Math 1030 Workshop #5 (Due: July 29^{th}, 2011) **Name:** _____

Please turn in a paper copy and **SHOW YOUR WORK!**

1. Consider the function $P(q) = \begin{cases} -2q^2 - 5q + 1 & q < 0 \\ -2q^3 + q^2 + 4q + 2 & 0 \le q \le 2 \\ (q^2 - 5q + 9)e^{-(q-3)^2/10} & q > 2 \end{cases}$

   Be careful! Wolfram Alpha has a hard time interpreting commands applied to this function. You may want to deal with the function one piece at a time.

   (a) Find all of the critical points of $P(q)$. $q =$ _____

   (b) Restricting our attention to the interval $[-2, 8]$...

   The maximum value of $P(q)$ is _____. This occurs when $q =$ _____.

   The minimum value of $P(q)$ is _____. This occurs when $q =$ _____.

2. Carl manages a motel in Spruce Pine. He needs to keep a TV in each room in the motel and has found nice TV's which he can purchase for \$260. In addition, Carl has noticed that he spends an average of \$10 repairing TV's during their first year of operation, and then spends an average of \$25 repairing TV's during their second year of operation. Model the average annual cost of a TV using a function of the form: $A(t) = \dfrac{C}{t} + Rt^r$ where C is the cost of purchasing the TV and Rt^r models the repair costs.

   Use the facts $Rt^r = 10$ when $t = 1$ and $Rt^r = 17.5 \left(= \dfrac{10 + 25}{2}\right)$ when $t = 2$ to find R and r [Keep r out to 6 decimal places].

   $A(t) =$ _____

   Carl should replace his TV's every _____ years and _____ months.

   If he does this, his average annual cost (per TV) will be \$ _____.

3. Cindy sells locally-produced, scented candles in her store. She pays \$8 per candle and has found that her average inventory costs are \$0.25 per candle per year (base inventory costs on average inventory making all of the standard assumptions). Suppose Cindy is charged \$10 every time she places an order. Let $C(x)$ be Cindy's annual cost function.

   (a) If Cindy sells 50 candles each year, $C(x) =$ _____

   Her **ideal** EOQ is _____ and her **ideal** minimum annual cost is _____.

   (b) If Cindy sells 100 candles each year, $C(x) =$ _____

   Her **ideal** EOQ is _____ and her **ideal** minimum annual cost is _____.

   (c) Suppose that Cindy sells 100 candles per year and gets a discount if she places a large order. For orders of 20 or more candles, she pays \$6.50 each. However, her shipping costs increase to \$12 for a large shipment. (Inventory stays the same.)

   $C(x) = \begin{cases}$

   Cindy's **ideal** EOQ is _____. Her **ideal** minimum annual cost is _____.