Equations

Oscar and Maria each wrote an equation that they felt represented the proportional relationship between distance in kilometers and distance in miles. One entry in the table paired 152 km with 95 miles. If k represents the number of kilometers and m represents the number of miles, who wrote the correct equation that would relate miles to kilometers? Explain why.

Oscar wrote the equation $k = 1.6m$, and he said that the rate $\frac{1.6}{1}$ represents kilometers per mile.

Maria wrote the equation $k = 0.625m$ as her equation, and she said that 0.625 represents kilometers per mile.

1. A person who weighs 100 pounds on Earth weighs 16.6 lb. on the moon.

   a. Which variable is the independent variable? Explain why.

   b. What is an equation that relates weight on Earth to weight on the moon?

   c. How much would a 185 pound astronaut weigh on the moon? Use an equation to explain how you know.

   d. How much would a man that weighs 50 pounds on the moon weigh on Earth?

2. Use this table to answer the following questions.

Number of Gallons of Gas	Number of Miles Driven
0	0
2	62
4	124
10	310

   a. Which variable is the dependent variable and why?

   b. Is the number of miles driven proportionally related to the number of gallons of gas consumed? If so, what is the equation that relates the number of miles driven to the number of gallons of gas?

   c. In any ratio relating the number of gallons of gas and the number of miles driven, will one of the values always be larger? If so, which one?

   d. If the number of gallons of gas is known, can you find the number of miles driven? Explain how this value would be calculated.

   e. If the number of miles driven is known, can you find the number of gallons of gas consumed? Explain how this value would be calculated.

   f. How many miles could be driven with 18 gallons of gas?

   g. How many gallons are used when the car has been driven 18 miles?

   h. How many miles have been driven when half of a gallon of gas is used?

   i. How many gallons of gas have been used when the car has been driven for a half mile?

3. Suppose that the cost of renting a snowmobile is $37.50 for 5 hours.

    a. If c represents the cost and h represents the hours, which variable is the dependent variable? Explain why?

    b. What would be the cost of renting 2 snowmobiles for 5 hours?

4. In Katya's car, the number of miles driven is proportional to the number of gallons of gas used. Find the missing value in the table.

The Number of Gallons	The Number of Miles Driven
0	0
4	112
6	168
	224
10	280

    a. Write an equation that will relate the number of miles driven to the number of gallons of gas.

    b. What is the constant of proportionality?

    c. How many miles could Katya go if she filled her 22-gallon tank?

    d. If Katya takes a trip of 600 miles, how many gallons of gas would be needed to make the trip?

    e. If Katya drives 224 miles during one week of commuting to school and work, how many gallons of gas would she use?

Oscar and Maria each wrote an equation that they felt represented the proportional relationship between distance in kilometers and distance in miles. One entry in the table paired 152 km with 95 miles. If k represents the number of kilometers and m represents the number of miles, who wrote the correct equation that would relate kilometers to miles and why?

Oscar wrote the equation $k = 1.6m$, and he said that the rate $\dfrac{1.6}{1}$ represents kilometers per mile.

Maria wrote the equation $k = 0.625m$ as her equation, and she said that 0.625 represents kilometers per mile.

Oscar is correct. Oscar found the unit rate to be 1.6 by dividing kilometers by miles. The rate that Oscar used represents the number of kilometers per the number of miles. However, it should be noted that the variables were not well-defined. Since we do not know which values are independent or dependent, each equation should include a definition of each variable. For example, Oscar should have defined his variables so that k represented the number of kilometers and m represented the number of miles. For Maria's equation to be correct, she should have stated that k represents number of miles and m represents number of kilometers.

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1. A person who weighs 100 pounds on Earth weighs 16.6 lb. on the moon.

   a. Which variable is the independent variable? Explain why.

      Weight on Earth is the independent variable because most people do not fly to the moon to weigh themselves first. The weight on the moon depends on a person's weight on Earth.

   b. What is an equation that relates weight on Earth to weight on the moon?

      $$M = \left(\frac{16.6}{100}\right)E$$
      $$M = 0.166E$$

   c. How much would a 185 pound astronaut weigh on the moon? Use an equation to explain how you know.

      30.71 lb.

   d. How much would a man that weighs 50 pounds on the moon weigh on Earth?

      301 lb.

2. Use this table to answer the following questions.

Number of Gallons of Gas	Number of Miles Driven
0	0
2	62
4	124
10	310

   a. Which variable is the dependent variable and why?

      The number of miles driven is the dependent variable because the number of miles you can drive depends on the number of gallons of gas you have in your tank.

b. Is the number of miles driven proportionally related to the number of gallons of gas? If so, what is the equation that relates the number of miles driven to the number of gallons of gas?

Yes, the number of miles driven is proportionally related to the number of gallons of gas because every measure of gallons of gas can be multiplied by 31 to get every corresponding measure of miles driven.
$M = 31G$

c. In any ratio relating the number of gallons of gas and the number of miles driven, will one of the values always be larger? If so, which one?

Yes, the number of miles will be larger except for the point $(0, 0)$. The point $(0, 0)$ means 0 miles driven uses 0 gallons of gas.

d. If the number of gallons of gas is known, can you find the number of miles driven? Explain how this value would be calculated.

Yes, multiply the constant of proportionality (31 mpg) by the number of gallons of gas.

e. If the number of miles driven is known, can you find the number of gallons of gas used? Explain how this value would be calculated.

Yes, divide the number of miles driven by the constant of proportionality (31 mpg).

f. How many miles could be driven with 18 gallons of gas?

558 miles

g. How many gallons are used when the car has been driven 18 miles?

$\dfrac{18}{31}$ *gallons*

h. How many miles have been driven when half of a gallon of gas is used?

$\dfrac{31}{2} = 15.5$ *miles*

i. How many gallons have been used when the car has been driven for a half mile?

$\dfrac{1}{62}$ *gallons*

3. Suppose that the cost of renting a snowmobile is 37.50 for 5 hours.

a. If c represents the cost and h represents the hours, which variable is the dependent variable? Explain why.

c is the dependent variable because the cost of using the snowmobile depends on the number of hours you use it. $c = 7.5h$

b. What would be the cost of renting 2 snowmobiles for 5 hours?

$\$75$

4. In Katya's car, the number of miles driven is proportional to the number of gallons of gas used. Find the missing value in the table.

Number of Gallons of Gas	Number of Miles Driven
0	0
4	112
6	168
8	224
10	280

a. Write an equation that will relate the number of miles driven to the number of gallons of gas.

$M = 28G$, where M is the number of miles and G is the number of gallons of gas

b. What is the constant of proportionality?

28

c. How many miles could Katya go if she filled her 22-gallon tank?

616 miles

d. If Katya takes a trip of 600 miles, how many gallons of gas would be needed to make the trip?

$21\frac{3}{7}$ gallons

e. If Katya drives 224 miles during one week of commuting to school and work, how many gallons of gas would she use?

8 gallons