Name: Key

Math 151-01 Calculus I – Crawford

Quiz 3-A

24 October 2017

Books, notes (in any form), and calculators are not allowed. *Show all your work.* Good Luck!

1. (4 pts) Find the critical numbers of the function.

$f(t) = (t^2 - 9)^3$

$f'(t) = 3(t^2-9)^2 \cdot 2t$

$= 6t(t^2-9)^2 = 0$ (Note: f' exists everywhere)

$6t = 0$ or $(t^2-9)^2 = 0$

$t = 0$

$t^2 - 9 = 0$

$(t-3)(t+3) = 0$

$t = 3, -3$

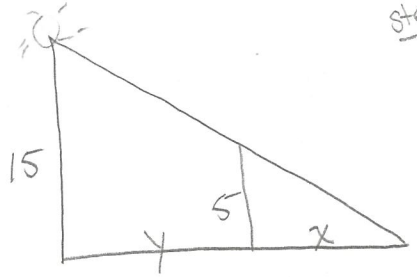
2. (4 pts) Turn in Section 2.8, #17 by 3pm today. If you turn it in immediately after turning in this quiz, I'll give you 2 bonus points.

See back side for the soln.

3. (7 pts) A street light is mounted at the top of a 15 ft tall pole. A 5 ft tall girl walks away from the pole with a speed of 4 ft/s along a straight path. How fast is the length of the shadow changing when she is 6 ft from the pole?

[Remember that significant partial credit will be given for clearly and accurately labeling the picture, and indicating values and equations in correct mathematical notation.]

Step1



Step2

x = length of shadow $\quad \frac{dx}{dt}$ = rate shadow length changes

y = distance from pole $\quad \frac{dy}{dt}$ = velocity girl walks.

Step3

Find $\frac{dx}{dt}$ when $y = 6$ ft

$\frac{dy}{dt} = 4$ ft/s

Step4 Similar Triangles

$$\frac{x}{5} = \frac{x+y}{15} \Rightarrow 15 \cdot \frac{x}{5} = \frac{x+y}{15} \cdot 15$$

Simplified

$$\Rightarrow 3x = x+y \Rightarrow 2x = y$$

Step5

$$\frac{d}{dt}[2x] = \frac{d}{dt}[y]$$

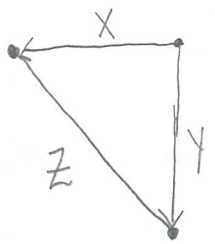
$$2\frac{dx}{dt} = \frac{dy}{dt}$$

Step6

$$\frac{dx}{dt} = \frac{1}{2}\frac{dy}{dt} = \frac{1}{2}(4) = \boxed{2 \text{ ft/s}}$$

Section 2.8 #17

Step1



Step2

x = dist. West car travels $\quad \frac{dx}{dt}$ = velocity of West car

y = dist. South car travels $\quad \frac{dy}{dt}$ = velocity of South car

z = dist between cars $\quad \frac{dz}{dt}$ = rate distance between changes.

Step3 Find $\frac{dz}{dt}$ when $t = 2$ hours $\Rightarrow$ So $x = 25\frac{mi}{h} \cdot 2h = 50m$

$\frac{dx}{dt} = 25$ mi/h

$\frac{dy}{dt} = 60$ mi/h

$y = 60\frac{mi}{h} \cdot 2h = 120m$

at same instant.

Step4 $x^2 + y^2 = z^2$

Step5 $2x \cdot \frac{dx}{dt} + 2y\frac{dy}{dt} = 2z\frac{dz}{dt}$

$x\frac{dx}{dt} + y\frac{dy}{dt} = z\frac{dz}{dt}$

↑ still need z

Step6 $50(25) + (120)(60) = 130\frac{dz}{dt}$

$\frac{8450}{130} = \frac{dz}{dt}$

$65 = \frac{dz}{dt}$ i.e. $\boxed{65 \text{ mi/h}}$

$(50)^2 + (120)^2 = z^2$

$16900 = z^2$

$z = \pm 130$

$z = 130$ mi