



# Which Garage is Better?

Student Activity

Name \_\_\_\_\_

Class \_\_\_\_\_

## Problem 1 – A Parking Garage

The cost schedules for two different parking garages are below. The maximum stay is 24 hours.

<b>Blue Street Garage</b>	
<b>Length of time in the garage</b>	<b>Cost</b>
1 hour or less	A flat fee of \$10.
More than 1 hour	\$10 for the first hour plus an additional fee of \$5 for every hour after your first hour in the garage.
<b>Red Street Garage</b>	
<b>Length of time in the garage</b>	<b>Cost</b>
5 hours or less	\$7 per hour
More than 5 hours	A flat fee of \$35

1. Complete the table.

<b>Length of time in the garage (hours)</b>	<b>Blue Street Garage total cost (dollars)</b>	<b>Red Street Garage total cost (dollars)</b>
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		

2. Joe parked in the Blue Street Garage and Flo parked in the Red Street Garage for the same length of time. After they checked out and paid, they asked each other which garage was cheaper, only to discover they paid the same amount for their stay.

Using the table above, answer the following questions:

- (a) Find the length of time each might have parked in the garage. Find all possible answers.



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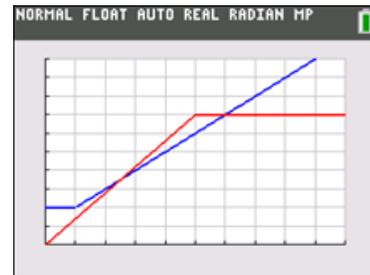
(b) Find what their fee would have been. Find all possible answers.

- Write the equations of piecewise functions that model the cost of staying in each of the garages.

Blue Street Garage:  $B(x) =$

Red Street Garage:  $R(x) =$

- To graph a piecewise function on your TI-84 Plus CE, press **y =**, **math**, **B: piecewise**(, select 2 pieces and select **OK**. Enter your equations and inequalities into the four empty boxes. You will repeat this for the Red Street Garage as well. Your graph should look like the one to the right using the viewing window shown.



```

NORMAL FLOAT AUTO REAL RADIAN MP
WINDOW
Xmin=0
Xmax=10
Xscl=1
Ymin=0
Ymax=50
Yscl=5
Xres=1
ΔX=.0378787878787878
TraceStep=.0757575757575757

```

- Find when the costs for using each garage will be equal to each other. Write down the equations you would set equal to each other to find when the costs are equal. Solve these equations below. Verify your answer by examining the intersection on the handheld. Press **2<sup>nd</sup>**, **trace**, **5:intersect**.

Equation 1: \_\_\_\_\_

Equation 2: \_\_\_\_\_



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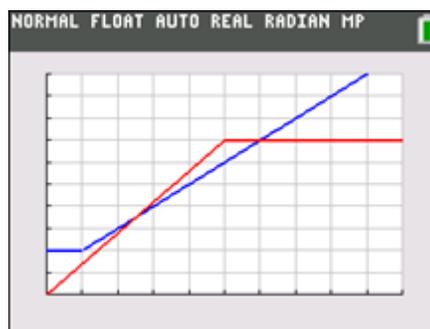
6. Use the table, formula, or graph to answer the following. Press **2<sup>nd</sup>**, **graph** for the **table**.

a. Find which garage costs less for a short stay. For example, you enter the garage, park, realize you forgot your wallet, and end up having to leave only 15 minutes later.

b. Suppose after a 2.5-hour movie you decide to go out to a restaurant and stay an additional 2 hours. Find which garage will cost less. State how much less.

c. Suppose you needed to park your car for 12 hours in the garage. State which garage will cost less. State how much less.

7. Use the graph to solve when  $B(x) < R(x)$ . Interpret the solution in real-world practical terms.



8. Over the length of a day, find what duration the Blue Street Garage is better. Find what duration the Red Street Garage is better.



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### Problem 2 – Music Sales

In recent years, the numbers of CDs sold in the United States has declined while digital music has become the new method for purchasing music.

The table below shows data of the sales, in millions, of CDs, digital albums (**DA**), and individual songs (**IS**) for the first three months of the year.

Year	CD	DA	IS
2006	112	119	24.2
2007	89	99	28.8
2007 – 2006	-23	-20	4.6

9. Describe what the value of -23 (under CD) represents.
  
10. Discuss with a classmate and write down why you think it is negative.
  
11. Discuss with a classmate how the result in the final column (IS) is different from the other two (CD and DA) and explain why.
  
12. Use the data in the table above to find the equation for each of the three lines in either slope-intercept form or point-slope form and write them in the spaces provided.
  - CDs \_\_\_\_\_
  - Digital Albums \_\_\_\_\_
  - Individual Songs \_\_\_\_\_

Use the lines to find and record the coordinates of the three intersection points.

CDs and Digital Albums ( \_\_\_\_\_ , \_\_\_\_\_ )

CDs and Individual Songs ( \_\_\_\_\_ , \_\_\_\_\_ )

Digital Albums and Individual Songs ( \_\_\_\_\_ , \_\_\_\_\_ )



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- 
13. Find when the sales of digital albums overtakes the CDs.
  
  14. Find when the graph projects that the sales of individual songs overtakes CDs.
  
  15. Find when the graph projects that the sales of individual songs overtakes digital albums.
  
  16. As time goes on according to the graph, it indicates the CD sales becoming zero. Discuss with a classmate if you think this is possible. Explain why or why not.

### **IB Further Extension**

To further instruction, finding where two functions are equal should not be limited to linear functions. In this extension, you will be exploring where two exponential functions are equal.

Luca purchases a new bike for himself at a cost of \$355. He also purchases a professional racing bike for his sister Christine for \$1815. Luca's bike will depreciate in value 5% per year, while Christine's will depreciated at a rate of 12% per year. Luca and Christine's bikes will have the same value  $t$  years after they were purchased.

- (a) Estimate the value of Luca's bike after 6 years.
  
- (b) Using your handheld, find  $t$ .
  
- (c) Explain why or why not the answer to part (b) is valid.