Name _____ Date _____

RATE

A **rate** is a ratio of changes in two different quantities that change together. Speed is a rate because one quantity -- the distance an object travels -- changes in relation to another quantity -- time. The following algorithm is used to determine an object's average speed.

$$\text{Average Speed} = \frac{\text{distance traveled}}{\text{time elapsed}}$$

Use the algorithm to complete the table. Write your answer in miles per hour or kilometers per hour.

Distance	Time	Average Speed
329 miles	7 hours	**1.** _____
203 miles	3 hours 30 minutes	**2.** _____
77.5 miles	1 hour 15 minutes	**3.** _____
4.5 miles	30 minutes	**4.** _____
117 miles	2 hours 15 minutes	**5.** _____
345 miles	5 hours 45 minutes	**6.** _____
192 kilometers	3 hours	**7.** _____
2.5 kilometers	30 minutes	**8.** _____
104 kilometers	6 hours 30 minutes	**9.** _____
90 kilometers	2 hours 15 minutes	**10.** _____

Solve.

11. You are traveling in a train. The train has traveled 45 miles from the last stop in 36 minutes. What is the average speed of the train?

_____

12. Your mother is driving you from home to a soccer game. She is driving at an average speed of 35 miles per hour. If it takes 15 minutes to get to the game, how far away from your home is the game?

_____

Name _____ Date _____

Discovery EDUCATION

RATE

A **rate** is a ratio of changes in two different quantities that change together. Mileage is a rate because one quantity -- the miles an object travels -- changes in relation to another quantity -- gallons of fuel used. The following algorithm is used to determine mileage.

$$\text{Mileage} = \frac{\text{miles traveled}}{\text{gallons used}}$$

Use the algorithm to complete the table.

Miles Traveled	Gallons of Fuel Used	Mileage (mpg)
108 miles	6 gallons	**1.** _____
275.5 miles	14.5 gallons	**2.** _____
210 miles	7 gallons	**3.** _____
427 miles	15.25 gallons	**4.** _____
115.5 miles	5.25 gallons	**5.** _____
348 miles	12 gallons	**6.** _____
441 miles	14 gallons	**7.** _____
6 miles	0.25 gallons	**8.** _____
564.25 miles	18.5 gallons	**9.** _____
405 miles	15 gallons	**10.** _____

Solve.

11. Editors at a magazine tested a new car's fuel economy in city and highway driving. The car traveled 15 miles in the city and used 0.68 gallon of fuel. On the highway, the car traveled 45 miles and used 1.5 gallons of fuel. How much better is the highway mileage than the city mileage?

_____

12. Another car the editors tested had a highway fuel economy of 25 miles per gallon. If the test was run over 145 highway miles, how many gallons of fuel did the car use to the nearest tenth of a gallon?

_____

Name _____ Date _____

RATE

A **rate** is a ratio of changes in two different quantities that change together. Speed is a rate because one quantity -- the distance an object travels -- changes in relation to another quantity -- time. Mileage is a rate because one quantity the miles an object travels -- changes in relationship to another quantity -- gallons of fuel used. The following algorithms are used to determine average speed and mileage. Use the algorithms to solve the problems.

Average Speed	Mileage
Average Speed $= \frac{\text{distance traveled}}{\text{time elapsed}}$	Mileage $= \frac{\text{miles traveled}}{\text{gallons used}}$

Use the algorithms to solve the problems.

James left Southport at 3:15 p.m. He arrived at Oakdale at midnight. He figured his car traveled 507.5 miles on 18 $\frac{1}{8}$ gallons of gasoline.

1. What was James' average speed?

_____

2. What was his car's mileage?

_____

Mrs. Scott filled her car's gas tank which has a capacity of 16 gallons of gasoline. She then drove 286 miles to visit her daughter in college. When she completed the 5 $\frac{1}{2}$ hour trip, the car had half a tank of gasoline.

3. What was Mrs. Scott's average speed?

_____

4. What was her car's mileage?

_____

The distance from Max's home to his office is 48 miles. While commuting during a 5-day work-week, he uses 1 $\frac{1}{2}$ tanks of gasoline.

5. If the car's tank holds a maximum of 16 gallons of gasoline, what is its mileage?

_____

6. If the roundtrip takes Max 1 hour 45 minutes, what is his average speed rounded to the nearest mile per hour?

_____

Every Tuesday, Amy drives the same 178 mile route. Some days, the ride can take her 3 hours 15 minutes. Other days, the ride can take as long as 5 hours 45 minutes.

7. What is Amy's range of speeds for the trip rounded to the nearest mile per hour?

_____

8. If Amy uses 6 gallons of gasoline for the trip, what is her car's mileage?

_____

Name _____ Date _____

PERIMETER AND AREA OF SHAPES

Perimeter is the distance around the outside of a closed figure. You find the perimeter of a figure by adding the lengths of its sides.

Tasha made a square quilt that is 3.5 feet on a side. She wants to put lace around the edges of her quilt. How much lace should she buy?

1. What is a square? _____

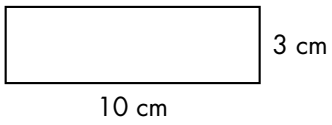
2. What is the length of one side of Tasha's quilt? _____

3. How can you determine the total distance around the outside of the quilt or its perimeter? _____

4. How much lace should Tasha buy? _____

Find the perimeter of each closed figure.

5.

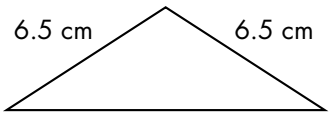


_____

6.

_____

7.



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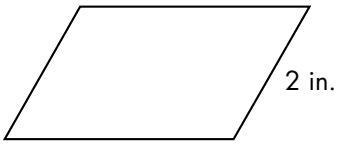

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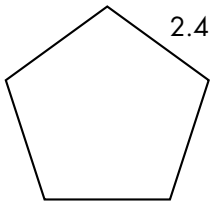
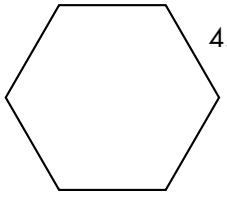


_____

10.

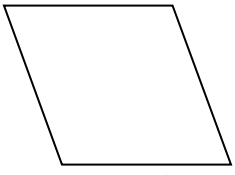
_____

11.



_____

12.



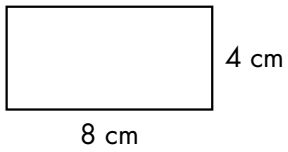
_____

Name _____ Date _____

PERIMETER AND AREA OF SHAPES

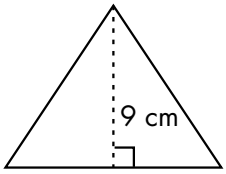
Area is the number of square units inside a closed figure. To find the areas of different closed figures, use these formulas.

Rectangle



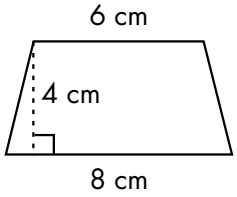
$A = l \times w$
$A = 8 \times 4$
$A = 32$
$32\ cm^2$

Triangle



$A = \frac{1}{2}(b \times h)$
$A = \frac{1}{2}(12 \times 9)$
$A = \frac{1}{2}(108)$
$A = 54$
$54\ cm^2$

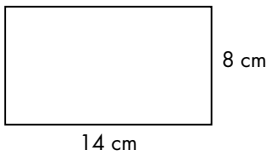
Trapezoid



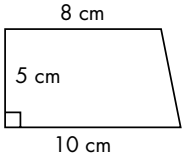
$A = \frac{1}{2}h(b_1 + b_2)$
$A = \frac{1}{2} \times 4(6 + 8)$
$A = \frac{1}{2} \times 4(14)$
$A = \frac{1}{2} \times 56$
$A = 28$
$28\ cm^2$

Use the appropriate formula to find the area of each figure.

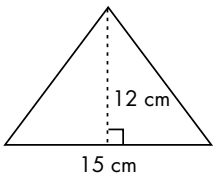
1. _____



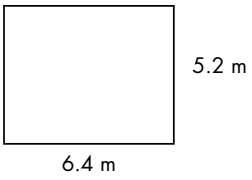
2. _____



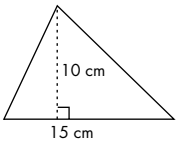
3. _____



4. _____



5. _____



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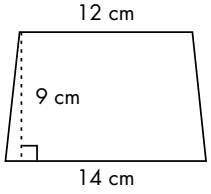
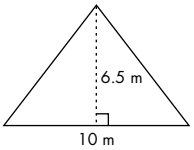
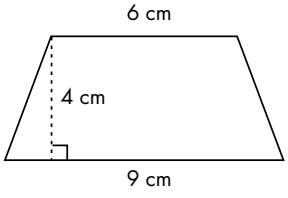


7. _____



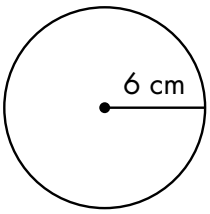
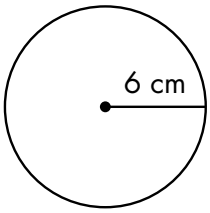
8. _____



Name _____ Date _____

PERIMETER AND AREA OF SHAPES

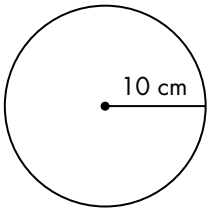
Circumference is the distance around the outside of a circle. **Area** is the number of square units inside a closed figure. Use these formulas to find the circumference or area of any circle. Round the answer to the nearest whole number, since we're using an estimate for π.

Circumference	Area
$C = 2\ \pi\ r$ or $C = \pi\ d$ Use 3.14 for π.	$A = \pi r^2$ Use 3.14 for π.
 $C = 2 \times 3.14 \times 6$ $C = 6.28 \times 6$ $C = 37.68 \approx 38$ 38cm	 $A = 3.14 \times 6^2$ $A = 3.14 \times 36$ $A = 113.04 \approx 113$ $113\ cm^2$

Use the formulas to find the circumference and area of each circle. Round answers to the nearest whole number.

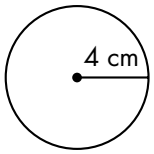
1. Circumference _____

2. Area _____



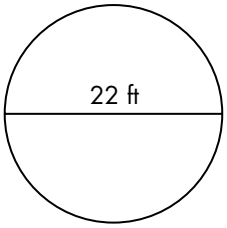
3. Circumference _____

4. Area _____



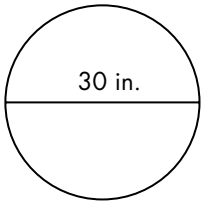
5. Circumference _____

6. Area _____



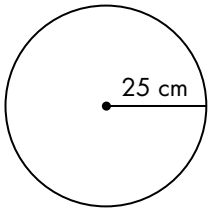
7. Circumference _____

8. Area _____



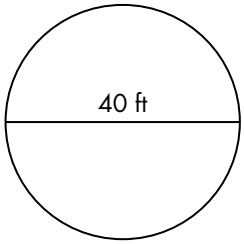
9. Circumference _____

10. Area _____



11. Circumference _____

12. Area _____

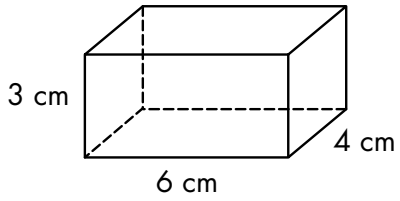


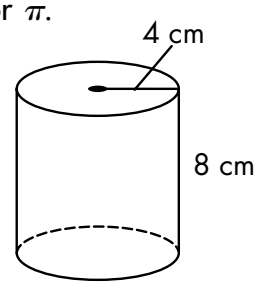
Name _____ Date _____

AREA AND VOLUME RELATIONSHIPS AND FORMULAS

Volume is the amount of space inside a three-dimensional figure expressed in cubic units. You can use the following formulas to calculate the volume of a prism or a cylinder.

