

## 10.6.6: Exercises

1. Out of 230 racers who started the marathon, 212 completed the race, 14 gave up, and 4 were disqualified. What percentage did not complete the marathon?
2. Patrick left an \$8 tip on a \$50 restaurant bill. What percent tip is that?
3. Ireland has a 23% VAT (value-added tax, similar to a sales tax). How much will the VAT be on a purchase of a €250 item?
4. Employees in 2012 paid 4.2% of their gross wages towards social security (FICA tax), while employers paid another 6.2%. How much will someone earning \$45,000 a year pay towards social security out of their gross wages?
5. A project on Kickstarter.com was aiming to raise \$15,000 for a precision coffee press. They ended up with 714 supporters, raising 557% of their goal. How much did they raise?
6. Another project on Kickstarter for an iPad stylus raised 1,253% of their goal, raising a total of \$313,490 from 7,511 supporters. What was their original goal?
7. The population of a town increased from 3,250 in 2008 to 4,300 in 2010. Find the absolute and relative (percent) increase.
8. The number of CDs sold in 2010 was 114 million, down from 147 million the previous year[1]. Find the absolute and relative (percent) decrease.
9. A company wants to decrease their energy use by 15%.
  - a. If their electric bill is currently \$2,200 a month, what will their bill be if they're successful?
  - b. If their next bill is \$1,700 a month, were they successful? Why or why not?
10. A store is hoping an advertising campaign will increase their number of customers by 30%. They currently have about 80 customers a day.
  - a. How many customers will they have if their campaign is successful?
  - b. If they increase to 120 customers a day, were they successful? Why or why not?
11. An article reports "attendance dropped 6% this year, to 300." What was the attendance before the drop?
12. An article reports "sales have grown by 30% this year, to \$200 million." What were sales before the growth?
13. The Walden University had 47,456 students in 2010, while Kaplan University had 77,966 students. Complete the following statements:
  - a. Kaplan's enrollment was \_\_\_\_% larger than Walden's.
  - b. Walden's enrollment was \_\_\_\_% smaller than Kaplan's.
  - c. Walden's enrollment was \_\_\_\_% of Kaplan's.
14. In the 2012 Olympics, Usain Bolt ran the 100m dash in 9.63 seconds. Jim Hines won the 1968 Olympic gold with a time of 9.95 seconds.
  - a. Bolt's time was \_\_\_\_% faster than Hines'.
  - b. Hine' time was \_\_\_\_% slower than Bolt's.
  - c. Hine' time was \_\_\_\_% of Bolt's.
15. A store has clearance items that have been marked down by 60%. They are having a sale, advertising an additional 30% off clearance items. What percent of the original price do you end up paying?
16. Which is better: having a stock that goes up 30% on Monday than drops 30% on Tuesday, or a stock that drops 30% on Monday and goes up 30% on Tuesday? In each case, what is the net percent gain or loss?
17. Are these two claims equivalent, in conflict, or not comparable because they're talking about different things?
  - a. "16.3% of Americans are without health insurance"[2]
  - b. "only 55.9% of adults receive employer provided health insurance"[3]

