

**Lesson: Problem Solving**

**Eighth Grade Objective: 1.02** Develop flexibility in solving problems by selecting strategies and using mental computation, estimation, calculators or computers, and paper and pencil.

**Lesson:**

When it comes to problem solving in math, there are many ways to approach the same problem. While one person may approach a problem by making a graph, another may choose to make a table and yet another may choose to write an equation. Frequently, drawing and using pictures helps to organize information so that a solution may be determined.

In this lesson, we are going to use a variety of strategies to solve problems.

Let's try:

1. Jill spends  $\frac{1}{3}$  of her salary on rent. After paying rent, she has \$800 left. How much is her rent?

**Strategy 1 – Using an equation:**

Let  $x$  represent Jill's salary. Jill's salary minus  $\frac{1}{3}$  of her salary is \$800.

$$x - \left(\frac{1}{3}\right)x = 800$$

-combine like terms:  $\left(\frac{2}{3}\right)x = 800$

-divide by  $\left(\frac{2}{3}\right)$ :  $x = 1200$

So Jill makes \$1200 per month and she has \$800 left after paying rent, which means she spent \$400 on rent.

**Strategy 2 – Using a picture:**

Rent	part of what's left over	part of what's left over
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The rectangle represents Jill's entire salary. It is divided into three parts because our problem is given to use in thirds (the denominator of the fraction).

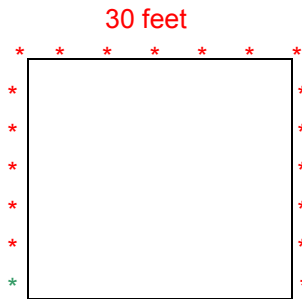
Notice that the two parts labeled "part of what's left over" together represent \$800, so one of the parts must be worth \$400. All the parts represent  $\frac{1}{3}$  of the whole, so all the parts must be equal to \$400, which means she spends \$400 on rent.

2. Steven is planting Leland Cypress trees at five foot intervals around three sides of his square yard. The area of his yard is 900 square feet. How many trees will he plant?

**Strategy 1: Breaking the problem down:**

We know the area of the yard, 900 square feet. To find a side length, we can use the formula  $900 = s^2$ . We can “undo” the square by taking the square root,  $30 = s$ , one side of the yard is 30 feet long.

Draw a picture:



Beginning at the green tree – place a “tree” every 5 feet around three sides of the yard. There are 19 trees placed around the yard.

3. Jeremy and Shelly are both salespeople. Jeremy makes \$200 per month plus \$50 for every computer he sells. Shelly makes \$500 per month plus \$20 for every computer she sells. For how many computers sold per month would Jeremy make more than Shelly?

Strategy 1: Make a table:

Jeremy makes \$200 plus \$50 per computer or  $j = 200 + 50c$ .

Shelly makes \$500 plus \$20 per computer or  $s = 500 + 20c$ .

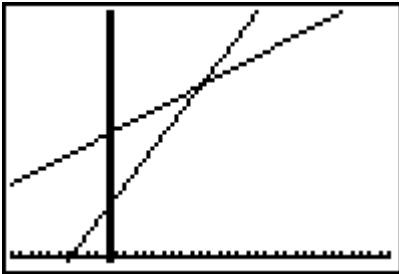
Number of Computers	Jeremy's Pay	Shelly's Pay
0	\$200	\$500
1	\$250	\$520
2	\$300	\$540
3	\$350	\$560
4	\$400	\$580
5	\$450	\$600
6	\$500	\$620
7	\$550	\$640
8	\$600	\$660
9	\$650	\$680
10	\$700	\$700
11	\$750	\$720

At 10 computers sold, Jeremy and Shelly make the same amount of money. At 11 computers sold, Jeremy makes more money.

Strategy 2: Use a graph:

Jeremy makes \$200 plus \$50 per computer or  $j = 200 + 50c$ .

Shelly makes \$500 plus \$20 per computer or  $s = 500 + 20c$ .



Graph the first equation by starting with the y-intercept of 200, then go up 50, right one.

Graph the second equation by starting with the y-intercept 500, then go up 20, right one.

The x-axis represents the number of computers, the y-axis represents the amount of money made. The point where the two lines cross, (10, 700), is the number of computers that need to be sold in order for both people to make the same amount of money. Any more than 10 computers sold, Jeremy makes more money. Even though Shelly initially makes more money, the amount of money Jeremy makes increases at a faster rate.

Try these on your own!