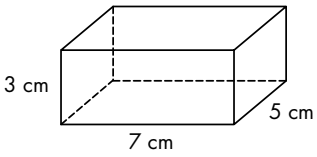
Rectangular Prism	Cylinder
$V = l \times w \times h$	$V = \pi r^2 h$ Use 3.14 for π.
$V = l \times w \times h$ $V = 6 \times 4 \times 3$ $V = 72$ $72\ cm^3$	$V = \pi r^2 h$ $V = 3.14 \times 16 \times 8$ $V = 401.92 \approx 402$ $402\ cm^3$



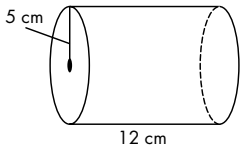


Use the formulas to find the volume of each three-dimensional figure. Round each answer to the nearest whole number.

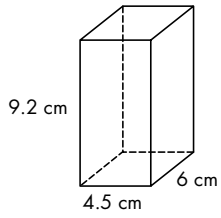
1. _____



2. _____



3. _____



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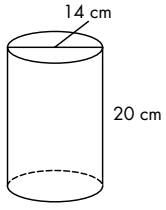

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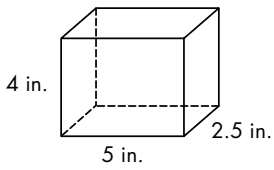

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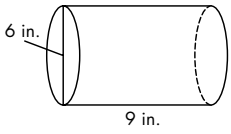

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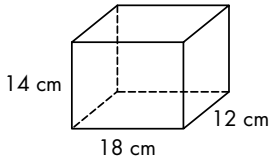

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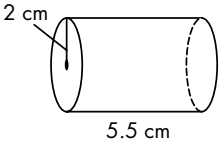
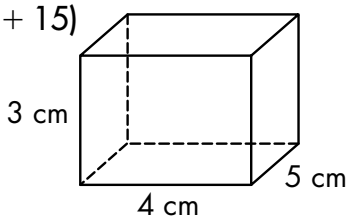


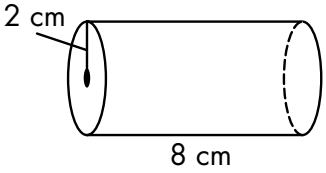
Name _____ Date _____

AREA AND VOLUME RELATIONSHIPS AND FORMULAS

Surface area is the total area of the faces, or surfaces, of a solid figure. You can use the following formulas to calculate the surface area of a rectangular prism or a cylinder.

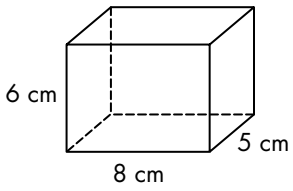
Rectangular Prism	Cylinder
$S = 2(lh + lw + wh)$	$S = 2(\pi r^2) + (2\ \pi rh)$ Use 3.14 for π.
$S = 2(lh + lw + wh)$ $S = 2(12 + 20 + 15)$ $S = 2(47)$ $S = 94$ 94 cm^2	$S = 2(\pi r^2) + (2\ \pi rh)$ $S = 2(12.56) + (100.48)$ $S = 2(12.56) + (100.48)$ $S = 25.12 + 100.48$ $S = 125.6 \approx 126$ 126 cm^2



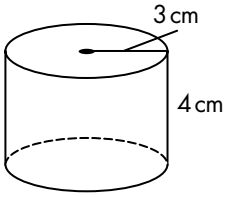


Use the formulas to find the surface area of each three-dimensional figure. Round each answer to the nearest whole number.

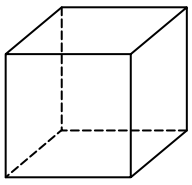
1. _____



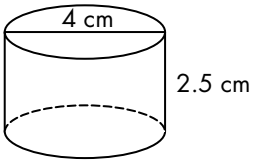
2. _____



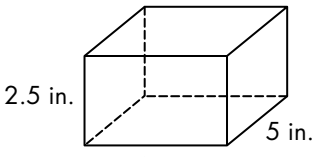
3. _____



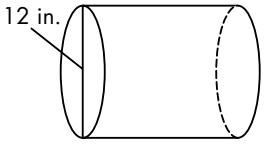
4. _____



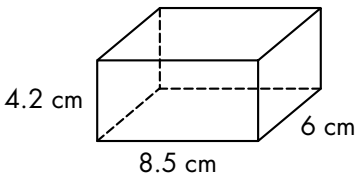
5. _____



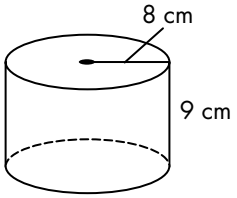
6. _____



7. _____



8. _____



Name _____ Date _____

AREA AND VOLUME RELATIONSHIPS AND FORMULAS

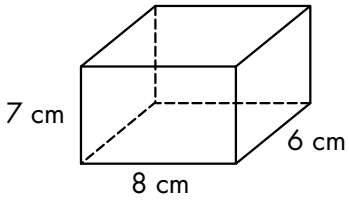
Volume is the amount of space inside a three-dimensional figure expressed in cubic units. **Surface area** is the total areas of the faces, or surfaces, of a solid figure. You can use the following formulas to calculate the volume and surface area of a rectangular prism or a cylinder.

Rectangular Prism	Cylinder
$V = l \times w \times h$ $S = 2(lh + lw + wh)$	$V = \pi r^2 h$ Use 3.14 for π. $S = 2(\pi r^2) + (2\pi rh)$

Use the formulas to find the volume and surface area of each three-dimensional figure. Round your answers to the nearest whole number.

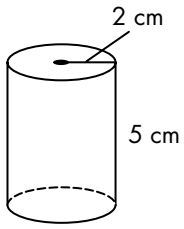
1. Volume _____

2. Surface Area _____



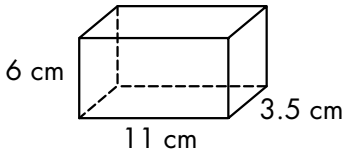
3. Volume _____

4. Surface Area _____



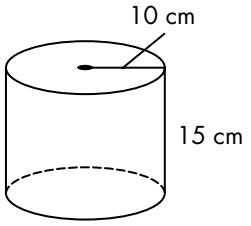
5. Volume _____

6. Surface Area _____



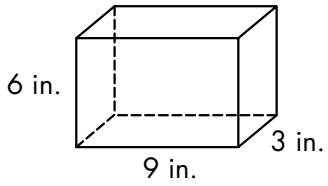
7. Volume _____

8. Surface Area _____



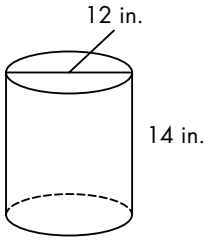
9. Volume _____

10. Surface Area _____



11. Volume _____

12. Surface Area _____



Name _____ Date _____

PROBLEM SOLVING WITH UNITS AND CONVERSION

Customary Units of Length	
1 foot (ft) = 12 inches (in.)	1 mile (mi) = 5,280 feet (ft)
1 yard (yd) = 36 inches (in.)	1 mile (mi) = 1,760 yards (yd)
1 yard (yd) = 3 feet (ft)	

Convert the measure to the given unit.

1. 36 in. = _____ ft	**2.** 2 mi = _____ yd
3. 5 yd = _____ in.	**4.** 52,800 ft = _____ mi
5. $2\frac{1}{2}$ ft = _____ in.	**6.** 6 yd = _____ ft
7. 72 in. = _____ ft	**8.** 5 ft = _____ in.
9. $3\frac{1}{2}$ yd = _____ in.	**10.** 6 mi = _____ ft
11. 156 in. = _____ ft	**12.** 4,400 yd = _____ mi
13. 51 ft = _____ yd	**14.** 324 in. = _____ yd
15. 108 in = _____ ft	**16.** 5 mi = _____ yd
17. $2\frac{3}{4}$ yd = _____ ft	**18.** $1\frac{7}{8}$ ft = _____ in.

Solve.

19. A road crew is putting signs on a 5 mile road. The first sign is at the start of the road. Then they will place a sign every 500 yards. How many signs do they need? (Hint: Don't forget to include the first sign.)

_____

20. A carpenter has a board that is 15 feet long. She cuts pieces that are 1 yard long. How many 1 yard-long pieces will she have? How much will be left of the original board?

_____

Name _____ Date _____

PROBLEM SOLVING WITH UNITS AND CONVERSION

Customary Units of Capacity and Weight

Capacity	Weight
8 fluid ounces (fl oz) = 1 cup (c)	16 ounces (oz) = 1 pound (lb)
2 cups (c) = 1 pint (pt)	2,000 pounds (lb) = 1 ton (t)
2 pints (pt) = 1 quart (qt)	
4 quarts (qt) = 1 gallon (gal)	

Convert the measure to the given unit.

1. 10,000 lb = _____ t	**2.** 48 oz = _____ lb
3. 7 gal = _____ qt	**4.** 32 c = _____ gal
5. 3 c = _____ fl oz	**6.** $2\frac{1}{2}$ gal = _____ qt
7. 10 pt = _____ c	**8.** 28 pt = _____ qt
9. 112 fl oz = _____ pt	**10.** $4\frac{1}{2}$ t = _____ lb
11. 32 pt = _____ gal	**12.** 2 gal = _____ fl oz
13. 88 oz = _____ lb	**14.** $3\frac{1}{4}$ t = _____ lb
15. 2 gal = _____ c	**16.** 256 oz = _____ lb
17. 8.5pt = _____ lb	**18.** 12 pt = _____ c

Solve.

19. A restaurant uses 1 pint of milk to make a milkshake. A party has ordered 14 milkshakes. The restaurant has 6 quarts of milk. Is there enough milk to make the milkshakes? If not, how much milk is needed to complete the order?

_____

20. Hoshi buys a six-pack of 12-ounce bottles of water. Debra buys a half-gallon bottle of water. Who buys more water? How much more?

_____

Name _____ Date _____

PROBLEM SOLVING WITH UNITS AND CONVERSION

Metric Units of Length

1 kilometer (km) = 1,000 meters (m)	1 meter (m) = 1,000 millimeters (mm)
1 meter (m) = 10 decimeters (dm)	1 centimeter (cm) = 10 millimeters (mm)
1 meter (m) = 100 centimeters (cm)	

Convert the measure to the given unit.