18. Are these two claims equivalent, in conflict, or not comparable because they're talking about different things?
- "We mark up the wholesale price by 33% to come up with the retail price"
  - "The store has a 25% profit margin"
19. Are these two claims equivalent, in conflict, or not comparable because they're talking about different things?
- "Every year since 1950, the number of American children gunned down has doubled."
  - "The number of child gunshot deaths has doubled from 1950 to 1994."
20. Are these two claims equivalent, in conflict, or not comparable because they're talking about different things?[4]
- "75 percent of the federal health care law's taxes would be paid by those earning less than \$120,000 a year"
  - "76 percent of those who would pay the penalty [health care law's taxes] for not having insurance in 2016 would earn under \$120,000"
21. Are these two claims equivalent, in conflict, or not comparable because they're talking about different things?
- "The school levy is only a 0.1% increase of the property tax rate."
  - "This new levy is a 12% tax hike, raising our total rate to \$9.33 per \$1000 of value."
22. Are the values compared in this statement comparable or not comparable? "Guns have murdered more Americans here at home in recent years than have died on the battlefields of Iraq and Afghanistan. In support of the two wars, more than 6,500 American soldiers have lost their lives. During the same period, however, guns have been used to murder about 100,000 people on American soil"[5]
23. A high school currently has a 30% dropout rate. They've been tasked to decrease that rate by 20%. Find the equivalent percentage point drop.
24. A politician's support grew from 42% by 3 percentage points to 45%. What percent (relative) change is this?
25. Marcy has a 70% average in her class going into the final exam. She says "I need to get a 100% on this final so I can raise my score to 85%." Is she correct?
26. Suppose you have one quart of water/juice mix that is 50% juice, and you add 2 quarts of juice. What percent juice is the final mix?
27. Find a unit rate: You bought 10 pounds of potatoes for \$4.
28. Find a unit rate: Joel ran 1500 meters in 4 minutes, 45 seconds.
29. Solve:  $\frac{2}{5} = \frac{6}{x}$ .
30. Solve:  $\frac{n}{5} = \frac{16}{20}$ .
31. A crepe recipe calls for 2 eggs, 1 cup of flour, and 1 cup of milk. How much flour would you need if you use 5 eggs?
32. An 8ft length of 4 inch wide crown molding costs \$14. How much will it cost to buy 40ft of crown molding?
33. Four 3-megawatt wind turbines can supply enough electricity to power 3000 homes. How many turbines would be required to power 55,000 homes?
34. A highway had a landslide, where 3,000 cubic yards of material fell on the road, requiring 200 dump truck loads to clear. On another highway, a slide left 40,000 cubic yards on the road. How many dump truck loads would be needed to clear this slide?
35. Convert 8 feet to inches.
36. Convert 6 kilograms to grams.
37. A wire costs \$2 per meter. How much will 3 kilometers of wire cost?
38. Sugar contains 15 calories per teaspoon. How many calories are in 1 cup of sugar?
39. A car is driving at 100 kilometers per hour. How far does it travel in 2 seconds?
40. A chain weighs 10 pounds per foot. How many ounces will 4 inches weigh?

41. The table below gives data on three movies. Gross earnings is the amount of money the movie brings in. Compare the net earnings (money made after expenses) for the three movies.[6]

Movie Earnings

Movie	Release Date	Budget	Gross Earnings
Saw	10/29/2004	\$1,200,000	\$103,096,345
Titanic	10/29/2004	\$200,000,000	\$1,842,879,955
Jurassic Park	6/11/1993	\$63,000,000	\$923,863,984

42. For the movies in the previous problem, which provided the best return on investment?

43. The population of the U.S. is about 309,975,000, covering a land area of 3,717,000 square miles. The population of India is about 1,184,639,000, covering a land area of 1,269,000 square miles. Compare the population densities of the two countries.

44. The GDP (Gross Domestic Product) of China was \$5,739 billion in 2010, and the GDP of Sweden was \$435 billion. The population of China is about 1,347 million, while the population of Sweden is about 9.5 million. Compare the GDP per capita of the two countries.

45. In June 2012, Twitter was reporting 400 million tweets per day. Each tweet can consist of up to 140 characters (letter, numbers, etc.). Create a comparison to help understand the amount of tweets in a year by imagining each character was a drop of water and comparing to filling something up.

46. The photo sharing site Flickr had 2.7 billion photos in June 2012. Create a comparison to understand this number by assuming each picture is about 2 megabytes in size, and comparing to the data stored on other media like DVDs, iPods, or flash drives.

47. Your chocolate milk mix says to use 4 scoops of mix for 2 cups of milk. After pouring in the milk, you start adding the mix, but get distracted and accidentally put in 5 scoops of mix. How can you adjust the mix if:

- There is still room in the cup?
- The cup is already full?

