



## College Algebra Workshop 4



### Unit 4 - Changing Representations: Symbol Rule to Graph

1. The Gotham Toll Road Authority is studying the amount of toll receipts that will be collected from a toll road for different toll charges. When the toll charge is  $x$  dollars per car, the daily toll receipts are predicted to be  $R(x)$  thousands of dollars where

$$R(x) = \frac{50x}{x^2 + 1}$$

a. When the toll charge is \$1 per car, the toll receipts are predicted to be \$25,000. Express this information in function notation and use the function symbol rule to verify that it is correct.

b. Evaluate  $R(3)$ , and then interpret this value using a complete sentence.

c. Find the abstract domain of the function  $R$ .

d. Find the application domain of the function  $R$ .

e. Sketch a good graph of the function  $R$  by first tabulating the function, plotting the table, and then connecting the points with a smooth curve. We suggest an *initial* graphing window of  $[0, 20] \times [0, 30]$ , and 30 inputs for the *initial* table domain. (*Note:* Be sure the table domain is included in the application domain. And don't forget to label the axes in your final graph with the names of the inputs and outputs.)

f. In order to help pay off the cost of the toll road, the receipts from the toll road must be at least \$10,000 daily. Use the graph to determine between what two toll charges the resulting receipts will be at least \$10,000. Write the answer using interval notation.

g. In part f you in effect solved an inequality graphically. Write this inequality.

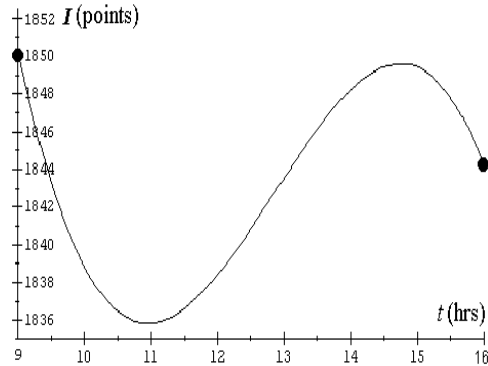
h. Find the intervals over which the output values of  $R$  are decreasing.

i. Find the intervals over which the output values of  $R$  are increasing.

j. Find the maximum output of  $R$ .

k. What do you recommend as the toll charge per car to maximize daily toll receipts for this toll road? Explain your answer.

2. The NASDAQ Composite Index is a numerical value that roughly measures the price of all stocks traded on the NASDAQ Stock Exchange. This exchange has become more important in recent years, since the stocks of many high-tech companies are traded there. The following graph depicts the “smoothed” value of the NASDAQ index over the course of a recent trading day (the input axis is marked off in military time).



a. What was the value of the NASDAQ index at 1 pm (13:00 military time)?

b. At what time was the NASDAQ index at its highest level? What was the value of the NASDAQ index at this time?

c. During what time period(s) was the NASDAQ index rising? During what time period(s) was it falling?

3. An experimental pesticide is applied to an acre of land to test its effectiveness. The following function  $P$  outputs the pest population at each month  $m$  after the treatment up to 8 months.

$$P = 0.03m^3 - 0.22m^2 - 0.45m + 17.05 \quad , \quad 0 \leq m \leq 8$$

a. Evaluate  $P(0)$  and then interpret this value in a complete sentence.

b. Over what time interval is the pest population decreasing? Over what time interval is it increasing? (*Hint*: First, graph the function.) State your answers rounded to one decimal place.

c. What is the minimum pest population? How many months after the treatment is this minimum achieved?