Related Rates Matching Lab

Purpose: To help students focus on first finding the general equation to be used on a problem and then differentiating that general equation using both the chain rule and implicit differentiation. The lab consists of 7 problems that are matched by the students and completed before every trying to actually solve the problem with the givens.

Materials:

- Lab handouts for groups of three
- Scissors
- Lab recording sheet
- Paper and pencil

Part 1: The first part of the lab is to cut out the cards and work to match each of the 7 problems with the appropriate cards. After this is completed, the student should record their findings in the recording sheet and move onto part 2 of the lab

Part 2: this part of the lab can be finished for homework if not completed in class and is meant to give the students practice in solving problems when they have the problem differentiated in the general form. Students must first record what variable the question is asking for and then list all initial givens to the problems (all variable except 1). Finally, the student must solve for the unknown in question.

Related Rates Lab Sheet

Names: ____

Class:____________________________________ **Date:** ___________________

Part 1:

Complete the table to record your matches.

Word Problem	*General Equation*	*Chain Rule*
A1		
A2		
A3		
A4		
A5		
A6		
A7		

Part 2:

Please the following on a separate sheet of paper for each of the 7 problems

a) Determine the unknown in question (ex. $\frac{dV}{dt}$)

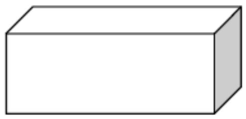
b) List all givens to the problem (ex. x$= 2\frac{dz}{dt} = 3$, …)

(Hint: if a value is a constant then is rate of change is 0)

c) Solve the problem (also state what solution means)

RELATED RATES MATCHING LAB   WORD PROBLEMS

Consider a rectangular prism bathtub (area of base is18 ft^2.) How fast is the water level rising if water is filling up the tub at a rate of 0.7 ft^3/min?



A1

Assume that the radius r of a sphere is expanding at a rate of 14 in,/min. Determine the rate at which the volume is changing with respect to time when r = 8 in.

A2

Assume that the radius r of a sphere is expanding at a rate of 14 in,/min. Determine the rate at which the surface area is changing when the radius r = 8 in.

A3

A conical tank has height 3 m and radius 2 m at the top. Water flows in at a rate of 3 m^3/min. How fast is the water level rising when it is 2m?

A4

Sonya and Issac are in motorboats located at the center of a lake. At time = 0, Sonya begins traveling south at a speed of 32 mph. At the same time, Issac takes off, heading east at a speed of 27 mph. At what rate is the distance between them increasing at t = 12 min?

A5

A jogger runs around a circular track of radius 60 ft. Let (x, y) be her coordinates, where the origin is at the center of the track. When the jogger's coordinates are (36, 48), her x-coordinate is changing at a rate of 14 ft/s. Find dy/dt.

A6

A Hot Air Balloon rising vertically is tracked by an observer who is located 2 miles from the lift-off point. At a certain moment, the angle between the observer's line of sight and the horizontal is $\frac{\pi}{5}$, and it is changing at a rate of 0.2 rad/min. How fast is the balloon rising at this moment?

A7

Related Rates Matching Lab

General Equations

$A = 4\pi r^2$ B1	$x \tan\theta = y$ B2
$V = \frac{1}{3}\pi r^2 h$ B3	$V = Bh$ B4
$V = \frac{4}{3}\pi r^3$ B5	$x^2 + y^2 = r^2$ B6
$x^2 + y^2 = z^2$ B7	

RELATED RATES DERIVATIVES W.R.T. TIME

$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$ C1	$2x\frac{dx}{dt} + 2y\frac{dy}{dt} - 2z\frac{dz}{dt}$ C2
$\frac{dA}{dt} = 8\pi r\frac{dr}{dt}$ C3	$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 2r\frac{dr}{dt}$ C4
$\frac{dV}{dt} = \frac{dB}{dt}h + B\frac{dh}{dt}$ C5	$\frac{dV}{dt} = \frac{1}{3}\pi\left(2r\frac{dr}{dt}h + r^2\frac{dh}{dt}\right)$ **C6**
$\tan\theta\frac{dx}{dt} + x\sec^2\theta\frac{d\theta}{dt} = \frac{dy}{dt}$ C7	