

Section 4  
Linear Functions

### Guided Exploration: Video/DVD Rentals

The neighborhood video/DVD store offers its customers two ways to rent videos/DVDs, the Regular Plan and the Membership Plan. In the *Regular Plan*, a customer pays the regular fee of \$2.00 per rental. In the *Membership Plan*, a customer pays a membership fee of \$40, good for one year, and then pays only \$0.75 per video/DVD rental during the membership year.

1. Complete the tables below for the cost of renting videos under the Regular Plan and under the Membership Plan. The first column, in each table, gives the number of videos rented and the second column gives the cost in dollars for renting these videos.

Regular Plan	
Videos rented	Cost (in dollars)
0	0
1	2
2	4
3	6
4	8
5	10

Membership Plan	
Videos rented	Cost (in dollars)
0	40
1	40.75
2	41.50
3	42.25
4	43
5	43.75

2. Describe, in words or symbols, a pattern you see in each of the tables given in Question 1.

Regular Plan (in words or symbols)	Membership Plan (in words or symbols)
cost increases by 2	cost increases by .75

3. Use the tables in Question 1 or your patterns in Question 2 to answer the following questions about renting videos.

a. How much will it cost to rent four videos under the Regular Plan? \$ 8

b. How much will it cost to rent five videos under the Membership Plan? \$43.75

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- c. If \$6 was spent renting videos under the Regular Plan, how many videos were rented?

3

- d. If \$43 was spent renting videos under the Membership Plan, how many videos were rented?

4

4. Some customers rent videos on a weekly basis. Over a year's time, a lot of videos are rented. Determine a rule that provides a method for computing the cost of renting a large number of videos—for example, for numbers greater than 20—without having to extend the pattern in the tables in Question 1 to find this cost.

**a. Regular Plan**

Write a rule, in the form of an equation, for the cost of renting  $x$  videos under the Regular Plan. Use  $C$  to denote the cost in dollars and  $x$  to denote number of videos rented.

