Which Garage Is Better?

ID: 10078

Time required
45 minutes

Activity Overview

Students are to find the solution to a system of linear equations using technology. They are presented with two problems; music sales and parking lot fees.

Topic: Linear Algebra: Vectors & Matrices

- *Graph a linear system in two variables and use technology to find the intersection point(s).*

Teacher Preparation and Notes

- *This activity is designed for use in a precalculus classroom as an introduction to systems of linear equations. Students should already be familiar with algebraic symbol manipulation, finding linear equations from two points, and properties of piece-wise functions.*
- *This activity is intended to be teacher-led for the introductions and the problems completed by students individually.*
- *Notes for using the TI-Nspire™ Navigator™ System are included throughout the activity. The use of the Navigator System is not necessary for completion of this activity.*
- ***To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter "10078" in the keyword search box.***

Associated Materials

- *WhichGarageIsBetter_Student.doc*
- *WhichGarageIsBetter.tns*
- *WhichGarageIsBetter_Soln.tns*

Suggested Related Activities

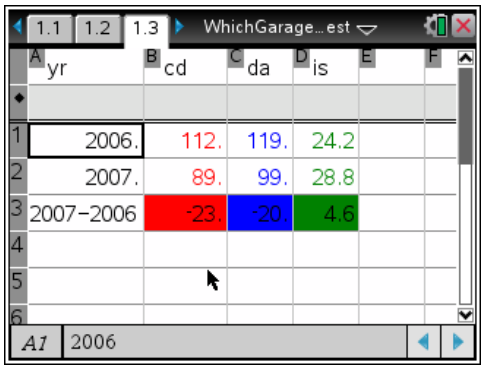
To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- *How Many Solutions (TI-Nspire technology) — 9284*
- *Nonlinear Systems of Equations (TI-Nspire technology) — 9982*

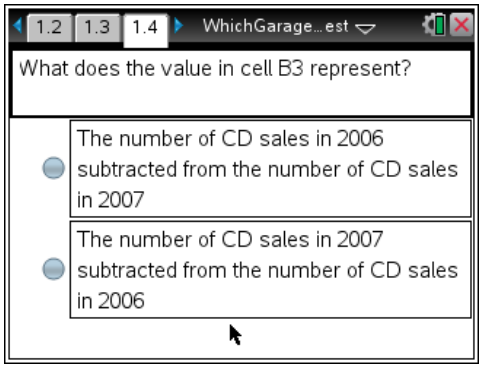
Problem 1 – Music Sales Problem

Students are given the data of the music sales in a *Lists & Spreadsheet* page with the assumption that the average CD has 10 songs so the individual song data has been modified from 242 million to 24.2 million.

On page 1.3 the slope is calculated for them and highlighted in cells B3, C3, and D3.



The students are to answer the questions on pages 1.4 and 1.5.



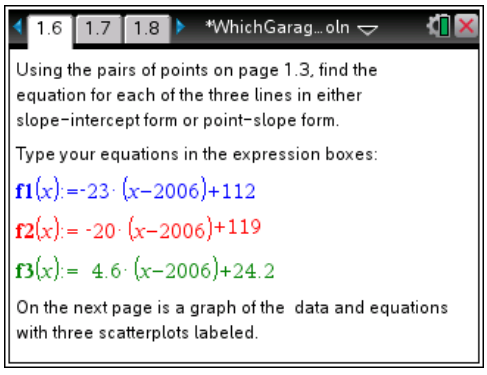
TI-Nspire™ Navigator™ Opportunity: *Quick Poll*

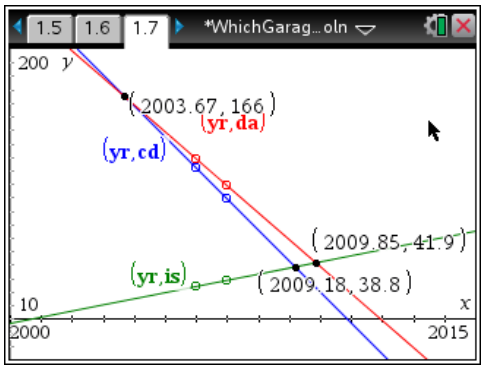
See Note 1 at the end of this lesson.

Students are instructed to use the pairs of points for each format of music to find the equation for each of the three lines in either slope-intercept form or point-slope form. They are to enter their equations in the expression boxes.

On page 1.7 is a graph of the data with the three scatter plots labeled and the three functions entered on page 1.6 graphed. In addition, the intersection points are graphed.