1. 7 km = _____ m	**2.** 38 cm = _____ m
3. 4 m = _____ mm	**4.** 2.5 km = _____ m
5. 13 cm = _____ dm	**6.** 75 dm = _____ m
7. 800 m = _____ km	**8.** 900 cm = _____ m
9. 317 mm = _____ dm	**10.** 6.8 m = _____ cm
11. 9.2 km = _____ mm	**12.** 1.36 dm = _____ mm
13. 0.42 km = _____ cm	**14.** 95 m = _____ km
15. 380 cm = _____ m	**16.** 25 mm = _____ cm
17. 6.4 dm = _____ cm	**18.** 0.58 km = _____ dm

Solve.

19. Eric is running a 10,000 meter race. What is the length of the race in kilometers?

_____

20. The length of an insect is given as 0.3 centimeters. How long is the insect in millimeters?

_____

Name _____ Date _____

ACCURACY, PRECISION AND SIGNIFICANT DIGITS

Precision is how close you can come to the same measurement when you measure something over and over. Generally, the smaller the unit of measure marked on the measuring instrument, the more precise the measurement can be—you can repeat the measurement reliably to within a smaller interval.

Identify the more precise measurement.

1. $4\frac{1}{2}$ feet 54 inches	**2.** 28 feet 9 yards
3. seven-eighths of an inch one half-inch	**4.** 2 yards 73 inches
5. 5,278 feet 1 mile	**6.** $2\frac{3}{4}$ feet $33\frac{1}{4}$ inches
7. 2 miles 3,519 yards	**8.** $13\frac{1}{2}$ feet $4\frac{1}{3}$ yards
9. 5 feet 59 inches	**10.** 6,599 feet $1\frac{1}{4}$ miles

Solve.

11. Kevin and Tamiko are measuring the length of the same line segment. Kevin has a ruler marked in intervals $\frac{1}{16}$ of an inch apart. Tamiko has a ruler marked in intervals $\frac{1}{8}$ of an inch apart. If both measure the line segment correctly, who will typically give the more precise measurement?

_____

12. In part of a women's triathlon the contestants cycle for 12.4 miles and run for 3.1 miles. Which is a more precise measure? Explain.

_____

_____

_____

Name _____ Date _____

ACCURACY, PRECISION AND SIGNIFICANT DIGITS

Precision is how close you can come to the same measurement when you measure something over and over. Generally, the smaller the unit of measure marked on the measuring instrument, the more precise the measurement can be—you can repeat the measurement to within a smaller interval.

Identify the more precise measurement.

1. 6.2 m	619 cm	**2.** 37 mm	4 cm
3. 2,011 m	2 km	**4.** 18 cm	177 mm
5. 79 cm	8 dm	**6.** 1,899 m	1.9 km
7. 57 mm	0.06 m	**8.** 21 m	0.02 km
9. 18 mm	2 cm	**10.** 384 dm	3.9 m
11. 83 m	0.08 km	**12.** 11 cm	113 mm

Solve.

13. Which measurement of a board would be most precise: 3 feet or 36 $\frac{1}{2}$ inches? Explain.

_____

Name _____ Date _____

ACCURACY, PRECISION AND SIGNIFICANT DIGITS

Accuracy is how close a measurement is to the actual value. **Precision** is how close you can get to the same measurement in repeated measurements. The accuracy and precision of a measurement are shown by its number of significant digits. **Significant digits** are the number of digits used to express a measurement that are not zero at the beginning or end of the number.

As the accuracy and/or precision of a number increases, the number of significant digits used to express it increases to reflect the greater accuracy or precision.

A measurement was made, of an object with a meter stick marked in cm only, resulting in a measurement of 47 cm, and another measurement was made of the same object with a meter stick marked in mm, resulting in a measurement of 47.2 cm. Both meter sticks are equally accurate for where their marking are.

1. Which measurement is accurate to within a smaller interval?

_____

Identify the number of significant digits in each measurement.

2. measurement: 92.45 m
Unit: 0.01 m

_____

3. measurement: 7.5 cm
Unit: 0.1 cm

_____

4. measurement: 5.678 ft
Unit: 0.001 ft

_____

5. measurement: 349.24 km
Unit: 0.01 km

_____

Identify the measurement that is expressed with a precision of a smaller interval.

6. Measurement: 17.5 cm Unit: 0.1 cm
Measurement: 17.55 cm Unit: 0.01 cm

_____

7. Measurement: 6.892 m Unit: 0.001 m
Measurement: 6.89 m Unit: 0.01 m

_____

Name _____ Date _____

ACCURACY AND TOOL CHOICE

When making a measurement, you should select a tool that will provide the appropriate precision and accuracy. **Precision** is how close you can come to the same measurement when you measure something over and over. **Accuracy** is how close a measurement is to the actual value.

Identify the tool that will yield a more precise, accurate measurement, assuming that the tools described are equally accurate for the units that they measure.

1. Mia needs to measure the height of her desk. Should she use a meter stick marked in cm, or a meter stick marked in mm?

_____

2. A jeweler wants to measure the mass of a diamond. Should he use a pan balance (like the one in the grocery store) or a carat scale?

_____

3. Sue is measuring the thickness of her math book. Should she use a ruler marked to the $\frac{1}{16}$ inch or a yardstick marked to the $\frac{1}{4}$ inch to measure the thickness of the book?

_____

4. Dan is measuring the thickness of a coin. Should he use a ruler marked in millimeters or one marked in centimeters?

_____

Which unit of measure will generally yield a more precise, accurate measurement assuming that the tool used to measure is accurate, and no fractional or decimal values are used beyond those noted.

5. Length of a school bus
1 yard 1 foot

_____

6. Mass of a leaf
1 milligram 1 kilogram

_____

7. Capacity of a mug
1 fluid ounce 1 pint

_____

8. Width of your hand
1 inch $\frac{1}{4}$ inch

_____

Name _____ Date _____

ACCURACY AND TOOL CHOICE

When making a measurement, you should select a unit of measure that will provide the appropriate precision and accuracy. **Precision** is how close you can come to the same measurement when you measure something over and over. **Accuracy** is how close a measurement is to the actual value.

Which unit is best suited for each measurement, presuming a desire to minimize the use of decimal or fractional values?

1. Air temperature for the purpose of deciding whether to wear a jacket
1 degree 0.1 degree

2. Mass of a gold necklace for the purpose of determing the value of the gold in it
1 gram 1 milligram

3. Width of a classroom for the purpose of fitting a rug in it
1 foot 1 yard

4. Capacity of a bathtub for the purpose of knowing roughly how big it is
1 quart 1 gallon

5. Width of a window for the purpose of purchasing a shade for it
$\frac{1}{2}$ inch $\frac{1}{2}$ foot

6. Body temperature for the purpose of determining if someone has a fever
1 degree 0.1 degree

7. Length of a crayon for the purpose of knowing how easy it will be to use, i.e. whether it's getting too small
1 centimeter 0.1 centimeter

8. Distance between towns for the purpose of estimating how long it will take to drive the distance
1 kilometer 0.1 kilometer

9. Weight of a slice of cheese for the purpose of determining exactly what it will cost
1 ounce $\frac{1}{4}$ pound

10. Mass of a puppy for the purpose of determining if it's a healthy size for its age
1 gram 1 kilogram

11. Capacity of a water bottle for the purpose of determining if it can hold enough for a bike ride of a given length
1 liter 1 milliliter

12. Length of an insect for the purpose of a scientific report on the characteristics of the species
1 centimeter 1 millimeter

Name _____ Date _____

ACCURACY AND TOOL CHOICE

When taking a measurement, you should use a unit of measure that will provide the appropriate precision and accuracy. **Precision** is how close you can come to the same measurement when you measure something over and over. **Accuracy** is how close a measurement is to the actual value.

Which unit is best suited for each measurement, presuming a desire to minimize the use of decimal or fractional values, and the number of places in the whole numbers.

1. Weight of a gem for the purpose of describing it to a jeweler who will determine its value
1 carat 1 ounce

_____

2. Capacity of a pitcher for the purpose of deciding if it will hold enough for a dinner for 4 people
1 pint 1 quart

_____

3. Length of a van for the purpose of determining whether it's large enough for moving a particular household
1 meter 1 centimeter

_____

4. Width of a shoe for the purpose of knowing if it will fit your foot
1 meter 1 centimeter

_____

5. Length of a movie for the purpose of planning for a ride to come after it
1 minute 1 second

_____

6. Length of a song for the purpose of planning how much of a 6-minute segment of a radio program it will occupy
1 minute 1 second

_____

7. Swimmer's time for the purpose of comparing her performance to that of a closely-matched teammate
1 second 0.1 second

_____

8. Capacity of a fish tank for the purpose of getting a rough idea of its size for planning a place for it in the house
1 quart 1 gallon

_____

9. Capacity of an eyedropper for the purpose of adding a measured amount of food coloring to a recipe
1 liter 1 milliliter

_____

10. Width of computer screen for the purpose of determining whether a screen protector would fit exactly over it
$\frac{1}{4}$ inch 1 inch

_____

Name _____ Date _____

ESTIMATION TO SOLVE PROBLEMS

An **estimate** is an answer that is close to an actual answer. An **underestimate** is intended to be less than the actual answer. An **overestimate** is intended to be greater than the actual answer.

Estimate the sum of 325 + 578.

Underestimate	**Overestimate**
Round both addends down.	**Round both addends up.**
325 + 578 ⟶ 320 + 570	325 + 578 ⟶ 330 + 580
Find the sum of the rounded addends.	**Find the sum of the rounded addends.**
320 + 570 = 890	330 + 580 = 910

Find a range of estimates by determining an underestimate and an overestimate for each problem. (Round each number up or down to the tens place.)

562 + 318

1. Underestimate: _____

2. Overestimate: _____

3. Range of Estimates: _____

743 + 196

4. Underestimate: _____

5. Overestimate: _____

6. Range of Estimates: _____

679 + 417

7. Underestimate: _____

8. Overestimate: _____

9. Range of Estimates: _____

941 + 863

10. Underestimate: _____

11. Overestimate: _____

12. Range of Estimates: _____

Name _____ Date _____

ESTIMATION TO SOLVE PROBLEMS

An **estimate** is an answer that is close to an actual answer. An **underestimate** is intended to be less than the actual answer. An **overestimate** is intended to be greater than the actual answer.

Underestimate	Overestimate
Addition: Round both addends down. $748 + 231 \longrightarrow 740 + 230$	**Addition:** Round both addends up. $748 + 231 \longrightarrow 750 + 240$
Find the sum of the rounded addends. $740 + 230 = 970$	Find the sum of the rounded addends. $750 + 240 = 990$
Multiplication: Round both factors down. $78 \times 23 \longrightarrow 70 \times 20$	**Multiplication:** Round both factors up. $78 \times 23 \longrightarrow 80 \times 30$
Find the product of the rounded factors. $70 \times 20 = 1{,}400$	Find the product of the rounded factors. $80 \times 30 = 2{,}400$

Find a range of estimates by determining an underestimate and an overestimate for each problem.

