DO NOW

We will save questions on last night's homework for work days later in the week. Please get out the Classwork 3.7 Worksheet.

3.7 Related Rates - Day 3

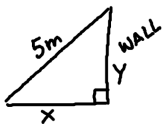
Questions/observations/thoughts so far:

Example:

5. A bag is tied to the top of a 5 m ladder resting against a vertical wall. The ladder begins sliding down the wall such that the foot of the ladder is moving away from the wall. How fast is the bag falling at the instant the foot of the ladder is 4 m from the wall, moving at 2 m/sec?

Find $\frac{dy}{dt}$ when $x = 4$ m

$\frac{dx}{dt} = 2$ m/sec



$a^2 + b^2 = c^2$

$x^2 + y^2 = 5^2$

$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$

$2y\frac{dy}{dt} = -2x\frac{dx}{dt}$

$\frac{dy}{dt} = \frac{-2x}{2y}\frac{dx}{dt}$

$\frac{dy}{dt} = -\frac{x}{y}\frac{dx}{dt}$

Find y...

$y = 3$ pythagorean triple

$\frac{dy}{dt} = \frac{-4}{3}(2)$

$\frac{dy}{dt} = \frac{-8}{3}$

$\frac{8}{3}$ m/sec

6. A person 6 ft tall is walking away from a street light 20 ft high at a rate of 7 ft/sec.
   a) At what rate is the length of his shadow increasing?
   b) At what rate is the tip of his shadow increasing?

$\frac{dy}{dt} = 7$ ft/sec

a) Find $\frac{dx}{dt}$.

*Similar Δ's

$\frac{6}{x} = \frac{20}{x+y}$

$20x = 6x + 6y$

$14x = 6y$

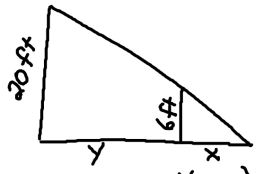
$x = \frac{6y}{14}$

$x = \frac{3}{7}y$

$\frac{dx}{dt} = \frac{3}{7}\frac{dy}{dt}$

$\frac{dx}{dt} = \frac{3}{7}(7)$

3 ft/sec



b) Find $\frac{d(x+y)}{dt}$

$\frac{dx}{dt} + \frac{dy}{dt}$

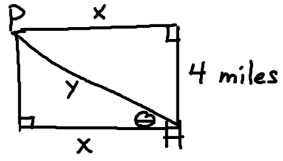
$3 + 7$

10 ft/sec

7. Everyday a flight from LA to NY flies directly over my house at an altitude of 4 miles and at a rate of 400 mph. At what rate is the angle of elevation of my line of sight changing when the horizontal distance between the approaching jet and my location is exactly 3 miles?

$\frac{dx}{dt} = -400$ mph

Find $\frac{d\theta}{dt}$ when $x = 3$ miles



$\tan\theta = \frac{4}{x}$ ← $4x^{-1}$

$\sec^2\theta\frac{d\theta}{dt} = \frac{-4}{x^2}\frac{dx}{dt}$

$\frac{d\theta}{dt} = \cos^2\theta\left(\frac{-4}{x^2}\right)\frac{dx}{dt}$

$\frac{d\theta}{dt} = \left(\frac{3}{5}\right)^2\left(\frac{-4}{3^2}\right)(-400)$

$\frac{d\theta}{dt} = \frac{3^2}{25}\cdot\frac{-4}{3^2}(-400)$

$\frac{d\theta}{dt} = \frac{1600}{25} = 64$

If $x = 3$, then $y = 5$

Pyth. Triple.

64 rad/hour

HOMEWORK

Worksheet: Homework 3.7; 19 - 35