Key

Group Quiz

Organize yourselves into groups with no more than three people (individuals are ok). Work on the following questions together and turn in *one* completed quiz for the group. Make sure all of your names are on the quiz.
You are welcome to use any material in the classroom that you have *except* the internet. Show *all* your work for each and simplify. No credit is given without supporting work.

1. [7] An ice cream company finds that at a price of \$4.00, demand is 4000 units. For every \$0.25 decrease in price, demand increases by 200 units. Use calculus to find the price and quantity sold that maximize revenue.

started (+.5)

Rev = price · quantity (+1)

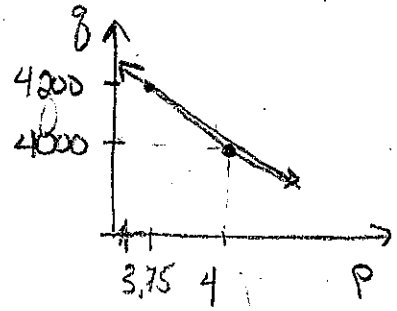
$= p \cdot q$

$= p(-800p + 7200)$ sub (+.5)

$= -800p^2 + 7200p$

need a relationship between p & q

looking (+.5)



slope $= \frac{4200-4000}{3.75-4} = \frac{200}{-.25} = \frac{200}{-1/4} = -800$ (+.5)

passes through (4, 4000)

$4000 = -800(4) + b$

$4000 + 3200 = b$

$7200 = b$ (+.5)

So $q = -800p + 7200$

kept variables straight (+.5)

done (+1)

Critical Points happen when set to zero (+.5)

$-1600p + 7200 = 0$ or $-1600p + 7200$ is undef.

$-1600p = -7200$

This never happens

$p = \frac{7200}{1600}$ adj (+.5)

$= \frac{72}{16} = \frac{36}{8} = \frac{18}{4} = \frac{9}{2} = 4.5$

+	−

↗ 4.5 MAX ↘

check max (+.5)

price that max rev is \$4.5

=> quantity is $-800(4.5) + 7200$

$-3600 + 7200 = 3600$ units

found p & q (+.5)

4.5 | 9
36.0

2. A truck has a minimum speed of 9 mph in high gear. When traveling x mph, the truck burns diesel fuel at the rate of

$$0.003935\left(\frac{675}{x}+x\right)\frac{\text{gal}}{\text{mile}}$$

Assume that the truck cannot be driven over 63 mph and that diesel fuel costs \$1.44 a gallon.

(a) [3] Find the total cost of a 570 mile trip as a function of x.

$.003935\left(\frac{675}{x}+x\right)\frac{\text{gal}}{\text{mi}} \cdot 1.44\ \$/\text{gal} \cdot 570\ \text{mi}$ (+.5) (+.5) (+.5)

started (+.5) look at units (+1)

(b) [4] Find the total cost of a 570 mile trip if the driver is paid \$13 an hour as a function of x.

started (+.5) broke up (+1)

cost of fuel (+1) + cost of driver (+1.5)

$.003935\left(\frac{675}{x}+x\right)1.44\cdot 570 + 13\ \$/\text{hr} \cdot \frac{\text{hr}}{x\ \text{mi}} \cdot 570\ \text{mi}$

$.003935\left(\frac{675}{x}+x\right)1.44\cdot 570 + \frac{13\cdot 570}{x}$

(c) [6] Use calculus and part (b) to find the steady speed that will minimize the total cost of the trip if the driver is paid \$13 an hour.

started (+.5)

Want to minimize the function in (b) need Critical Points looking for CP (+.5)

$\frac{.003935\cdot 1.44\cdot 570\cdot 675}{x} + .003935\cdot 1.44\cdot 570x + \frac{13\cdot 570}{x} = \text{Cost}$

der (+2)

$(\text{Cost})'(x) = -\frac{.003935\cdot 1.44\cdot 570\cdot 675}{x^2} + .003935\cdot 1.44\cdot 570 - \frac{13\cdot 570}{x^2}$ (+.5) (+.5)

Set the above equal to 0 (+.5) & note the above is undef when $x=0$ (+.5)

$-.003935\cdot 1.44\cdot 570 = \left(-.003935\cdot 1.44\cdot 570\cdot 675 - 13\cdot 570\right)\frac{1}{x^2}$

$x^2 = \pm\sqrt{\frac{-.003935\cdot 1.44\cdot 570\cdot 675 - 13\cdot 570}{-.003935\cdot 1.44\cdot 570^2}} \approx 54.49$

about 54 mi/hr

alg (+1) solved for x (+.5)