36×49	$466 + 854$
1. Underestimate: _____	**4.** Underestimate: _____
2. Overestimate: _____	**5.** Overestimate: _____
3. Range of Estimates: _____	**6.** Range of Estimates: _____
$693 + 255$	53×89
7. Underestimate: _____	**10.** Underestimate: _____
8. Overestimate: _____	**11.** Overestimate: _____
9. Range of Estimates: _____	**12.** Range of Estimates: _____

Name _____ Date _____

ESTIMATION TO SOLVE PROBLEMS

An **estimate** is an answer that is close to an actual answer. An **underestimate** is intended to be less than the actual answer. An **overestimate** is intended to be greater than the actual answer.

Underestimate	Overestimate
Multiplication: Round both factors down. $46 \times 85 \longrightarrow 40 \times 80$ Find the product of the rounded factors. $40 \times 80 = 3{,}200$	**Multiplication:** Round both factors up. $46 \times 85 \longrightarrow 50 \times 90$ Find the product of the rounded factors. $50 \times 90 = 4{,}500$
Division: Use compatible numbers with a dividend that is less than the actual dividend and a divisor that is greater than the actual divisor. $5{,}712 \div 83$ $5{,}400 \div 90 = 60$	**Division:** Use compatible numbers with a dividend that is greater than the actual dividend and a divisor that is less than the actual divisor. $5{,}712 \div 83$ $6{,}400 \div 80 = 80$

Find a range of estimates by determining an underestimate and an overestimate for each problem.

29×54 **1.** Underestimate: _____ **2.** Overestimate: _____ **3.** Range of Estimates: _____	$2{,}675 \div 38$ **4.** Underestimate: _____ **5.** Overestimate: _____ **6.** Range of Estimates: _____
$6{,}592 \div 75$ **7.** Underestimate: _____ **8.** Overestimate: _____ **9.** Range of Estimates: _____	57×66 **10.** Underestimate: _____ **11.** Overestimate: _____ **12.** Range of Estimates: _____

Name _____ Date _____

INDIRECT MEASUREMENT

An **indirect measurement** can be a quick way to estimate size, distance, length, or area. To make an indirect measurement, you compare the unknown quantity to a known quantity indirectly, rather than by direct comparison using a measuring tool.

If each square on the grid is 1 cm^2, estimate the area of the irregular figure.

1. How many whole or nearly whole squares does the figure cover?

_____

2. About how many half squares does the figure cover?

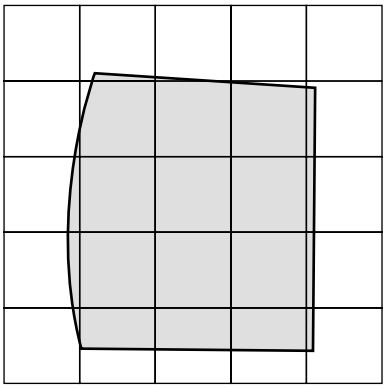
_____

3. Complete this addition sentence to represent the covered squares:

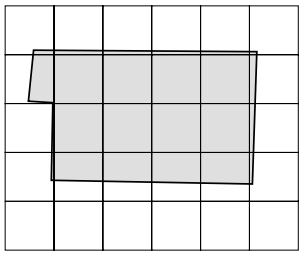
$9 + \frac{1}{2} \times$ _____ = _____

4. What is a reasonable estimate of the area of the irregular figure?

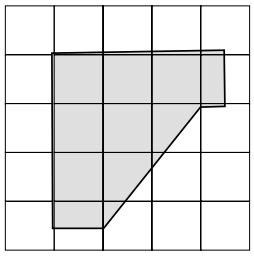
_____



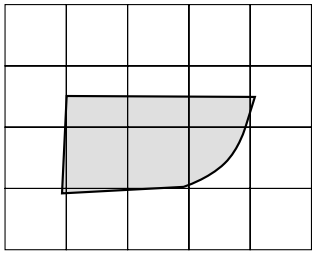
Estimate the area of each irregular figure. Each square on the grid is 1 cm^2.



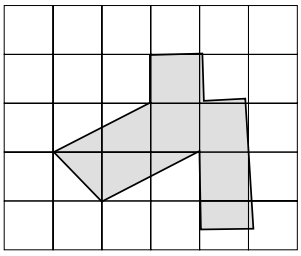
5. _____



6. _____



7. _____



8. _____

DISCOVERING MATH

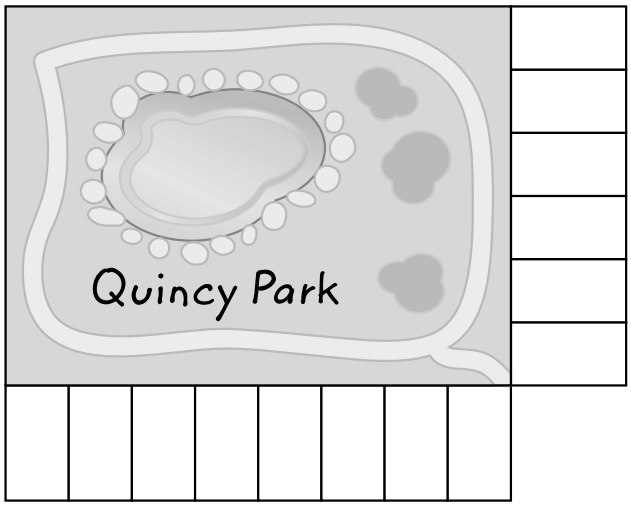
LEVEL 1

Name _____ Date _____

INDIRECT MEASUREMENT

An **indirect measurement** can be a quick way to estimate size, distance, length, or area. To make an indirect measurement, you compare the unknown quantity to a known quantity indirectly, rather than by direct comparison using a measuring tool.

If each parking space is 8 feet across, estimate the perimeter and the area of the park shown below.



1. How many parking spaces run along the width of the park?

_____

2. About how wide is the park if each space is 8 feet wide?

_____

3. How many parking spaces run along the length of the park?

_____

4. About how long is the park?

_____

5. How do you calculate the perimeter of a closed straight-sided figure?

_____

6. Estimate the perimeter of the park.

_____

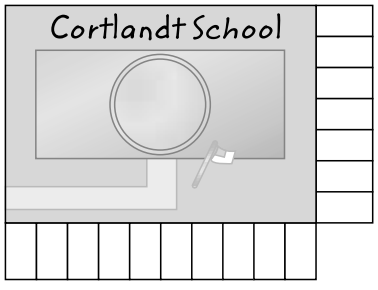
7. How do you calculate the area of a rectangle?

_____

8. Estimate the area of the park.

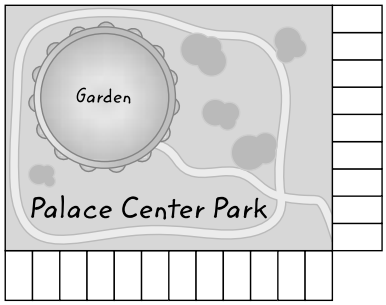
_____

Use indirect measurements to estimate the perimeter and area of each rectangular region. Each parking space is about 8 feet wide.



9. Perimeter _____

10. Area _____



11. Perimeter _____

12. Area _____

Name _____ Date _____

INDIRECT MEASUREMENT

An **indirect measurement** can be a quick way to estimate a measure. Writing and solving a proportion can help you calculate an indirect measurement.

A street sign that's 6 feet tall casts a 4-ft shadow at the same time that a nearby tree casts a 10-ft shadow. How tall is the tree?

- Set up a proportion. Let t represent the height of the tree.
- $\frac{\text{Height of Object}}{\text{Height of Shadow}} \longrightarrow \frac{6}{4} = \frac{t}{10}$
- Find the cross products. $60 = 4t$
- Solve the equation. $\frac{60}{4} = \frac{4t}{4}$
- The tree is 15 feet tall. $15 = t$

Write and solve a proportion to find each indirect measurement.

1. Adam is 5 ft tall. He casts a 6 ft shadow at the same time a fence post casts a 9 ft shadow. What is the approximate height of the fence post?

_____

2. A 3 ft tall shrub casts a $4\frac{1}{2}$ foot shadow. Estimate the length of the shadow cast by a nearby flagpole that is 18 ft tall.

_____

3. Jon casts an 8 ft long shadow at the same time that a 7 ft street sign casts a 10 ft shadow. About how tall is Jon?

_____

4. A 24 ft tall billboard casts a 16 ft shadow. About how tall is a tree that casts a 9-ft shadow at the same time?

_____

5. Kim is 48 inches tall. Her father is 72 inches tall. Estimate the length of Kim's father's shadow if Kim's shadow is 7 ft long at the same time.

_____

6. A 7.5 ft tall fence casts a 20 ft shadow at the same time a plant casts a 4 ft shadow. What is the approximate height of the plant?

_____

Challenge

If you wanted to determine the height of a flagpole during a sunny day, and you had a tape measure, how could you do it without leaving the ground?

_____

_____

_____

Name _____ Date _____

RATE

A **rate** is a ratio of changes in two different quantities that change together. Speed is a rate because one quantity -- the distance an object travels -- changes in relation to another quantity -- time. The following algorithm is used to determine an object's average speed.

$$\text{Average Speed} = \frac{\text{distance traveled}}{\text{time elapsed}}$$

Use the algorithm to complete the table. Write your answer in miles per hour or kilometers per hour.

Distance	Time	Average Speed
329 miles	7 hours	**1.** [47 mph]
203 miles	3 hours 30 minutes	**2.** [58 mph]
77.5 miles	1 hour 15 minutes	**3.** [62 mph]
4.5 miles	30 minutes	**4.** [9 mph]
117 miles	2 hours 15 minutes	**5.** [52 mph]
345 miles	5 hours 45 minutes	**6.** [60 mph]
192 kilometers	3 hours	**7.** [64 kph]
2.5 kilometers	30 minutes	**8.** [5 kph]
104 kilometers	6 hours 30 minutes	**9.** [16 kph]
90 kilometers	2 hours 15 minutes	**10.** [40 kph]

Solve.

11. You are traveling in a train. The train has traveled 45 miles from the last stop in 36 minutes. What is the average speed of the train?

[75 mph]

12. Your mother is driving you from home to a soccer game. She is driving at an average speed of 35 miles per hour. If it takes 15 minutes to get to the game, how far away from your home is the game?

[8.75 miles]

Name _____ Date _____

Discovery EDUCATION

RATE

A **rate** is a ratio of changes in two different quantities that change together. Mileage is a rate because one quantity -- the miles an object travels -- changes in relation to another quantity -- gallons of fuel used. The following algorithm is used to determine mileage.

$$\text{Mileage} = \frac{\text{miles traveled}}{\text{gallons used}}$$

Use the algorithm to complete the table.

Miles Traveled	Gallons of Fuel Used	Mileage (mpg)
108 miles	6 gallons	**1.** [18 mpg]
275.5 miles	14.5 gallons	**2.** [19 mpg]
210 miles	7 gallons	**3.** [30 mpg]
427 miles	15.25 gallons	**4.** [28 mpg]
115.5 miles	5.25 gallons	**5.** [22 mpg]
348 miles	12 gallons	**6.** [29 mpg]
441 miles	14 gallons	**7.** [31.5 mpg]
6 miles	0.25 gallons	**8.** [24 mpg]
564.25 miles	18.5 gallons	**9.** [30.5 mpg]
405 miles	15 gallons	**10.** [27 mpg]

Solve.

