20 \qquad \frac{dx}{dt} = 1 \qquad \tan\theta = \frac{y}{x}$

$y = 10 \qquad \frac{dy}{dt} = -2$

$c = \sqrt{500} \qquad \sec^2\theta \frac{d\theta}{dt} = \frac{x\frac{dy}{dt} - y\frac{dx}{dt}}{x^2}$

$$\left(\frac{\sqrt{500}}{10}\right)^2 \frac{d\theta}{dt} = \frac{20(-2) - 10(1)}{10^2}$$

$$\frac{d\theta}{dt} = -0.1 \text{ radian/sec} \approx -6^\circ / \text{sec}$$