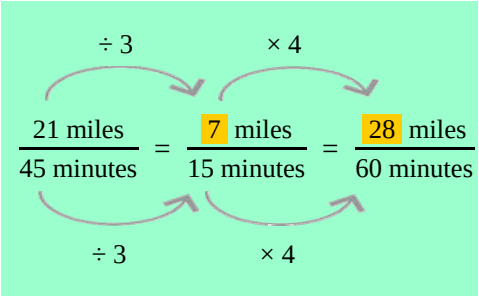
Using Equivalent Ratios

Example. If Jake can ride his bike to a town that is 21 miles away in 45 minutes, how far can he ride in 1 hour?

Let's form some equivalent rates, starting with 21 miles per 45 minutes, and hoping to arrive at so many miles per 60 minutes.

However, it is not easy to go directly from 45 minutes to 60 minutes (1 hour). So, let's first figure the rate for *15 minutes*, which *is* easy.

Why? Because to get from 45 minutes to 15 minutes you simply divide both terms of the rate by 3.



Then from 15 minutes, we can easily get to 60 minutes: Just multiply both terms by 4. We find that he can ride 28 miles in one hour.

1. Write the equivalent rates.

a. $\frac{15\text{ km}}{3\text{ hr}} = \frac{\quad}{1\text{ hr}} = \frac{\quad}{15\text{ min}} = \frac{\quad}{45\text{ min}}$	**b.** $\frac{\$6}{45\text{ min}} = \frac{\quad}{15\text{ min}} = \frac{\quad}{1\text{ hr}} = \frac{\quad}{1\text{ hr }45\text{ min}}$
c. $\frac{3\text{ in}}{8\text{ ft}} = \frac{\quad}{2\text{ ft}} = \frac{\quad}{12\text{ ft}} = \frac{\quad}{20\text{ ft}}$	**d.** $\frac{115\text{ words}}{2\text{ min}} = \frac{\quad}{1\text{ min}} = \frac{\quad}{3\text{ min}}$

2. **a.** Jake can ride 8 miles in 14 minutes. How long will it take him to ride 36 miles? Use the equivalent rates.

$$\frac{8\text{ miles}}{14\text{ minutes}} = \frac{4\text{ miles}}{\quad\text{ minutes}} = \frac{36\text{ miles}}{\quad\text{ minutes}}$$

b. How many miles can Jake ride in 35 minutes?

3. A car can go 50 miles on 2 gallons of gasoline.

a. How many gallons of gasoline would the car need for a trip of 60 miles? Use the equivalent rates below.

$$\frac{50\text{ miles}}{2\text{ gallons}} = \frac{5\text{ miles}}{\quad\text{ gallons}} = \frac{60\text{ miles}}{\quad\text{ gallons}}$$

b. How far can the car travel on 15 gallons of gasoline?

Example. You get 20 erasers for $1.80. How much would 22 erasers cost?

Cost (C)			$0.90	$1.80	
Erasers (E)	1	2	10	20	22

You can solve this problem in many ways. Let's use a table of rates this time.

First, find the cost for *10 erasers*, and then the cost for 2. After that, you can get the cost for 22 by adding.

Ten erasers will cost half of $1.80. Two erasers will cost one-fifth of that (divide by 5 to find it!). Lastly, add the cost of 20 erasers to the cost of 2 erasers to get the cost for 22 erasers.

Note 1: *Each* pair of numbers in the table is a rate. For example, *$1.80 for 20 erasers* (or $1.80/20 erasers) is a rate, and so is $0.90 for 10 erasers.

Note 2: We can write an equation relating the Cost (C) and the number of Erasers (E). You will find that easily from the unit rate (price for one): C = 0.09E. In other words, the cost is 0.09 times the number of erasers.

4. Finish solving the problem in the example above.

5. How many erasers would you get with $1.35?

6. On average, Scott makes a basket nine times out of twelve shots when he is practicing. How many baskets can he expect to make when he tries 200 shots? Fill in a table of rates to solve this.

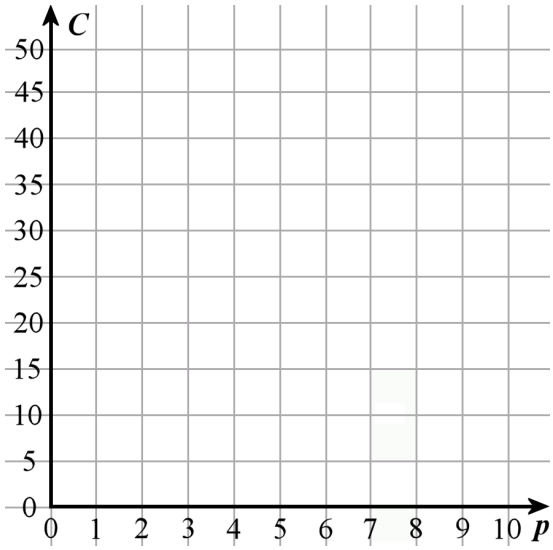
baskets						
shots						

7. **a.** Three pairs of socks cost $9. Fill in the table of rates. The variable *C* stands for cost, and *p* for pairs of socks.

C			9							
p	1	2	3	4	5	6	7	8	9	10

b. Each number pair in the table *is* a rate, but we can also view them as points with two coordinates. Plot the number pairs in the coordinate grid.

c. Write an equation relating the cost (C) and the number of pairs of socks (*p*).