$$C = 2x$$

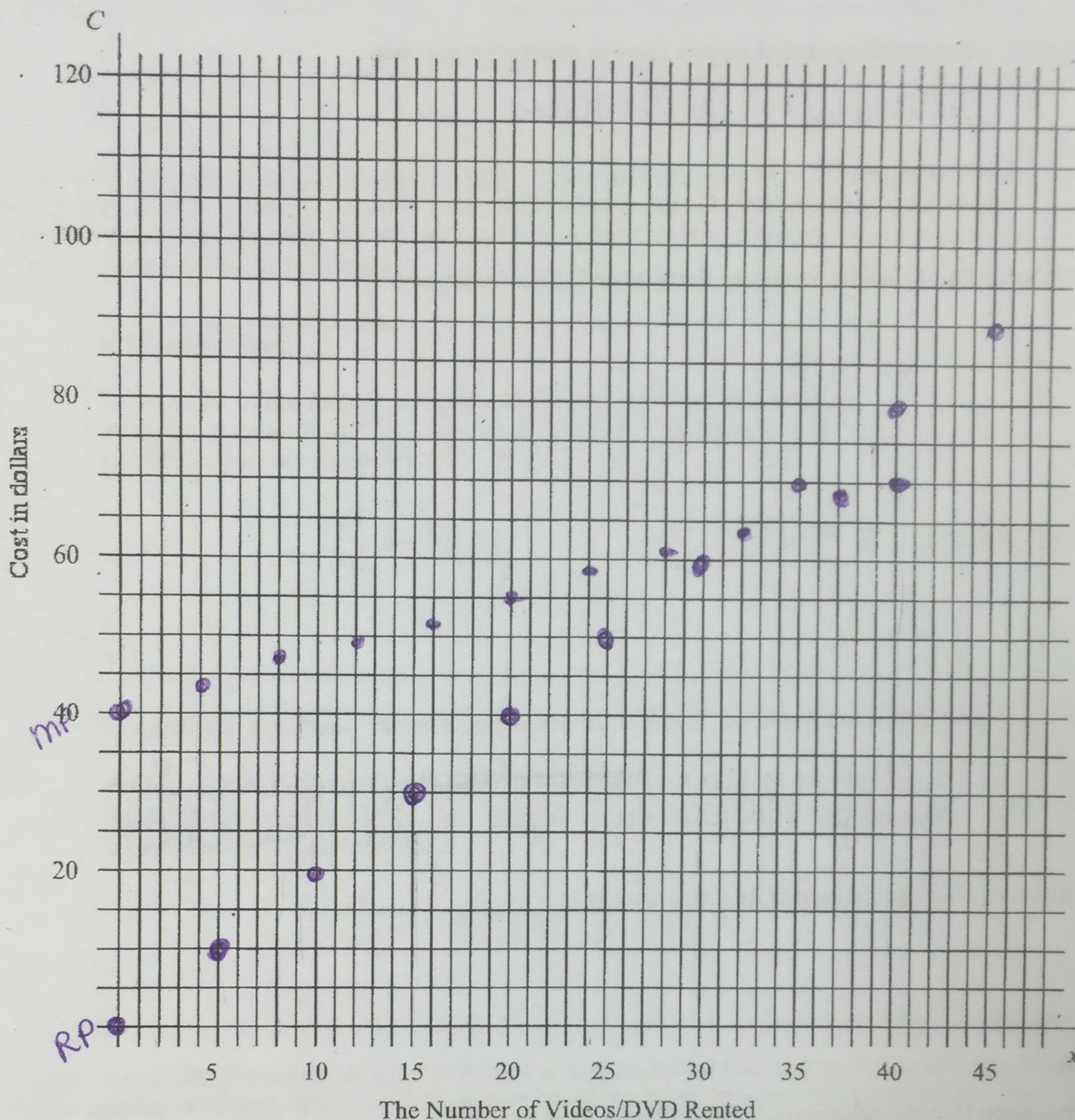
**b. Membership Plan**

Write a rule, in the form of an equation, for the cost of renting  $x$  videos under the Membership Plan. Use  $C$  to denote the cost in dollars and  $x$  to denote number of videos rented.

$$C = .75x + 40$$

5. a. Extend the values in each table in Question 1 or use your rules in Question 4 to give a plot of cost versus number of rented videos for each rental plan on the coordinate system given below. The horizontal axis denotes number of video/DVD rentals and the vertical axis denotes cost in dollars.

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- b. Compare the two graphs. Describe ways in which these two different plots are **alike**. Also, describe ways in which these two plots are **different**.  
*A: pos slope (increasing line)*  
*D: mp has higher y-int; RP is more steep*
- c. Should the points in the plot given in Part (a) be connected? Justify your answer.  
*No, there are no prices/rentals in less than whole increments*

6. Solving algebraic equations provides answers to questions. In this question you are given an equation in Parts (a) and (b). The solution to each equation answers a question of the form "How many videos/DVDs could be rented under the \_\_\_\_\_ Plan for \$70?" Use the blank to identify the correct word, *Regular* or *Membership*, that should be placed in the blank.

a.  $70 = 2x$       Regular

b.  $70 = 0.75x + 40$       Membership

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c. Explain what mathematical clues you used to make your choices.

Various answers

7. Solve the equations below to answer Parts (a) and (b) in Question 6.

a.  $2x = 70$

$x = 35$

b.  $0.75x + 40 = 70$

$x = 40$

8. Write a question that is answered by solving the following equations:

a.  $2x = 48$

In the regular ~~membership~~ program, how many videos can you rent for \$48?

The question that the solution of  $2x = 48$  answers is: \_\_\_\_\_ ↑

b.  $0.75x + 40 = 54.25$

The question that the solution of  $0.75x + 40 = 54.25$  answers is:

In the membership program, how many videos can you rent for \$54.25?

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9. Solve each equation below to answer your corresponding question in Question 8.

$2x = 48$

$x = 24$

$0.75x + 40 = 54.25$

$x = 19$

10. a. The graphs in Question 5 illustrate the cost of video/DVD rentals under the Regular and Membership Plans. These graphs show a point where the cost is the same for the same number of video/DVD rentals under each plan. This point is called the **break-even point**. Describe how the break-even point appears in the graphs in Question 5.

it's the point they have in common.

- b. Estimate the break-even point from the graphs given in Question 5.

around (30, 60)

- c. Can the break-even point be located or estimated by extending your tables in Question 1? Explain.

Yes, you would look for a point they have in common.

- d. Describe the meaning of the following equation:  $2x = 0.75x + 40$ .

It is when the regular rental = membership rental

- e. Solve the equation  $2x = 0.75x + 40$  for  $x$ . What is the meaning of the solution of this equation?

$$2x = 0.75x + 40$$

$$\begin{array}{r} -0.75x \\ \hline 1.25x = 40 \end{array}$$

$$1.25x = 40$$

$$x = 32$$

They will cost the same when you rent 32 videos/DVDs

11. A friend is considering whether or not to join the Membership Plan at the neighborhood video/DVD store for the annual fee of \$40. Use the work that you have accomplished in this activity to give your friend advice on what to do. Be sure to support your advice with algebra as well as reasoning based on the results of your algebra.

If you are going to rent less than 32 videos/DVD's, you should go with the regular plan because it is cheaper. If you will rent more than that, go with the membership plan.

Ex: Rent 31 videos

$$\Rightarrow \text{Reg: } 2(31) = \$62 \text{ } \overbrace{=}^{\text{cheaper!}}$$

$$\text{membership: } .75(31) + 40 = \$63.25$$

Ex: Rent 32 videos

$$\text{Reg: } 2(32) = \$64$$

$$\text{membership: } .75(32) + 40 = \$64 \quad \left. \vphantom{\text{membership:}} \right\} \text{Same cost}$$

Ex: Rent 33 videos

$$\text{Reg: } 2(33) = \$66$$

$$\Rightarrow \text{Membership: } .75(33) + 40 = \$64.75 \text{ } \overbrace{=}^{\text{cheaper}}$$