

Please show **all** your work! Answers without supporting work will not be given credit.
Write answers in spaces provided.

Name: _____

1. [5pts] Use implicit differentiation to find dy/dx given

$$\tan\left(\frac{x}{y}\right) = 10x$$

Solution:

$$\frac{d}{dx}\left(\tan\left(\frac{x}{y}\right)\right) = \frac{d}{dx}(10x)$$

$$\sec^2\left(\frac{x}{y}\right) \left[\frac{y - x \frac{dy}{dx}}{y^2} \right] = 10 \quad [2 \text{ pts}]$$

$$\frac{y - x \frac{dy}{dx}}{y^2} = 10 \cos^2\left(\frac{x}{y}\right)$$

$$y - x \frac{dy}{dx} = 10y^2 \cos^2\left(\frac{x}{y}\right)$$

$$y - 10y^2 \cos^2\left(\frac{x}{y}\right) = x \frac{dy}{dx}$$

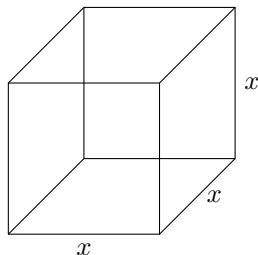
$$\frac{1}{x} \left(y - 10y^2 \cos^2\left(\frac{x}{y}\right) \right) = \frac{dy}{dx} \quad [3 \text{ pts}]$$

2. [5pts] All the edges of a cube are shrinking at the rate of 2 cm/sec. How fast is the surface area decreasing when each edge is 5 cm?

[To receive full credit for this problem, you must show all 5 steps, as discussed in class.]

Solution: Let A denote Surface Area. Following the steps, from class,

- (1) [1pt] Draw a picture.



- (3) [1pt] Equation

$$A = 2(x^2 + x^2 + x^2) = 6x^2$$

- (4) [1pt] Implicit Differentiate

$$\frac{dA}{dt} = 12x \frac{dx}{dt}$$

- (2) [1pt] What do you **KNOW** and **WANT** to know?

KNOW: $2 \frac{cm}{sec}$

WANT: $\left. \frac{dA}{dt} \right|_{x=5 \text{ cm}}$

- (5) [1pt] Solve for dA/dt .

$$\frac{dA}{dt} = 12 \cdot 5 \cdot 2 = 120$$