48. A recipe for sabayon calls for 2 egg yolks, 3 tablespoons of sugar, and  $\frac{1}{4}$  cup of white wine. After cracking the eggs, you start measuring the sugar, but accidentally put in 4 tablespoons of sugar. How can you compensate?

49. The Deepwater Horizon oil spill resulted in 4.9 million barrels of oil spilling into the Gulf of Mexico. Each barrel of oil can be processed into about 19 gallons of gasoline. How many cars could this have fueled for a year? Assume an average car gets 20 miles to the gallon, and drives about 12,000 miles in a year.

50. The store is selling lemons at 2 for \$1. Each yields about 2 tablespoons of juice. How much will it cost to buy enough lemons to make a 9-inch lemon pie requiring  $\frac{1}{2}$  cup of lemon juice?

51. A piece of paper can be made into a cylinder in two ways: by joining the short sides together, or by joining the long sides together[7]. Which cylinder would hold more? How much more?

52. Which of these glasses contains more liquid? How much more?

In the next 4 questions, estimate the values by making reasonable approximations for unknown values, or by doing some research to find reasonable values.

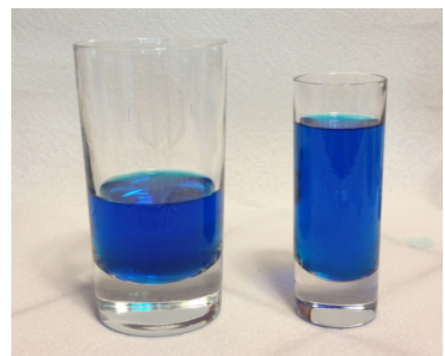
53. Estimate how many gallons of water you drink in a year.

54. Estimate how many times you blink in a day.

55. How much does the water in a 6-person hot tub weigh?

56. How many gallons of paint would be needed to paint a two-story house 40 ft long and 30 ft wide?

57. During the landing of the Mars Science Laboratory *Curiosity*, it was reported that the signal from the rover would take 14 minutes to reach earth. Radio signals travel at the speed of light, about 186,000 miles per second. How far was Mars from Earth when *Curiosity* landed?



58. It is estimated that a driver takes, on average, 1.5 seconds from seeing an obstacle to reacting by applying the brake or swerving. How far will a car traveling at 60 miles per hour travel (in feet) before the driver reacts to an obstacle?
59. The flash of lightning travels at the speed of light, which is about 186,000 miles per second. The sound of lightning (thunder) travels at the speed of sound, which is about 750 miles per hour.
- If you see a flash of lightning, then hear the thunder 4 seconds later, how far away is the lightning?
  - Now let's generalize that result. Suppose it takes  $n$  seconds to hear the thunder after a flash of lightning. How far away is the lightning, in terms of  $n$ ?
60. Sound travels about 750 miles per hour. If you stand in a parking lot near a building and sound a horn, you will hear an echo.
- Suppose it takes about  $\frac{1}{2}$  a second to hear the echo. How far away is the building?[8]?
  - Now let's generalize that result. Suppose it takes  $n$  seconds to hear the echo. How far away is the building, in terms of  $n$ ?
61. It takes an air pump 5 minutes to fill a twin sized air mattress (39 by 8.75 by 75 inches). How long will it take to fill a queen sized mattress (60 by 8.75 by 80 inches)?
62. It takes your garden hose 20 seconds to fill your 2-gallon watering can. How long will it take to fill
- An inflatable pool measuring 3 feet wide, 8 feet long, and 1 foot deep.[9]
  - A circular inflatable pool 13 feet in diameter and 3 feet deep.[10]
63. You want to put a 2" thick layer of topsoil for a new 20'x30' garden. The dirt store sells by the cubic yards. How many cubic yards will you need to order?
64. A box of Jell-O costs \$0.50, and makes 2 cups. How much would it cost to fill a swimming pool 4 feet deep, 8 feet wide, and 12 feet long with Jell-O? (1 cubic foot is about 7.5 gallons)
65. You read online that a 15 ft by 20 ft brick patio would cost about \$2,275 to have professionally installed. Estimate the cost of having a 18 by 22 ft brick patio installed.
66. I was at the store, and saw two sizes of avocados being sold. The regular size sold for \$0.88 each, while the jumbo ones sold for \$1.68 each. Which is the better deal?