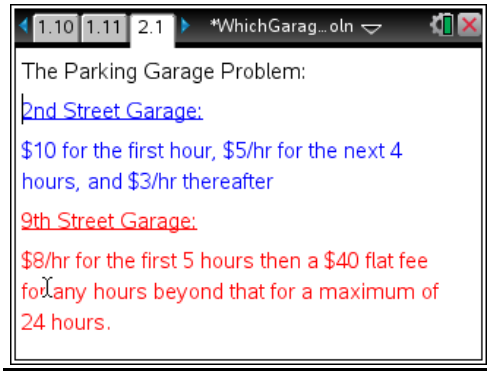
Students are asked to answer the questions on pages 1.8 - 1.11.





Problem 2 – Parking Garage Problem

The second problem of this activity involves the different pay schedules for two parking garages. The students are given this information



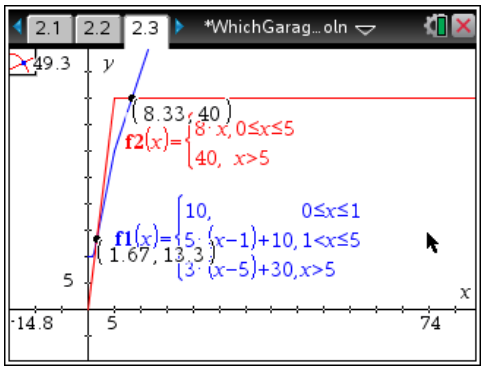
2nd Street Garage:

$10 for the first hour, $5/hr for the next 4 hours, and $3/hr thereafter

9th Street Garage:

$8/hr for the first 5 hours then a $40 flat fee for any hours beyond that for a maximum of 24 hours.

For the parking garage problem, the students are instructed to write the piecewise functions that model each of the parking garage payment schedules. Graph them on page 2.3 and set an appropriate window. To access the piecewise function template, instruct students to press [ctrl] to bring up the Template palette and then select the *n*-piecewise function template.

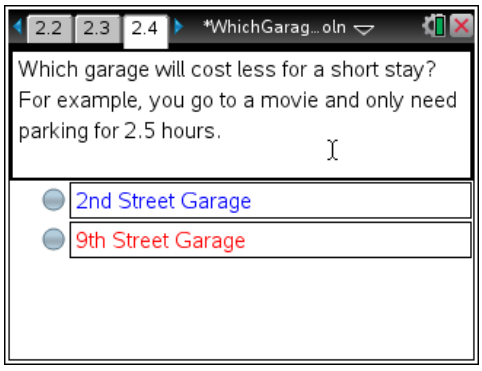


To find the points of intersection, students should select [menu] **> Geometry > Points & Lines > Intersection Point(s)**.

TI-Nspire™ Navigator™ Opportunity: *Class Capture*

See Note 2 at the end of this lesson.

Students are asked to answer the questions on pages 2.4 - 2.7.



Sample Solutions:

Problem 1 – Music Sales Problem

1) The difference between the sales data for CDs and, since there is only a difference of one year, it is also equal to the slope of the line
2) Because there was a decrease in sales of CDs from 2006 to 2007
3 The result is positive because the individual song sales went up for the same time period.

$y = -23(x - 2006) + 112$ $(2003.67,\ 166)$

$y = -20(x - 2006) + 119$ $(2009.85,\ 419)$

$y = 4.6(x - 2006) + 24.2$ $(2009.18,\ 38.8)$

4) the later part of 2003
5) the beginning of 2009
6) the later part of 2009
7) the sales of CDs will continue to go down but probably will not go away

Problem 2 – Parking Garage Problem

$$f(x) = \begin{cases} 10, & 0 \le x \le 1 \\ 5(x-1)+10, & 1 < x \le 5 \\ 3(x-5)+30, & x > 5 \end{cases} \qquad g(x) = \begin{cases} 8x, & 0 \le x \le 5 \\ 40, & x > 5 \end{cases}$$

(8.33, 40)

(1.67, 13.3)

1) 2nd Street garage
2) 2nd Street garage
3) 9th Street garage
4) two times - at $1\frac{2}{3}$ or 1.67 hours and $8\frac{1}{3}$ or 8.33 hours

TI-Nspire™ Navigator™ Opportunities

Note 1
Problem 1, *Quick Poll*
You may choose to use Quick Poll to assess student understanding. The worksheet questions can be used as a guide for possible questions to ask.

Note 2
Problem 2, Class *Capture*
You may want to use Class Capture to verify that students are able to enter a piecewise function.