11. Editors at a magazine tested a new car's fuel economy in city and highway driving. The car traveled 15 miles in the city and used 0.68 gallon of fuel. On the highway, the car traveled 45 miles and used 1.5 gallons of fuel. How much better is the highway mileage than the city mileage?

[8 mpg better (30-22)]

12. Another car the editors tested had a highway fuel economy of 25 miles per gallon. If the test was run over 145 highway miles, how many gallons of fuel did the car use to the nearest tenth of a gallon?

[5.8 gallons]

Name _____ Date _____

RATE

A **rate** is a ratio of changes in two different quantities that change together. Speed is a rate because one quantity -- the distance an object travels -- changes in relation to another quantity -- time. Mileage is a rate because one quantity the miles an object travels -- changes in relationship to another quantity -- gallons of fuel used. The following algorithms are used to determine average speed and mileage. Use the algorithms to solve the problems.

Average Speed	Mileage
$\text{Average Speed} = \frac{\text{distance traveled}}{\text{time elapsed}}$	$\text{Mileage} = \frac{\text{miles traveled}}{\text{gallons used}}$

Use the algorithms to solve the problems.

James left Southport at 3:15 p.m. He arrived at Oakdale at midnight. He figured his car traveled 507.5 miles on $18\frac{1}{8}$ gallons of gasoline.

1. What was James' average speed?

[58 mph]

2. What was his car's mileage?

[28 mpg]

Mrs. Scott filled her car's gas tank which has a capacity of 16 gallons of gasoline. She then drove 286 miles to visit her daughter in college. When she completed the $5\frac{1}{2}$ hour trip, the car had half a tank of gasoline.

3. What was Mrs. Scott's average speed?

[52 mph]

4. What was her car's mileage?

[35.75 mpg]

The distance from Max's home to his office is 48 miles. While commuting during a 5-day work-week, he uses $1\frac{1}{2}$ tanks of gasoline.

5. If the car's tank holds a maximum of 16 gallons of gasoline, what is its mileage?

[20 mpg]

6. If the roundtrip takes Max 1 hour 45 minutes, what is his average speed rounded to the nearest mile per hour?

[55 mph]

Every Tuesday, Amy drives the same 178 mile route. Some days, the ride can take her 3 hours 15 minutes. Other days, the ride can take as long as 5 hours 45 minutes.

7. What is Amy's range of speeds for the trip rounded to the nearest mile per hour?

[31 mph to 55 mph]

8. If Amy uses 6 gallons of gasoline for the trip, what is her car's mileage?

[29.7 mpg]

Name _____ Date _____

PERIMETER AND AREA OF SHAPES

Perimeter is the distance around the outside of a closed figure. You find the perimeter of a figure by adding the lengths of its sides.

Tasha made a square quilt that is 3.5 feet on a side. She wants to put lace around the edges of her quilt. How much lace should she buy?

1. What is a square? [a quadrilateral with four congruent sides]

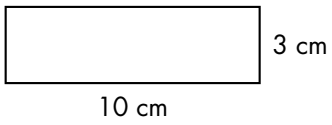
2. What is the length of one side of Tasha's quilt? [3.5 feet]

3. How can you determine the total distance around the outside of the quilt or its perimeter? [multiply 4 times 3.5]

4. How much lace should Tasha buy? [14 feet]

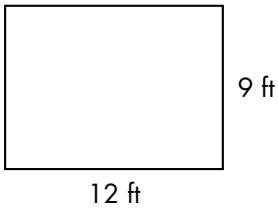
Find the perimeter of each closed figure.

5.



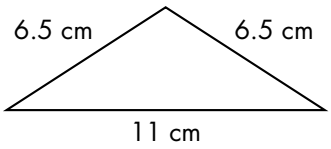
[26 cm]

6.



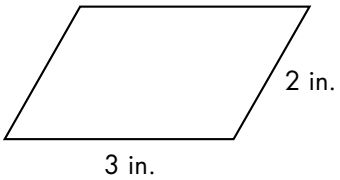
[42 ft]

7.



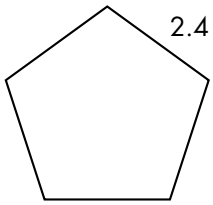
[24 cm]

8.



[10 in.]

9.

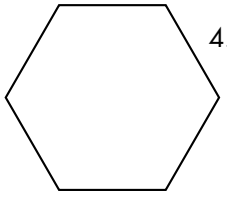


[12 ft]

10.

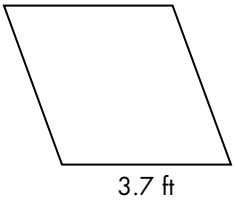
[50 cm]

11.



[27 in.]

12.



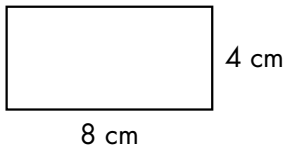
[14.8 ft]

Name _____ Date _____

PERIMETER AND AREA OF SHAPES

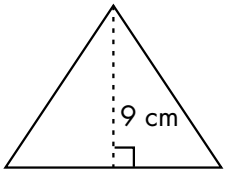
Area is the number of square units inside a closed figure. To find the areas of different closed figures, use these formulas.

Rectangle



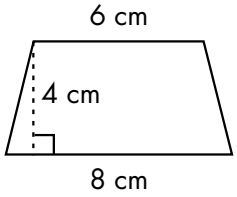
$A = l \times w$
$A = 8 \times 4$
$A = 32$
$32\ cm^2$

Triangle



$A = \frac{1}{2}(b \times h)$
$A = \frac{1}{2}(12 \times 9)$
$A = \frac{1}{2}(108)$
$A = 54$
$54\ cm^2$

Trapezoid

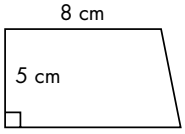


$A = \frac{1}{2}h(b_1 + b_2)$
$A = \frac{1}{2} \times 4(6 + 8)$
$A = \frac{1}{2} \times 4(14)$
$A = \frac{1}{2} \times 56$
$A = 28$
$28\ cm^2$

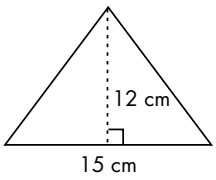
Use the appropriate formula to find the area of each figure.

1. [112 cm²]

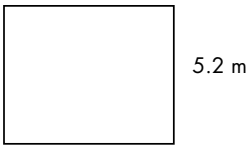
2. [45 cm²]



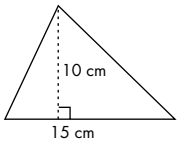
3. [90 cm²]



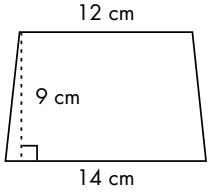
4. [33.28 m²]



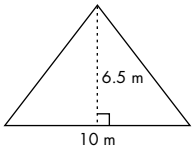
5. [75 cm²]



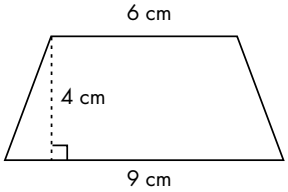
6. [117 cm²]



7. [32.5 m²]



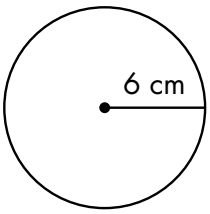
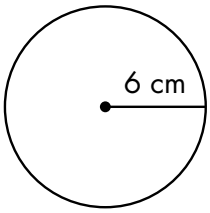
8. [30 cm²]



Name _____ Date _____

PERIMETER AND AREA OF SHAPES

Circumference is the distance around the outside of a circle. **Area** is the number of square units inside a closed figure. Use these formulas to find the circumference or area of any circle. Round the answer to the nearest whole number, since we're using an estimate for π.

Circumference	Area
$C = 2\ \pi\ r$ or $C = \pi\ d$ Use 3.14 for π.	$A = \pi r^2$ Use 3.14 for π.
 $C = 2 \times 3.14 \times 6$ $C = 6.28 \times 6$ $C = 37.68 \approx 38$ 38cm	 $A = 3.14 \times 6^2$ $A = 3.14 \times 36$ $A = 113.04 \approx 113$ 113 cm^2

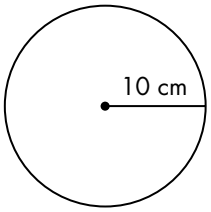
Use the formulas to find the circumference and area of each circle. Round answers to the nearest whole number.

1. Circumference

[63 cm]

2. Area

[314 cm^2]

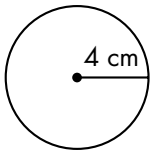


3. Circumference

[25 cm]

4. Area

[50 cm^2]

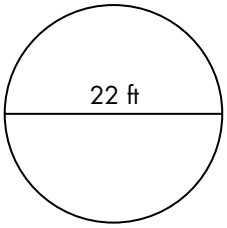


5. Circumference

[69 ft]

6. Area

[380 ft^2]

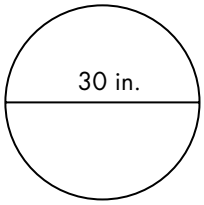


7. Circumference

[94 in.]

8. Area

[707 $in.^2$]

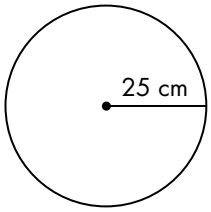


9. Circumference

[157 cm]

10. Area

[1,963 cm^2]

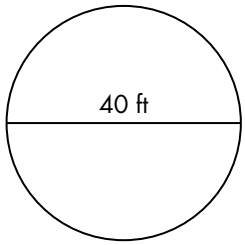


11. Circumference

[126 ft]

12. Area

[1,256 ft^2]

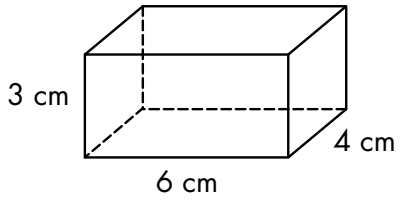


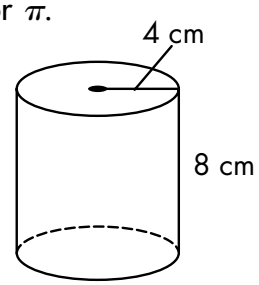
Name _____ Date _____

AREA AND VOLUME RELATIONSHIPS AND FORMULAS

Volume is the amount of space inside a three-dimensional figure expressed in cubic units. You can use the following formulas to calculate the volume of a prism or a cylinder.

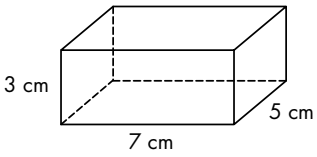
Rectangular Prism	Cylinder
$V = l \times w \times h$	$V = \pi r^2 h$ Use 3.14 for π.
$V = l \times w \times h$ $V = 6 \times 4 \times 3$ $V = 72$ 72 cm^3	$V = \pi r^2 h$ $V = 3.14 \times 16 \times 8$ $V = 401.92 \approx 402$ 402 cm^3





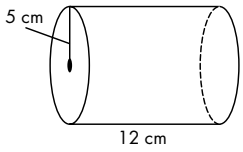
Use the formulas to find the volume of each three-dimensional figure. Round each answer to the nearest whole number.

