

Copy original problem.

Convince *me* that **you** understand the concept!**No calculators.***Remember: All problems require meaningful, complete sentences which contain no pronouns.*

Chapter 4 Applications Exam

I Sandy and Robbie plan to meet at a restaurant. To get to the restaurant, Sandy is West of the restaurant and is driving East at 35 mph. Robbie is North of the restaurant and is driving South at 40 mph. At what rate is the straight-line distance between Sandy and Robbie changing when Sandy is still 3 miles from the restaurant and Robbie is still 4 miles from the restaurant? (25 pts)

II The Czarina was making fudge to send to her many admirers. She plans to make her own personalized boxes by taking a rectangular piece of cardboard covered with foil that measures twelve by six inches. She will cut out congruent squares out of each corner; folding up all 4 sides of the remaining cardboard and taping where the edges touch. She wants to be as generous as possible so she wants the boxes capable of holding the most fudge. What are the dimensions of the cut out squares? Verify using the $f''(x)$ test. (25 pts)

III In manufacturing and selling the ever popular Wonderous Widget. The Wonderous Widget Corporation found that its price *per item* in dollars and cost function are given by: $Q(x) = \frac{15}{\sqrt{x}} - \sqrt{x}$ and $C(x) = 3\sqrt{x} + 4$, respectively. Here x is measured in thousands of widgets and $R(x), C(x)$, and $P(x)$ are measured in hundreds of dollars. Consider values of x such that $\frac{1}{2} \leq x \leq 5$. (25 pts tot)

- Find expressions for the revenue, marginal revenue, marginal cost and the marginal profit.
- Determine the production level that will produce the maximum total profit. (Verify, of course.)

IV The Better Bippy Company offers the original *sweet bippie* which has the shape of a rectangular prism (a rectangular box -- that is the volume = lwh) and the new *sour bippie* in the shape of a cylinder ($V = \pi r^2 h$). Jake likes the sweet bippies which have length 2 cm, height 4.7 cm and width 1 cm. Jed likes the sour bippies, the cylinders have a radius of 1 cm and a height of 3 cm. (Let $\pi=3.14$) (25 pts tot)

- Compare the volume of the two candies.
- Jed thinks the sour bippies melt faster than the sweet ones. The boys each tried a candy at the same time. They gathered the following information: After 5 minutes, the boys noticed that the heights of the candies remained constant. Furthermore, the cylinder had a the radius of .5, the radius was decreasing at .1 cm/min and for the prism the length was 1 cm and the width was .5 cm. Both the length and width were decreasing at .1 cm per minute. Whose candy was melting faster and by how much?

Extra Credit

5 pts

Refer to section I above. Who arrives at the restaurant first? Be sure your method is *very clear*.