1. Charla spends  $\frac{1}{4}$  of her income on her car. After she pays her car payment, she has \$900 remaining. How much is her car payment?
2. Mark is planting one flower for every square foot of his garden. His garden is circular and has circumference 31.4 feet. How many flowers will Mark plant in his garden?
3. Tia and Ron are raising money for a charity by participating in a charity walk. Tia's family has pledged \$10 plus \$2 per mile walked. Ron's family has pledged \$20 plus \$1 per mile walked. After how many miles will Tia and Ron have raised the same amount of money?

Check your answers:

1. Strategy 1 – Using an equation:

Let  $x$  represent Charla's salary. Charla's salary minus  $\frac{1}{4}$  of her salary is \$600.

$$x - \left(\frac{1}{4}\right)x = 600$$

-combine like terms:

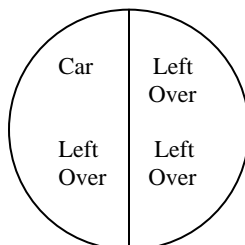
$$\left(\frac{3}{4}\right)x = 600$$

-divide by  $\left(\frac{3}{4}\right)$ :

$$x = 800$$

So Jill makes \$800 per month and she has \$600 left after paying for her car, which means she spent \$200 on her car payment. .

Strategy 2 – Using a picture:



The circle represents Charla's entire salary. It is divided into four parts because our problem is given to use in fourths (the denominator of the fraction).

Notice that the three parts labeled "Left Over" together represent \$600, since the three parts are equal, one of the parts must be worth \$200. All the parts represent 1/4 of the whole, so all the parts must be equal to \$200, which means she spends \$200 on her car payment.

2. Strategy – Breaking the problem down:

We know the circumference, so we can find the radius using the formula  $c = 2\pi r$

Substitute:  $31.4 = 2\pi r$

Divide by  $2\pi$ :  $5 = r$

Now that we know the radius, we can determine the area using the formula  $a = \pi r^2$

Substitute:  $a = \pi 5^2$

Simplify:  $a = \pi * 25$

$a = 78.5$  square feet

Mark will plant 79 flowers.

3. Strategy 1: Make a table:

Tia earns \$10 plus \$2 per mile or  $t = 10 + 2m$ .

Ron earns \$20 plus \$1 per mile or  $r = 20 + 1m$ .

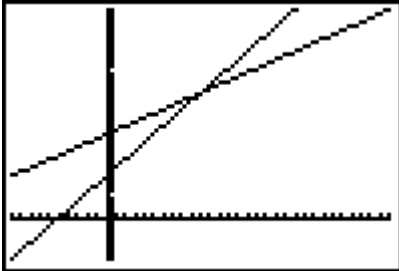
Number of Miles	Tia's Earnings	Ron's Earnings
0	\$10	\$20
1	\$12	\$21
2	\$14	\$22
3	\$16	\$23
4	\$18	\$24
5	\$20	\$25
6	\$22	\$26
7	\$24	\$27
8	\$26	\$28
9	\$28	\$29
10	\$30	\$30

At 10 miles, Tia and Ron have earned the same amount of money.

Strategy 2: Use a graph:

Tia makes \$10 plus \$2 per mile or  $t = 10 + 2m$ .

Ron earns \$20 plus \$1 per mile or  $r = 20 + 1m$ .



Graph the first equation by starting with the y-intercept of 10, then go up 2, right one.

Graph the second equation by starting with the y-intercept 20, then go up 1, right one.

The x-axis represents the number of miles walked, the y-axis represents the amount of money earned. The point where the two lines cross, (10, 30), is the number of miles that need to be walked in order for both people to earn the same amount of money.

Quiz Yourself!

1. Alex spends  $\frac{1}{3}$  of his monthly allowance on clothes and  $\frac{1}{4}$  of his allowance on video games. After buying both clothes and video games, Alex has \$35 left. How much money did he spend on clothes?
2. Mario is building a fence around his horse pasture. The pasture is a rectangle measuring 54 feet by 60 feet. Fence posts are located every 6 feet. How many fence posts does Mario need to use?
3. Natalie and Sam are raising money for a summer trip. Natalie's parents have agreed to donate \$100 plus \$5 for every window she washes in their house. Sam's parents agreed to donate \$50 plus \$10 for every window he washes in their house. How many windows must be washed for Natalie and Sam to have equal amounts of money raised?

Check your answers:

1. \$28 spent on clothes (\$21 spent on video games, his allowance is \$84 per month. If you complete this using the diagrams, break your diagram up into 12 parts, the least common denominator.)
2. 38 fence posts
3. After washing 10 windows, Natalie and Sam will have \$150 each.