1.



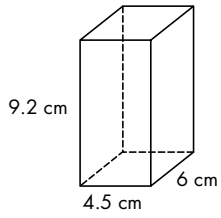
[105 cm^3]

2.



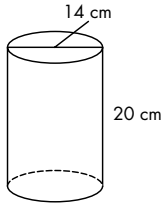
[942 cm^3]

3.



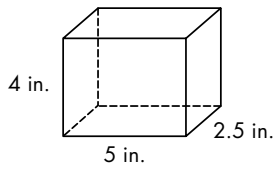
[248 cm^3]

4.



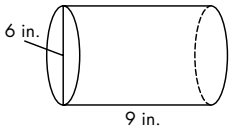
[3,077 cm^3]

5.



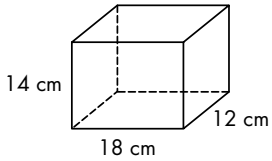
[50 in.^{3}]

6.



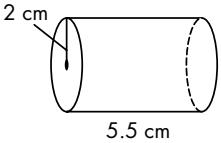
[254 in.^{3}]

7.



[3,024 cm^3]

8.



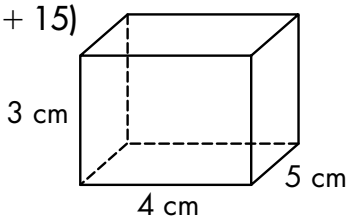
[69 cm^3]

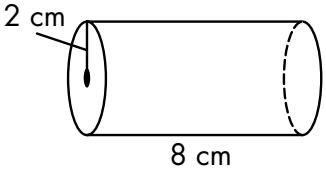
Name _____ Date _____

AREA AND VOLUME RELATIONSHIPS AND FORMULAS

Surface area is the total area of the faces, or surfaces, of a solid figure. You can use the following formulas to calculate the surface area of a rectangular prism or a cylinder.

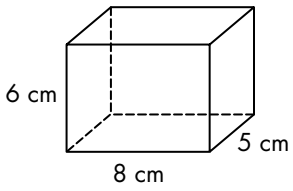
Rectangular Prism	Cylinder
$S = 2(lh + lw + wh)$	$S = 2(\pi r^2) + (2\ \pi rh)$ Use 3.14 for π.
$S = 2(lh + lw + wh)$ $S = 2(12 + 20 + 15)$ $S = 2(47)$ $S = 94$ 94 cm^2	$S = 2(\pi r^2) + (2\ \pi rh)$ $S = 2(12.56) + (100.48)$ $S = 2(12.56) + (100.48)$ $S = 25.12 + 100.48$ $S = 125.6 \approx 126$ 126 cm^2





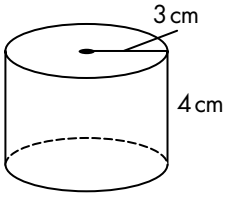
Use the formulas to find the surface area of each three-dimensional figure. Round each answer to the nearest whole number.

1.



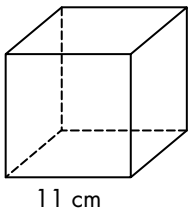
[236 cm^2]

2.



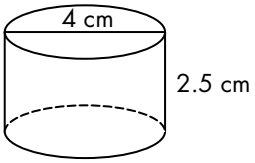
[132 cm^2]

3.



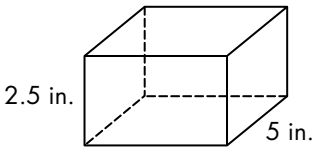
[726 cm^2]

4.



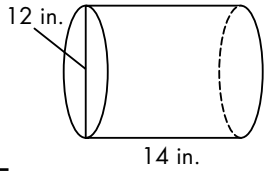
[57 cm^2]

5.



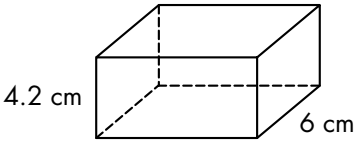
[85 in.^{2}]

6.



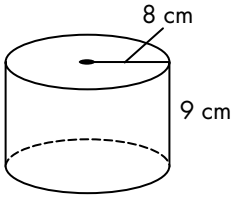
[754 in.^{2}]

7.



[224 cm^2]

8.



[854 cm^2]

Name _____ Date _____

AREA AND VOLUME RELATIONSHIPS AND FORMULAS

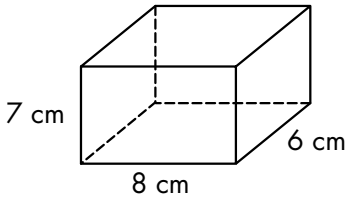
Volume is the amount of space inside a three-dimensional figure expressed in cubic units. **Surface area** is the total areas of the faces, or surfaces, of a solid figure. You can use the following formulas to calculate the volume and surface area of a rectangular prism or a cylinder.

Rectangular Prism	Cylinder
$V = l \times w \times h$ $S = 2(lh + lw + wh)$	$V = \pi r^2 h$ Use 3.14 for π. $S = 2(\pi r^2) + (2\pi rh)$

Use the formulas to find the volume and surface area of each three-dimensional figure. Round your answers to the nearest whole number.

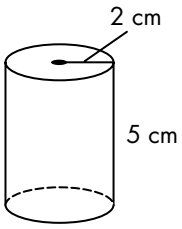
1. Volume [336 cm^3]

2. Surface Area [292 cm^2]



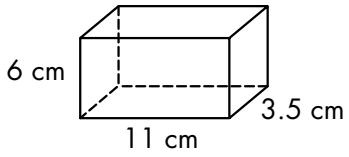
3. Volume [63 cm^3]

4. Surface Area [88 cm^2]



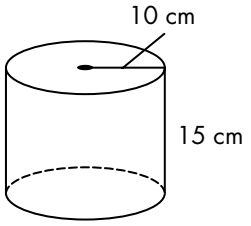
5. Volume [231 cm^3]

6. Surface Area [251 cm^2]



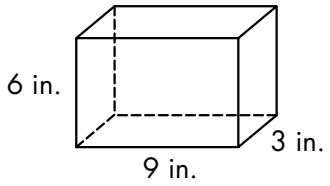
7. Volume [4,710 cm^3]

8. Surface Area [1,570 cm^2]



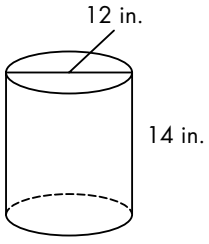
9. Volume [162 $in.^3$]

10. Surface Area [198 $in.^2$]



11. Volume [1,583 $in.^3$]

12. Surface Area [754 $in.^2$]



Name _____ Date _____

PROBLEM SOLVING WITH UNITS AND CONVERSION

Customary Units of Length

1 foot (ft) = 12 inches (in.)
1 yard (yd) = 36 inches (in.)
1 yard (yd) = 3 feet (ft)
1 mile (mi) = 5,280 feet (ft)
1 mile (mi) = 1,760 yards (yd)

Convert the measure to the given unit.

1. 36 in. = [3] ft	**2.** 2 mi = [3,520] yd
3. 5 yd = [180] in.	**4.** 52,800 ft = [10] mi
5. $2\frac{1}{2}$ ft = [30] in.	**6.** 6 yd = [18] ft
7. 72 in. = [6] ft	**8.** 5 ft = [60] in.
9. $3\frac{1}{2}$ yd = [126] in.	**10.** 6 mi = [31,680] ft
11. 156 in. = [13] ft	**12.** 4,400 yd = [$2\frac{1}{2}$] mi
13. 51 ft = [17] yd	**14.** 324 in. = [9] yd
15. 108 in = [9] ft	**16.** 5 mi = [8,800] yd
17. $2\frac{3}{4}$ yd = [$8\frac{1}{4}$] ft	**18.** $1\frac{7}{8}$ ft = [$22\frac{1}{2}$] in.

Solve.

19. A road crew is putting signs on a 5 mile road. The first sign is at the start of the road. Then they will place a sign every 500 yards. How many signs do they need? (Hint: Don't forget to include the first sign.)

[20 signs]

20. A carpenter has a board that is 15 feet long. She cuts pieces that are 1 yard long. How many 1 yard-long pieces will she have? How much will be left of the original board?

[three 1 yd long pieces; 1ft left]

Name _____ Date _____

PROBLEM SOLVING WITH UNITS AND CONVERSION

Customary Units of Capacity and Weight

Capacity	Weight
8 fluid ounces (fl oz) = 1 cup (c)	16 ounces (oz) = 1 pound (lb)
2 cups (c) = 1 pint (pt)	2,000 pounds (lb) = 1 ton (t)
2 pints (pt) = 1 quart (qt)	
4 quarts (qt) = 1 gallon (gal)	

Convert the measure to the given unit.

1. 10,000 lb = [5] t	**2.** 48 oz = [3] lb
3. 7 gal = [28] qt	**4.** 32 c = [2] gal
5. 3 c = [24] fl oz	**6.** $2\frac{1}{2}$ gal = [10] qt
7. 10 pt = [20] c	**8.** 28 pt = [14] qt
9. 112 fl oz = [7] pt	**10.** $4\frac{1}{2}$ t = [9,000] lb
11. 32 pt = [4] gal	**12.** 2 gal = [256] fl oz
13. 88 oz = [$5\frac{1}{2}$] lb	**14.** $3\frac{1}{4}$ t = [6,500] lb
15. 2 gal = [48] c	**16.** 256 oz = [16] lb
17. 8.5pt = [17,000] lb	**18.** 12 pt = [24] c

Solve.

19. A restaurant uses 1 pint of milk to make a milkshake. A party has ordered 14 milkshakes. The restaurant has 6 quarts of milk. Is there enough milk to make the milkshakes? If not, how much milk is needed to complete the order?

[No; 1 pint]

20. Hoshi buys a six-pack of 12-ounce bottles of water. Debra buys a half-gallon bottle of water. Who buys more water? How much more?

[Hoshi; 8 ounces]

Name _____ Date _____

PROBLEM SOLVING WITH UNITS AND CONVERSION

Metric Units of Length

1 kilometer (km) = 1,000 meters (m)
1 meter (m) = 10 decimeters (dm)
1 meter (m) = 100 centimeters (cm)
1 meter (m) = 1,000 millimeters (mm)
1 centimeter (cm) = 10 millimeters (mm)

Convert the measure to the given unit.

1. 7 km = [7,000] m	**2.** 38 cm = [0.38] m
3. 4 m = [4,000] mm	**4.** 2.5 km = [2,500] m
5. 13 cm = [1.3] dm	**6.** 75 dm = [7.5] m
7. 800 m = [0.8] km	**8.** 900 cm = [9] m
9. 317 mm = [3.17] dm	**10.** 6.8 m = [680] cm
11. 9.2 km = [9,200,000] mm	**12.** 1.36 dm = [136] mm
13. 0.42 km = [42,000] cm	**14.** 95 m = [0.095] km
15. 380 cm = [3.8] m	**16.** 25 mm = [2.5] cm
17. 6.4 dm = [64] cm	**18.** 0.58 km = [5,800] dm

Solve.

