QUIZ 17 SOLUTIONS: LESSON 21
MARCH 8, 2019

Write legibly, clearly indicate the question you are answering, and put a box or circle around your final answer. If you do not clearly indicate the question numbers, I will take off points. Write as much work as you need to demonstrate to me that you understand the concepts involved. If you have any questions, raise your hand and I will come over to you.

$$\Delta z \approx \frac{\partial z}{\partial x}\Delta x + \frac{\partial z}{\partial y}\Delta y$$

1. [4 pts] Use increments to estimate the change in z at $(5, 3)$ if

$$\frac{\partial z}{\partial x} = -3x - 8 \quad \text{and} \quad \frac{\partial z}{\partial y} = 5y + 8$$

and the change in x is 0.4 and the change in y is 0.3. Round to the nearest tenth.

Δx Δy

$$\Delta z = \frac{\partial z}{\partial x}(5,3)\,\Delta x + \frac{\partial z}{\partial y}(5,3)\,\Delta y$$

$$= (-3(5) - 8)(.4) + (5(3) + 8)(.3)$$

$$= -23(.4) + 23(.3)$$

$$= -23(.1)$$

$$= \boxed{-2.3}$$

2. [6 pts] A soft drink can is a cylinder h cm tall with a radius r cm. Its volume is given by the formula $V(r,h) = \pi r^2 h$. A particular can is 10 cm tall and has a radius of 5 cm.

If the **height** is decreased by 1.5 cm, use calculus to estimate the change in the **radius** needed so that the **volume** stays the same. Round your answer to 4 decimal places.

$V = \pi r^2 h$, $\frac{\partial V}{\partial r} = 2\pi r h$, $\frac{\partial V}{\partial h} = \pi r^2$

$r = 5$ $\quad h = 10$

$\Delta V = 0$ $\quad \Delta r = ?$ $\quad \Delta h = -1.5$

$\Delta V = 0$: No change in volume

$\Delta r = ?$: goal

$$\Delta V = \frac{\partial V}{\partial r}(5,10)\Delta r + \frac{\partial V}{\partial h}(5,10)\Delta h$$

$$0 = [2\pi(5)(10)]\Delta r + [\pi(5)^2](-1.5)$$

$$0 = 100\pi\Delta r - 37.5\pi$$

$$37.5\pi = 100\pi\Delta r$$

$$\Rightarrow \Delta r = \frac{37.5\pi}{100\pi} = .375$$

r increases by .375 cm