67. The grocery store has bulk pecans on sale, which is great since you're planning on making 10 pecan pies for a wedding. Your recipe calls for  $1\frac{3}{4}$  cups pecans per pie. However, in the bulk section there's only a scale available, not a measuring cup. You run over to the baking aisle and find a bag of pecans, and look at the nutrition label to gather some info. How many pounds of pecans should you buy?

Nutrition Facts	
Serving Size: 1 cup, halves (99 g)	
Servings per Container: about 2	
Amount Per Serving	
<b>Calories</b> 684	Calories from Fat 596
% Daily Value*	
<b>Total Fat</b> 71g	110%
Saturated Fat 6g	31%
Trans Fat	
<b>Cholesterol</b> 0mg	0%

68. Soda is often sold in 20 ounce bottles. The nutrition label for one of these bottles is shown to the right. A packet of sugar (the kind they have at restaurants for your coffee or tea) typically contain 4 grams of sugar in the U.S. Drinking a 20 oz soda is equivalent to eating how many packets of sugar?[11]

Nutrition Facts	
Serving Size: 8 fl oz (240 mL)	
Servings Per Container: about 2.5	
Amount Per Serving	
Calories 110	
	% Daily Value*
Total Fat 0g	0%
Sodium 70mg	3%
Total Carbohydrate 31g	10%
Sugars 30g	
Protein 0g	

For the next set of questions, *first* identify the information you need to answer the question, and *then* turn to the end of the section to find that information. The details may be imprecise; answer the question the best you can with the provided information. Be sure to justify your decision.

69. You're planning on making 6 meatloafs for a party. You go to the store to buy breadcrumbs, and see they are sold by the canister. How many canisters do you need to buy?

70. Your friend wants to cover their car in bottle caps, like in this picture.[12] How many bottle caps are you going to need?



71. You need to buy some chicken for dinner tonight. You found an ad showing that the store across town has it on sale for \$2.99 a pound, which is cheaper than your usual neighborhood store, which sells it for \$3.79 a pound. Is it worth the extra drive?

72. I have an old gas furnace, and am considering replacing it with a new, high efficiency model. Is upgrading worth it?

73. Janine is considering buying a water filter and a reusable water bottle rather than buying bottled water. Will doing so save her money?

74. Marcus is considering going car-free to save money and be more environmentally friendly. Is this financially a good decision?

For the next set of problems, research or make educated estimates for any unknown quantities needed to answer the question.

75. You want to travel from Tacoma, WA to Chico, CA for a wedding. Compare the costs and time involved with driving, flying, and taking a train. Assume that if you fly or take the train you'll need to rent a car while you're there. Which option is best?

76. You want to paint the walls of a 6ft by 9ft storage room that has one door and one window. You want to put on two coats of paint. How many gallons and/or quarts of paint should you buy to paint the room as cheaply as possible?

77. A restaurant in New York tiled their floor with pennies[13]. Just for the materials, is this more expensive than using a more traditional material like ceramic tiles? If each penny has to be laid by hand, estimate how long it would take to lay the pennies for a 12ft by 10ft room. Considering material and labor costs, are pennies a cost-effective replacement for ceramic tiles?

78. You are considering taking up part of your back yard and turning it into a vegetable garden, to grow broccoli, tomatoes, and zucchini. Will doing so save you money, or cost you more than buying vegetables from the store?

79. Barry is trying to decide whether to keep his 1993 Honda Civic with 140,000 miles, or trade it in for a used 2008 Honda Civic. Consider gas, maintenance, and insurance costs in helping him make a decision.