19. Eric is running a 10,000 meter race. What is the length of the race in kilometers?

[10 km]

20. The length of an insect is given as 0.3 centimeters. How long is the insect in millimeters?

[3 mm]

Name _____ Date _____

ACCURACY, PRECISION AND SIGNIFICANT DIGITS

Precision is how close you can come to the same measurement when you measure something over and over. Generally, the smaller the unit of measure marked on the measuring instrument, the more precise the measurement can be—you can repeat the measurement reliably to within a smaller interval.

Identify the more precise measurement.

1. $4\frac{1}{2}$ feet 54 inches [54 inches]	**2.** 28 feet 9 yards [28 feet]
3. seven-eighths of an inch one half-inch [$\frac{7}{8}$ inch]	**4.** 2 yards 73 inches [73 inches]
5. 5,278 feet 1 mile [5,278 feet]	**6.** $2\frac{3}{4}$ feet $33\frac{1}{4}$ inches [$33\frac{1}{4}$ inches]
7. 2 miles 3,519 yards [3,519 yards]	**8.** $13\frac{1}{2}$ feet $4\frac{1}{3}$ yards [$13\frac{1}{2}$ feet]
9. 5 feet 59 inches [59 inches]	**10.** 6,599 feet $1\frac{1}{4}$ miles [6,599 feet]

Solve.

11. Kevin and Tamiko are measuring the length of the same line segment. Kevin has a ruler marked in intervals $\frac{1}{16}$ of an inch apart. Tamiko has a ruler marked in intervals $\frac{1}{8}$ of an inch apart. If both measure the line segment correctly, who will typically give the more precise measurement?

[Kevin]

12. In part of a women's triathlon the contestants cycle for 12.4 miles and run for 3.1 miles. Which is a more precise measure? Explain.

[Neither; both measures are given to the nearest tenth of a mile]

Name _____ Date _____

ACCURACY, PRECISION AND SIGNIFICANT DIGITS

Precision is how close you can come to the same measurement when you measure something over and over. Generally, the smaller the unit of measure marked on the measuring instrument, the more precise the measurement can be—you can repeat the measurement to within a smaller interval.

Identify the more precise measurement.

1. 6.2 m 619 cm [619 cm]	**2.** 37 mm 4 cm [37 mm]
3. 2,011 m 2 km [2,011 m]	**4.** 18 cm 177 mm [177 mm]
5. 79 cm 8 dm [79 cm]	**6.** 1,899 m 1.9 km [1,899 m]
7. 57 mm 0.06 m [57 mm]	**8.** 21 m 0.02 km [21 m]
9. 18 mm 2 cm [18 mm]	**10.** 384 dm 3.9 m [384 dm]
11. 83 m 0.08 km [83 m]	**12.** 11 cm 113 mm [113 mm]

Solve.

13. Which measurement of a board would be most precise: 3 feet or 36 $\frac{1}{2}$ inches? Explain.

[36 $\frac{1}{2}$ inches; 3 ft is measured to the nearest foot, and 36 $\frac{1}{2}$ inches is measured to the nearest $\frac{1}{2}$ inch]

Name _____ Date _____

ACCURACY, PRECISION AND SIGNIFICANT DIGITS

Accuracy is how close a measurement is to the actual value. **Precision** is how close you can get to the same measurement in repeated measurements. The accuracy and precision of a measurement are shown by its number of significant digits. **Significant digits** are the number of digits used to express a measurement that are not zero at the beginning or end of the number.

As the accuracy and/or precision of a number increases, the number of significant digits used to express it increases to reflect the greater accuracy or precision.

A measurement was made, of an object with a meter stick marked in cm only, resulting in a measurement of 47 cm, and another measurement was made of the same object with a meter stick marked in mm, resulting in a measurement of 47.2 cm. Both meter sticks are equally accurate for where their marking are.

1. Which measurement is accurate to within a smaller interval?

the second measurement

Identify the number of significant digits in each measurement.

2. measurement: 92.45 m
Unit: 0.01 m

[4]

3. measurement: 7.5 cm
Unit: 0.1 cm

[2]

4. measurement: 5.678 ft
Unit: 0.001 ft

[4]

5. measurement: 349.24 km
Unit: 0.01 km

[5]

Identify the measurement that is expressed with a precision of a smaller interval.

6. Measurement: 17.5 cm Unit: 0.1 cm
Measurement: 17.55 cm Unit: 0.01 cm

[17.55 cm]

7. Measurement: 6.892 m Unit: 0.001 m
Measurement: 6.89 m Unit: 0.01 m

[6.892 m]

Name _____ Date _____

ACCURACY AND TOOL CHOICE

When making a measurement, you should select a tool that will provide the appropriate precision and accuracy. **Precision** is how close you can come to the same measurement when you measure something over and over. **Accuracy** is how close a measurement is to the actual value.

Identify the tool that will yield a more precise, accurate measurement, assuming that the tools described are equally accurate for the units that they measure.

1. Mia needs to measure the height of her desk. Should she use a meter stick marked in cm, or a meter stick marked in mm?

[marked in mm]

2. A jeweler wants to measure the mass of a diamond. Should he use a pan balance (like the one in the grocery store) or a carat scale?

[carat scale]

3. Sue is measuring the thickness of her math book. Should she use a ruler marked to the $\frac{1}{16}$ inch or a yardstick marked to the $\frac{1}{4}$ inch to measure the thickness of the book?

[ruler]

4. Dan is measuring the thickness of a coin. Should he use a ruler marked in millimeters or one marked in centimeters?

[millimeters]

Which unit of measure will generally yield a more precise, accurate measurement assuming that the tool used to measure is accurate, and no fractional or decimal values are used beyond those noted.

5. Length of a school bus
1 yard 1 foot

[1 foot]

6. Mass of a leaf
1 milligram 1 kilogram

[1 milligram]

7. Capacity of a mug
1 fluid ounce 1 pint

[1 fluid ounce]

8. Width of your hand
1 inch $\frac{1}{4}$ inch

[$\frac{1}{4}$ inch]

Name _____ Date _____

ACCURACY AND TOOL CHOICE

When making a measurement, you should select a unit of measure that will provide the appropriate precision and accuracy. **Precision** is how close you can come to the same measurement when you measure something over and over. **Accuracy** is how close a measurement is to the actual value.

Which unit is best suited for each measurement, presuming a desire to minimize the use of decimal or fractional values?

1. Air temperature for the purpose of deciding whether to wear a jacket
1 degree 0.1 degree

[1 degree]

2. Mass of a gold necklace for the purpose of determing the value of the gold in it
1 gram 1 milligram

[1 milligram]

3. Width of a classroom for the purpose of fitting a rug in it
1 foot 1 yard

[1 foot]

4. Capacity of a bathtub for the purpose of knowing roughly how big it is
1 quart 1 gallon

[1 gallon]

5. Width of a window for the purpose of purchasing a shade for it
$\frac{1}{2}$ inch $\frac{1}{2}$ foot

[$\frac{1}{2}$ inch]

6. Body temperature for the purpose of determining if someone has a fever
1 degree 0.1 degree

[0.1 degree]

7. Length of a crayon for the purpose of knowing how easy it will be to use, i.e. whether it's getting too small
1 centimeter 0.1 centimeter

[1 centimeter]

8. Distance between towns for the purpose of estimating how long it will take to drive the distance
1 kilometer 0.1 kilometer

[1 kilometer]

9. Weight of a slice of cheese for the purpose of determining exactly what it will cost
1 ounce $\frac{1}{4}$ pound

[1 ounce]

10. Mass of a puppy for the purpose of determining if it's a healthy size for its age
1 gram 1 kilogram

[1 kilogram]

11. Capacity of a water bottle for the purpose of determining if it can hold enough for a bike ride of a given length
1 liter 1 milliliter

[1 liter]

12. Length of an insect for the purpose of a scientific report on the characteristics of the species
1 centimeter 1 millimeter

[1 millimeter]

Name _____ Date _____

Discovery EDUCATION

ACCURACY AND TOOL CHOICE

When taking a measurement, you should use a unit of measure that will provide the appropriate precision and accuracy. **Precision** is how close you can come to the same measurement when you measure something over and over. **Accuracy** is how close a measurement is to the actual value.

Which unit is best suited for each measurement, presuming a desire to minimize the use of decimal or fractional values, and the number of places in the whole numbers.

1. Weight of a gem for the purpose of describing it to a jeweler who will determine its value
1 carat 1 ounce

[1 carat]

2. Capacity of a pitcher for the purpose of deciding if it will hold enough for a dinner for 4 people
1 pint 1 quart

[1 quart]

3. Length of a van for the purpose of determining whether it's large enough for moving a particular household
1 meter 1 centimeter

[1 meter]

4. Width of a shoe for the purpose of knowing if it will fit your foot
1 meter 1 centimeter

[1 centimeter]

5. Length of a movie for the purpose of planning for a ride to come after it
1 minute 1 second

[1 minute]

6. Length of a song for the purpose of planning how much of a 6-minute segment of a radio program it will occupy
1 minute 1 second

[1 second]

7. Swimmer's time for the purpose of comparing her performance to that of a closely-matched teammate
1 second 0.1 second

[0.1 second]

8. Capacity of a fish tank for the purpose of getting a rough idea of its size for planning a place for it in the house
1 quart 1 gallon

[1 gallon]

9. Capacity of an eyedropper for the purpose of adding a measured amount of food coloring to a recipe
1 liter 1 milliliter

[1 milliliter]

10. Width of computer screen for the purpose of determining whether a screen protector would fit exactly over it
$\frac{1}{4}$ inch 1 inch

[$\frac{1}{4}$ inch]

DISCOVERING MATH

LEVEL 3

Name _____ Date _____

ESTIMATION TO SOLVE PROBLEMS

An **estimate** is an answer that is close to an actual answer. An **underestimate** is intended to be less than the actual answer. An **overestimate** is intended to be greater than the actual answer.

Estimate the sum of 325 + 578.

Underestimate	**Overestimate**
Round both addends down.	**Round both addends up.**
325 + 578 ⟶ 320 + 570	325 + 578 ⟶ 330 + 580
Find the sum of the rounded addends.	**Find the sum of the rounded addends.**
320 + 570 = 890	330 + 580 = 910

Find a range of estimates by determining an underestimate and an overestimate for each problem. (Round each number up or down to the tens place.)

562 + 318

1. Underestimate:

[560 + 310 = 870]

2. Overestimate:

[570 + 320 = 890]

3. Range of Estimates:

[870 to 890]

743 + 196

4. Underestimate:

[740 + 190 = 930]

5. Overestimate:

[750 + 200 = 950]

6. Range of Estimates:

[930 to 950]

679 + 417

7. Underestimate:

[670 + 410 = 1,080]

8. Overestimate:

[680 + 420 = 1,100]

9. Range of Estimates:

[1,080 to 1,100]

941 + 863

10. Underestimate:

[940 + 860 = 1,800]

11. Overestimate:

[950 + 870 = 1,820]

12. Range of Estimates:

[1,800 to 1,820]

Name _____ Date _____

ESTIMATION TO SOLVE PROBLEMS

An **estimate** is an answer that is close to an actual answer. An **underestimate** is intended to be less than the actual answer. An **overestimate** is intended to be greater than the actual answer.

