Name: Key

Quiz 3-B

Math 151-02 Calculus I – Crawford

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.

$f(t) = (t^2 - 16)^3$

$f'(t) = 3(t^2-16)^2 \cdot 2t = 0$

(Note: $f'(t)$ exists everywhere)

$6t(t^2-16)^2 = 0$

$6t = 0$ or $t^2 - 16 = 0$

$t = 0$ $\quad t^2 = 16$

$t = \pm 4$

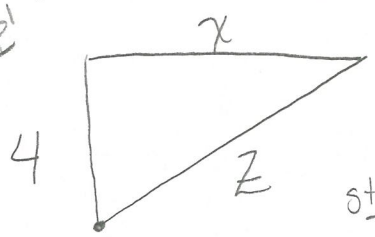
2. (4 pts) Turn in Section 2.8, #15 by 3pm today. If you turn it in immediately after turning in this quiz, I'll give you 2 bonus points.

See Back for Soln

3. (7 pts) A plane flying horizontally at an altitude of 4 mi and a speed of 500 mi/h passes directly over a radar station. Find the rate at which the distance from the plane to the station is increasing when the plane has flown horizontally 3 miles.

[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 = distance plane flies $\frac{dx}{dt}$ = velocity of plane

z = distance between plane & radar station $\frac{dz}{dt}$ = rate dist. between changes

Step3 Find $\frac{dz}{dt}$ when $x = 3$ mi

$\frac{dx}{dt} = 500$ mi/h

Step4 $x^2 + 4^2 = z^2$

Step5 $\frac{d}{dt}[x^2 + 4^2] = \frac{d}{dt}[z^2]$

$2x\frac{dx}{dt} = 2z\frac{dz}{dt}$

$\frac{x}{z}\frac{dx}{dt} = \frac{dz}{dt}$

Still need z at the same instant.

i.e. $3^2 + 4^2 = z^2$

$9 + 16 = z^2$

$25 = z^2$

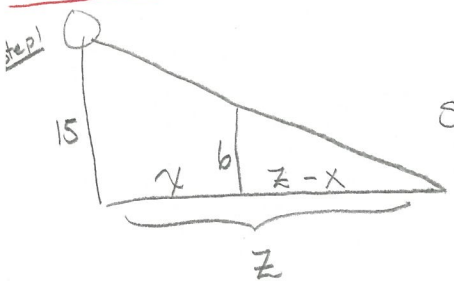
$z = \pm 5$

Now subs.

Step6 $\frac{3}{5} \cdot 500 = \frac{dz}{dt} \Rightarrow$ $\boxed{\frac{dz}{dt} = 300 \text{ mi/h}}$

Section 2.8 #15

Step1



Step2 x = dist. man is from pole $\frac{dx}{dt}$ = velocity of man

z = dist. tip of shadow from pole $\frac{dz}{dt}$ = rate the tip of shadow moves

Step3 Find $\frac{dz}{dt}$ when $x = 40$ ft

$\frac{dx}{dt} = 5$ ft/s

Step4 Similar triangles

$\frac{z}{15} = \frac{z-x}{6} \Rightarrow 30 \cdot \frac{z}{15} = \frac{z-x}{6} \cdot 30 \Rightarrow 2z = (z-x)5$

$2z = 5z - 5x \Rightarrow 5x = 3z$ ← Simplified

Step5 $\frac{d}{dt}[5x] = \frac{d}{dt}[3z]$

$5\frac{dx}{dt} = 3\frac{dz}{dt}$

Step6 $5(5) = 3\frac{dz}{dt}$

$\Rightarrow$ $\boxed{\frac{dz}{dt} = \frac{25}{3} \text{ ft/s}}$