© Math 141 Spring 2009 Quiz 2 KEY

(20 pts) NAME (printed neatly): _____

1. The number of banks in Maroon Town between years 1998 and 2008 is shown in the following table.

x	**0**	**2**	**4**	**6**	**8**	**10**	**L1**
Year	1998	2000	2002	2004	2006	2008	
Number of Banks	90	84	80	72	53	45	**L2**

a. (10 pts) Find the least-squares line for the number of banks, *y*, where *x* represents the number of years since 1998. If needed, round your coefficients to two decimal places. Remember to put any calculator commands used.

LinReg L1, L2, Y1

$y = -4.66x + 93.95$

b. (10 pts) Use your *unrounded* model to predict the number of banks in Maroon Town in the year 2010. Round down to the nearest bank.

$y1(2010 - 1998) = y1(12) = 38.06666667$

In 2010, the predicted number of banks is 38.

c. (5 pts) Use the *unrounded* model to predict the year in which the number of banks would be 30.

$y2 = 30$, intersect, $x \approx 13.732106$
1998 + 13 = 2011
The predicted year is 2011.

[An appropriate viewing window would be [-1, 20] by [20, 100]]

d. (5pts) To two decimal places, what is the correlation coefficient for the least-squares line for this data?

$r \approx -0.97$

2. (10 pts) The monthly supply and demand functions for a metallic Texas A&M car emblem are given below, where x is the quantity and p is the price per emblem in dollars.

Supply: $3x - 100p = -600$
Demand: $5x + 250p = 3500$

Determine the equilibrium price and quantity for the car emblems. Be sure to state your answer in terms of the appropriate units.

$$-5(3x-100p) = -5(-600)$$
$$3(5x+250p) = 3(3500)$$

OR $rref\begin{bmatrix} 3 & -100 & -600 \\ 5 & 250 & 3500 \end{bmatrix} \to \begin{bmatrix} 1 & 0 & 160 \\ 0 & 1 & 10.8 \end{bmatrix}$

$$-15x+500p = 3000$$
$$15x+750p = 10500$$
$$0x+1250p = 13500$$

$$p = 10.8$$

$$3x-100(10.8) = -600$$
$$3x = 480$$
$$x = 160$$

The equilibrium price is **$10.80** and the equilibrium quantity is **160 car emblems**.

3. (20 pts) It cost a company $22,500 to make 50 gadgets and $26,000 to make 120 gadgets. This company sells the gadgets for $80 each. What is the profit function?

$C(x) = cx + F$ is the linear cost function.
$R(x) = sx$ is the linear revenue function.
$P(x) = R(x) - C(x)$ is the linear profit function.

Cost
(x, C) (50, 22500) (120, 26000)

$$m = \frac{26000-22500}{120-50} = 50$$

$C - 22500 = 50(x-50)$ or $C - 26000 = 50(x-120)$

$$C(x) = 50x + 20000$$

Revenue
$$R(x) = 80x$$

Profit
$$P(x) = R(x) - C(x) = 80x - (50x + 20000) = 80x - 50x - 20000$$
Therefore $P(x) = 30x - 20000$

(20 pts) Set up, but ***DO NOT SOLVE***, a system of equations that can be used to solve the following problem. Be sure to clearly define the variables used in your equations.

A nutritionist wants to create a lunch for a client containing 500 calories and 45g of carbohydrates. The meal is to be created using two foods, Food I and Food II. The nutritional information for each food is listed in the table below.

Food	Calories per unit	Grams of carbohydrates per unit
I	35	4
II	20	6

Determine the number of units of each type of food needed to meet the nutritional requirements of this lunch.

Let x = number of units of Food I
Let y = number of units of Food II

$$35x + 20y = 500$$
$$4x + 6y = 45$$