80. Some people claim it costs more to eat vegetarian, while some claim it costs less. Examine your own grocery habits, and compare your current costs to the costs of switching your diet (from omnivore to vegetarian or vice versa as appropriate). Which

diet is more cost effective based on your eating habits?

### Info for the breadcrumbs question

How much breadcrumbs does the recipe call for?

It calls for 1½ cups of breadcrumbs.

How many meatloafs does the recipe make?

It makes 1 meatloaf.

How many servings does that recipe make?

It says it serves 8.

How big is the canister?

It is cylindrical, 3.5 inches across and 7 inches tall.

What is the net weight of the contents of 1 canister?

15 ounces.

How much does a cup of breadcrumbs weigh?

I'm not sure, but maybe something from the nutritional label will help.

Nutrition Facts	
Serving Size: 1/3 cup (30g)	
Servings per Container: about 14	
Amount Per Serving	
Calories 110	Calories from Fat 15
% Daily Value*	
Total Fat 1.5g	2%

How much does a canister cost?

\$2.39

### Info for bottle cap car

What kind of car is that?

A 1993 Honda Accord.

How big is that car / what are the dimensions? Here is some details from MSN autos:

Weight: 2800lb Length: 185.2 in Width: 67.1 in Height: 55.2 in

How much of the car was covered with caps?

Everything but the windows and the underside.

How big is a bottle cap?

Caps are 1 inch in diameter.

### Info for chicken problem

How much chicken will you be buying?

Four pounds

How far are the two stores?

My neighborhood store is 2.2 miles away, and takes about 7 minutes. The store across town is 8.9 miles away, and takes about 25 minutes.

What kind of mileage does your car get?

It averages about 24 miles per gallon in the city.

How many gallons does your car hold?

About 14 gallons

How much is gas?

About \$3.69/gallon right now.

### Info for furnace problem

How efficient is the current furnace?

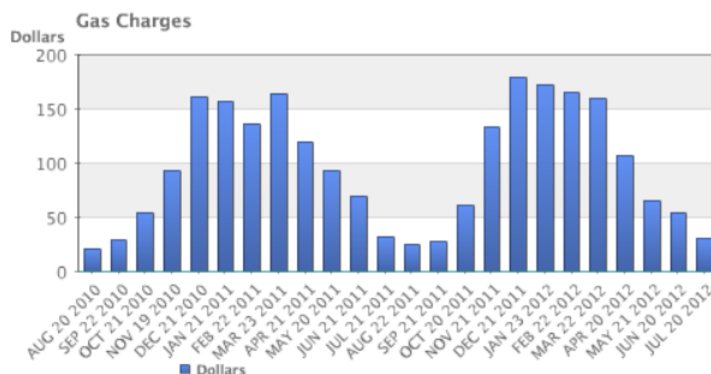
It is a 60% efficient furnace.

How efficient is the new furnace?

It is 94% efficient.

What is your gas bill?

Here is the history for 2 years:

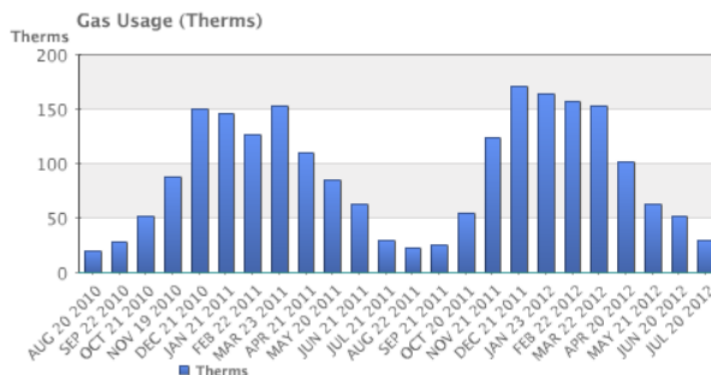


How much do you pay for gas?

There is \$10.34 base charge, plus \$0.39097 per Therm for a delivery charge, and \$0.65195 per Therm for cost of gas.