Underestimate	Overestimate
Addition: Round both addends down. $748 + 231 \longrightarrow 740 + 230$	**Addition:** Round both addends up. $748 + 231 \longrightarrow 750 + 240$
Find the sum of the rounded addends. $740 + 230 = 970$	Find the sum of the rounded addends. $750 + 240 = 990$
Multiplication: Round both factors down. $78 \times 23 \longrightarrow 70 \times 20$	**Multiplication:** Round both factors up. $78 \times 23 \longrightarrow 80 \times 30$
Find the product of the rounded factors. $70 \times 20 = 1{,}400$	Find the product of the rounded factors. $80 \times 30 = 2{,}400$

Find a range of estimates by determining an underestimate and an overestimate for each problem.

36×49	$466 + 854$
1. Underestimate: [$30 \times 40 = 1{,}200$]	**4.** Underestimate: [$460 + 850 = 1{,}310$]
2. Overestimate: [$40 \times 50 = 2{,}000$]	**5.** Overestimate: [$470 + 860 = 1{,}330$]
3. Range of Estimates: [1,200 to 2,000]	**6.** Range of Estimates: [1,310 to 1,330]
$693 + 255$	53×89
7. Underestimate: [$690 + 250 = 940$]	**10.** Underestimate: [$50 \times 80 = 4{,}000$]
8. Overestimate: [$700 + 260 = 960$]	**11.** Overestimate: [$60 \times 90 = 5{,}400$]
9. Range of Estimates: [940 to 960]	**12.** Range of Estimates: [4,000 to 5,400]

Name _____ Date _____

ESTIMATION TO SOLVE PROBLEMS

An **estimate** is an answer that is close to an actual answer. An **underestimate** is intended to be less than the actual answer. An **overestimate** is intended to be greater than the actual answer.

Underestimate	Overestimate
Multiplication: Round both factors down. $46 \times 85 \longrightarrow 40 \times 80$ Find the product of the rounded factors. $40 \times 80 = 3{,}200$	**Multiplication:** Round both factors up. $46 \times 85 \longrightarrow 50 \times 90$ Find the product of the rounded factors. $50 \times 90 = 4{,}500$
Division: Use compatible numbers with a dividend that is less than the actual dividend and a divisor that is greater than the actual divisor. $5{,}712 \div 83$ $5{,}400 \div 90 = 60$	**Division:** Use compatible numbers with a dividend that is greater than the actual dividend and a divisor that is less than the actual divisor. $5{,}712 \div 83$ $6{,}400 \div 80 = 80$

Find a range of estimates by determining an underestimate and an overestimate for each problem.

29×54

1. Underestimate:
[$20 \times 50 = 1{,}000$]

2. Overestimate:
[$30 \times 60 = 1{,}800$]

3. Range of Estimates:
[1,000 to 1,800]

$2{,}675 \div 38$

4. Underestimate:
[$2{,}400 \div 40 = 60$]

5. Overestimate:
[$2{,}700 \div 30 = 90$]

6. Range of Estimates:
[60 to 90]

$6{,}592 \div 75$

7. Underestimate:
[$6{,}400 \div 80 = 80$]

8. Overestimate:
[$7{,}000 \div 70 = 100$]

9. Range of Estimates:
[80 to 100]

57×66

10. Underestimate:
[$50 \times 60 = 3{,}000$]

11. Overestimate:
[$60 \times 70 = 4{,}200$]

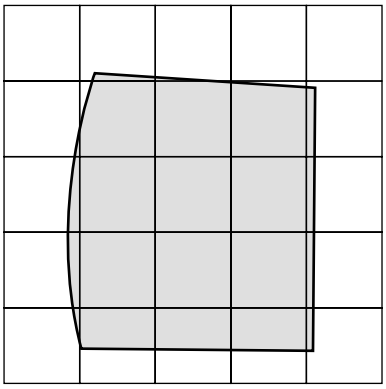
12. Range of Estimates:
[3,000 to 4,200]

Name _____ Date _____

INDIRECT MEASUREMENT

An **indirect measurement** can be a quick way to estimate size, distance, length, or area. To make an indirect measurement, you compare the unknown quantity to a known quantity indirectly, rather than by direct comparison using a measuring tool.

If each square on the grid is 1 cm^2, estimate the area of the irregular figure.



1. How many whole or nearly whole squares does the figure cover?

[9]

2. About how many half squares does the figure cover?

[3]

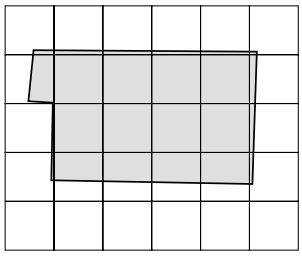
3. Complete this addition sentence to represent the covered squares:

$9 + \frac{1}{2} \times$ [3] $=$ [10.5]

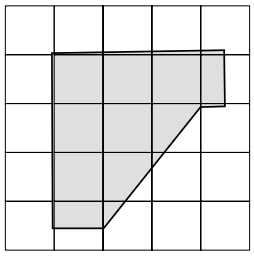
4. What is a reasonable estimate of the area of the irregular figure?

[About 10.5 cm^2]

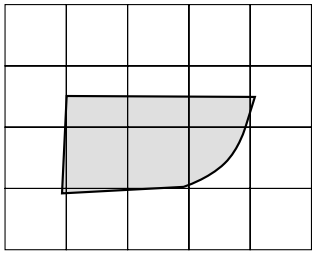
Estimate the area of each irregular figure. Each square on the grid is 1 cm^2.



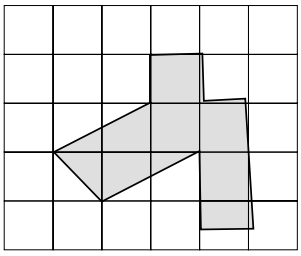
5. [About 10.5 cm^2]



6. [About 9 cm^2]



7. [About 4 cm^2]



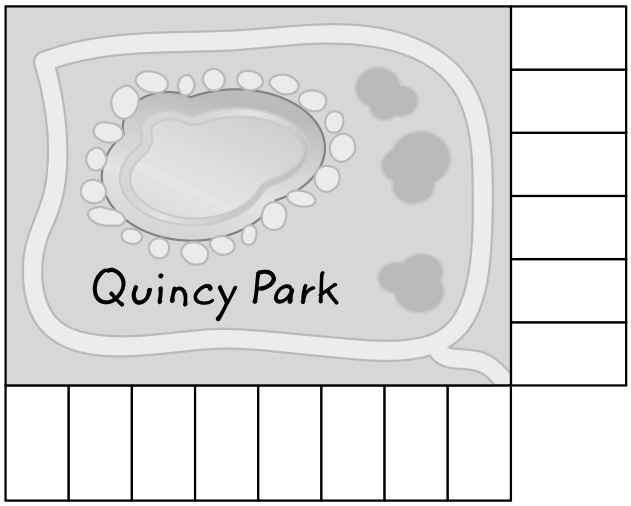
8. [About 7 cm^2]

Name _____ Date _____

INDIRECT MEASUREMENT

An **indirect measurement** can be a quick way to estimate size, distance, length, or area. To make an indirect measurement, you compare the unknown quantity to a known quantity indirectly, rather than by direct comparison using a measuring tool.

If each parking space is 8 feet across, estimate the perimeter and the area of the park shown below.



1. How many parking spaces run along the width of the park?

[6]

2. About how wide is the park if each space is 8 feet wide?

[About 48 feet]

3. How many parking spaces run along the length of the park?

[8]

4. About how long is the park?

[About 64 feet]

5. How do you calculate the perimeter of a closed straight-sided figure?

[Add the lengths of its sides]

6. Estimate the perimeter of the park.

[About 224 feet]

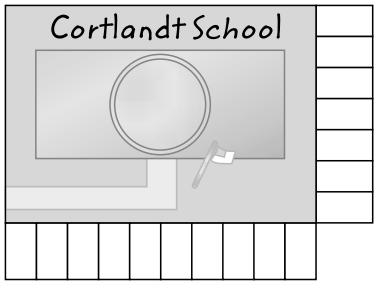
7. How do you calculate the area of a rectangle?

[Multiply its length by its width]

8. Estimate the area of the park.

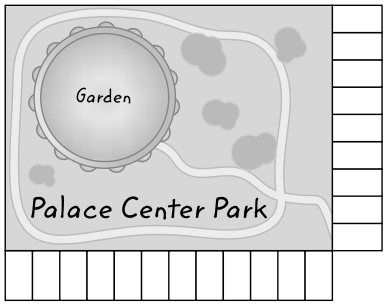
[About 3,072 ft^2]

Use indirect measurements to estimate the perimeter and area of each rectangular region. Each parking space is about 8 feet wide.



9. Perimeter [About 272 feet]

10. Area [About 4,480 ft^2]



11. Perimeter [About 336 feet]

12. Area [About 6,912 ft^2]

Name _____ Date _____

INDIRECT MEASUREMENT

An **indirect measurement** can be a quick way to estimate a measure. Writing and solving a proportion can help you calculate an indirect measurement.

A street sign that's 6 feet tall casts a 4-ft shadow at the same time that a nearby tree casts a 10-ft shadow. How tall is the tree?

- Set up a proportion. Let t represent the height of the tree.
- $\frac{\text{Height of Object}}{\text{Height of Shadow}} \longrightarrow \frac{6}{4} = \frac{t}{10}$
- Find the cross products. $60 = 4t$
- Solve the equation. $\frac{60}{4} = \frac{4t}{4}$
- The tree is 15 feet tall. $15 = t$

Write and solve a proportion to find each indirect measurement.

1. Adam is 5 ft tall. He casts a 6 ft shadow at the same time a fence post casts a 9 ft shadow. What is the approximate height of the fence post?

[About 7.5 feet]

2. A 3 ft tall shrub casts a $4\frac{1}{2}$ foot shadow. Estimate the length of the shadow cast by a nearby flagpole that is 18 ft tall.

[About 27 feet]

3. Jon casts an 8 ft long shadow at the same time that a 7 ft street sign casts a 10 ft shadow. About how tall is Jon?

[About 5.6 feet]

4. A 24 ft tall billboard casts a 16 ft shadow. About how tall is a tree that casts a 9-ft shadow at the same time?

[About 13.5 feet]

5. Kim is 48 inches tall. Her father is 72 inches tall. Estimate the length of Kim's father's shadow if Kim's shadow is 7 ft long at the same time.

[About 10.5 feet]

6. A 7.5 ft tall fence casts a 20 ft shadow at the same time a plant casts a 4 ft shadow. What is the approximate height of the plant?

[About 1.5 feet]

Challenge

If you wanted to determine the height of a flagpole during a sunny day, and you had a tape measure, how could you do it without leaving the ground?

[Possible answer: Find something short enough to measure its height and the length of its shadow, then measure the length of the flagpole's shadow. Use the ratio of the height of the measured object to the length of its shadow to determine the height of the flagpole, knowing the length of its shadow.]