8. **a.** You get 30 pencils for $4.50. How much would 52 pencils cost?

Cost						
Pencils						

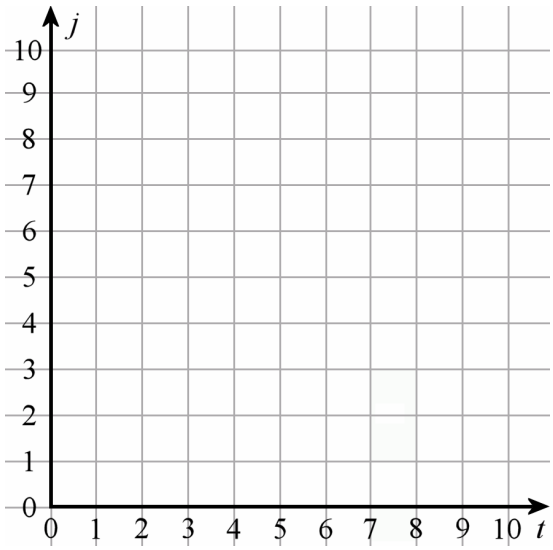
b. Write an equation relating the cost (C) and the number of pencils (P).

9. When Kate makes 4 liters of tea (a pot full), she needs five jars for the tea. From this, we get the rate of 4 liters / 5 jars.

a. Fill in the table. The variable *t* stands for the amount of tea, and *j* for the number of jars.

t					4					
j	1	2	3	4	5	6	7	8	9	10

b. Plot the number pairs from the table in this coordinate grid.



c. How many jars will Kate need for 20 liters of tea?

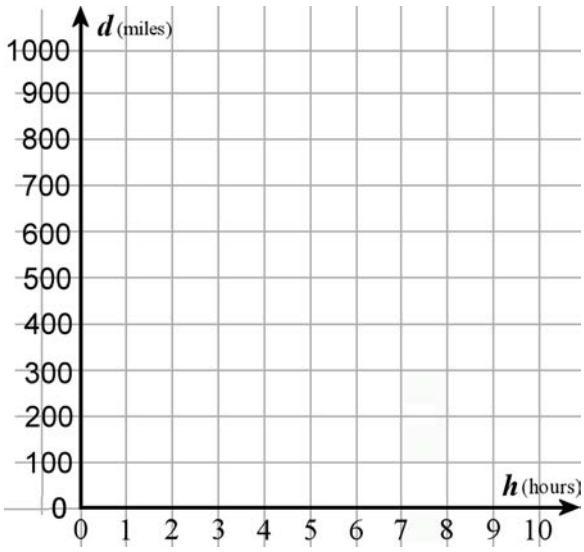
d. If Kate has 16 jars full of tea, how many liters of tea is in them?

10. **a.** A train travels at a constant speed of 80 miles per hour. Fill in the table of rates.

d										
h	1	2	3	4	5	6	7	8	9	10

b. Write an equation relating the distance (*d*) and the number of hours (*h*).

c. Plot the points in the grid on the right. The variable *h* stands for hours, and *d* for distance.



11. Another train travels at the constant speed of 60 miles per hour. Fill in the table of rates. Then, plot the points in the same coordinate grid as for the train in #10.

d					
h	1	2	3	4	5

d					
h	6	7	8	9	10

12. *How* can you see <u>from the graph</u> which train travels faster?

13. The plot shows the walking speeds for two persons (t is in minutes, d is in miles). Your task is to fill in the two ratio tables below. To make that easier, first find dots that are placed exactly on the lines, so that you can easily read the coordinates.
(Hint: For some of the points, you will need to use fractions and mixed numbers.)

Person 1 (red dot)

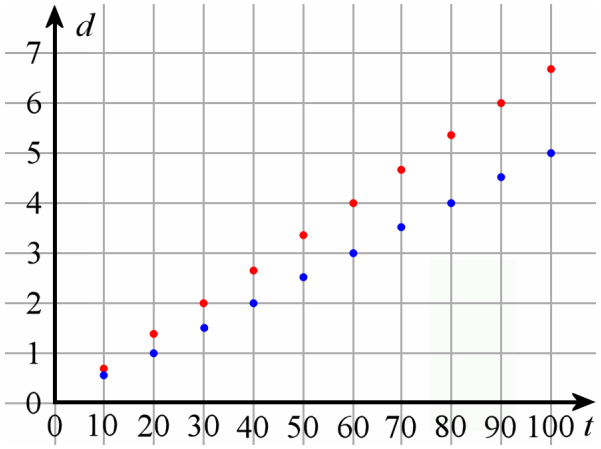
***d* (miles)**										
***t* (minutes)**										

Person 2 (blue dot)

***d* (miles)**										
***t* (minutes)**										

a. What is the speed of the first person in miles per hour?

b. What is the speed of the second person in miles per hour?



14. Train 1 travels at a constant speed of 240 miles in three hours. Train 2 travels 490 miles in seven hours. Which train is faster?

15. Find which is a better deal by comparing the unit rates: \$45 for eight bottles of shampoo, or \$34 for six bottles of shampoo?

16. In a poll of 1,000 people, 640 said they liked blue.

a. Simplify this ratio to the lowest terms:

640 people *out of* 1000 people = _____ people *out of* _____ people

b. Assuming the same ratio holds true in another group of 100 people, how many of those people can we expect to like blue?

c. Assuming the same ratio holds true in another group of 225 people, how many of those people can we expect to like blue?