How much gas do you use?

Here is the history for 2 years:



How much does the new furnace cost?

It will cost \$7,450.

How long do you plan to live in the house?

Probably at least 15 years.

### Info for water filter problem

How much water does Janine drink in a day?



She normally drinks 3 bottles a day, each 16.9 ounces.

How much does a bottle of water cost?

She buys 24-packs of 16.9 ounce bottles for \$3.99.

How much does a reusable water bottle cost?

About \$10.

How long does a reusable water bottle last?

Basically forever (or until you lose it).

How much does a water filter cost? How much water will they filter?

- A faucet-mounted filter costs about \$28. Refill filters cost about \$33 for a 3-pack. The box says each filter will filter up to 100 gallons (378 liters)
- A water filter pitcher costs about \$22. Refill filters cost about \$20 for a 4-pack. The box says each filter lasts for 40 gallons or 2 months
- An under-sink filter costs \$130. Refill filters cost about \$60 each. The filter lasts for 500 gallons.

### Info for car-free problem

Where does Marcus currently drive? He:

- Drives to work 5 days a week, located 4 miles from his house.
- Drives to the store twice a week, located 7 miles from his house.
- Drives to other locations on average 5 days a week, with locations ranging from 1 mile to 20 miles.
- Drives to his parent's house 80 miles away once a month.

How will he get to these locations without a car?

- For work, he can walk when it's sunny and he gets up early enough. Otherwise he can take a bus, which takes about 20 minutes
- For the store, he can take a bus, which takes about 35 minutes.
- Some of the other locations he can bus to. Sometimes he'll be able to get a friend to pick him up. A few locations he is able to walk to. A couple locations are hard to get to by bus, but there is a ZipCar (short term car rental) location within a few blocks.
- He'll need to get a ZipCar to visit his parents.

How much does gas cost?

About \$3.69/gallon.

How much does he pay for insurance and maintenance?

- He pays \$95/month for insurance.
- He pays \$30 every 3 months for an oil change, and has averaged about \$300/year for other maintenance costs.

How much is he paying for the car?

- He's paying \$220/month on his car loan right now, and has 3 years left on the loan.
- If he sold the car, he'd be able to make enough to pay off the loan.
- If he keeps the car, he's planning on trading the car in for a newer model in a couple years.

What mileage does his car get?

About 26 miles per gallon on average.

How much does a bus ride cost?

\$2.50 per trip, or \$90 for an unlimited monthly pass.

How much does a ZipCar rental cost?

- The "occasional driving plan": \$25 application fee and \$60 annual fee, with no monthly commitment. Monday-Thursday the cost is \$8/hour, or \$72 per day. Friday-Sunday the cost is \$8/hour or \$78/day. Gas, insurance, and 180 miles are included in the cost. Additional miles are \$0.45/mile.
- The "extra value plan": Same as above, but with a \$50 monthly commitment, getting you a 10% discount on the usage costs.



- [1] <http://www.cnn.com/2010/SHOWBIZ/Musi...les/index.html>
- [2] <http://www.cnn.com/2012/06/27/politi...are/index.html>
- [3] <http://www.politico.com/news/stories/0712/78134.html>
- [4] <http://factcheck.org/2012/07/twistin...th-care-taxes/>
- [5] [www.northjersey.com/news/opin...tml?c=y&page=2](http://www.northjersey.com/news/opin...tml?c=y&page=2)
- [6] <http://www.the-numbers.com/movies/records/budgets.php>
- [7] [vimeo.com/42501010](http://vimeo.com/42501010)
- [8] [vimeo.com/40377128](http://vimeo.com/40377128)
- [9] <http://www.youtube.com/watch?v=DlkwefReHZc>
- [10] <http://www.youtube.com/watch?v=p9SABH7Yg9M>
- [11] <http://www.youtube.com/watch?v=62JMfv0tf3Q>
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- [13] <http://www.notcot.com/archives/2009/...-of-pennie.php>

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