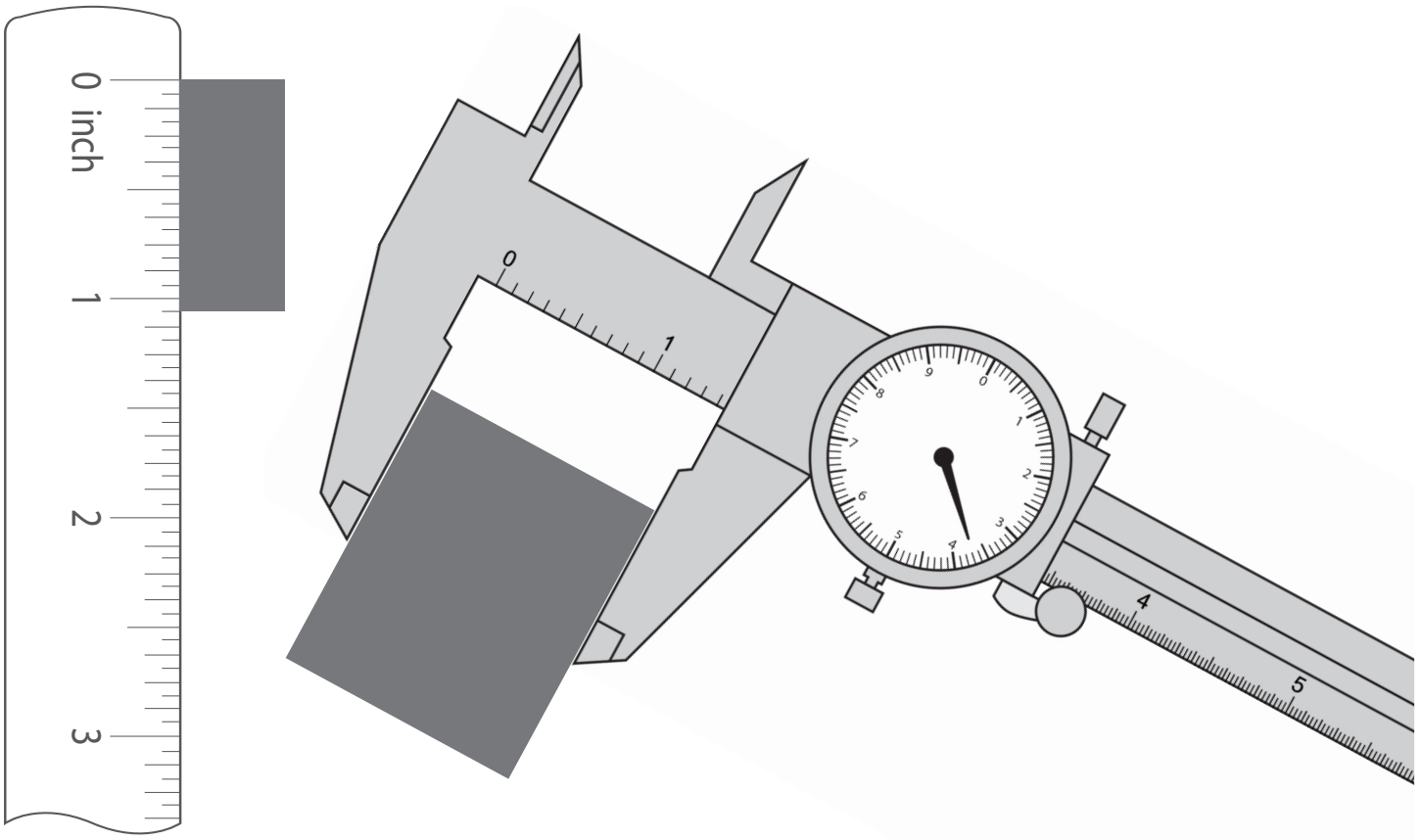
Measurement Math

Student Workbook - Answer Key



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NOTES:

- Ruler measurement answers may vary up to 0.5 cm, +/-1 mm, or +/-$^{1}/_{16}$ inch based on tolerance levels as defined by the instructor
- When measuring with a caliper, allow for a +/- 0.5 mm tolerance level
- All answers are to be within 0.50 hundredth
- Some tolerance level answers will include a low end, closest answer, and high end for each tolerance; they will look like this: 1 ¹⁄₁₆ in **2 in** 2 ¹⁄₁₆ in

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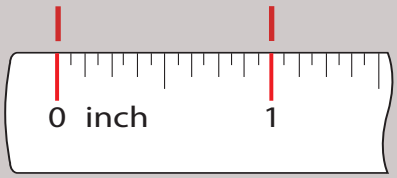
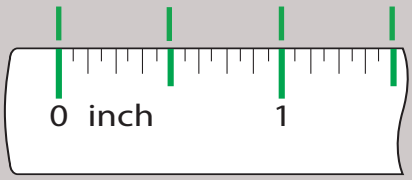
Measurement Units on a Ruler (Standard)

Standard rulers typically measure distances down 1/16 of an inch, although some versions have marks down to 1/32 or 1/64 of an inch. Many rulers have inches on one side and centimeters on the other. Rulers are generally 6, 12, or 36 inches long.

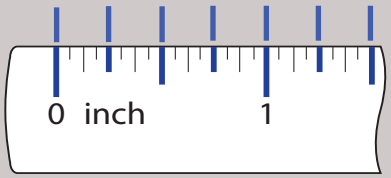
1″ The longest marks on a ruler represent whole inches.



1/2″ Inches can be broken down into smaller sections. There are 2 half inches in 1 inch.

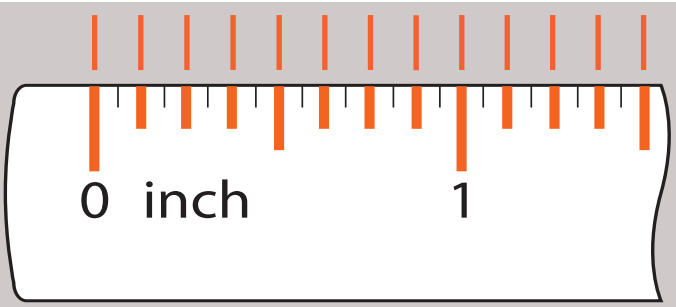


1/4″ The next shortest lines represent quarter inches. There are 4 quarter inches in 1 full inch.

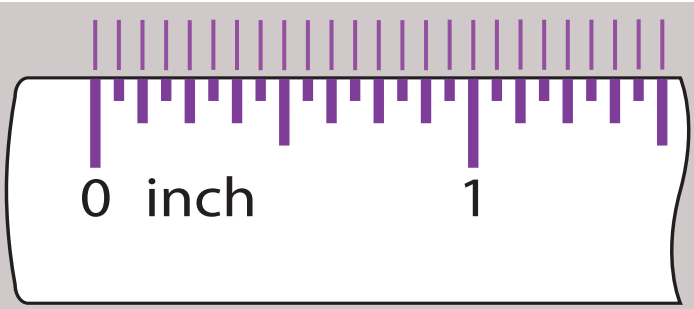


Note that 2/4″ would be the same as 1/2″.

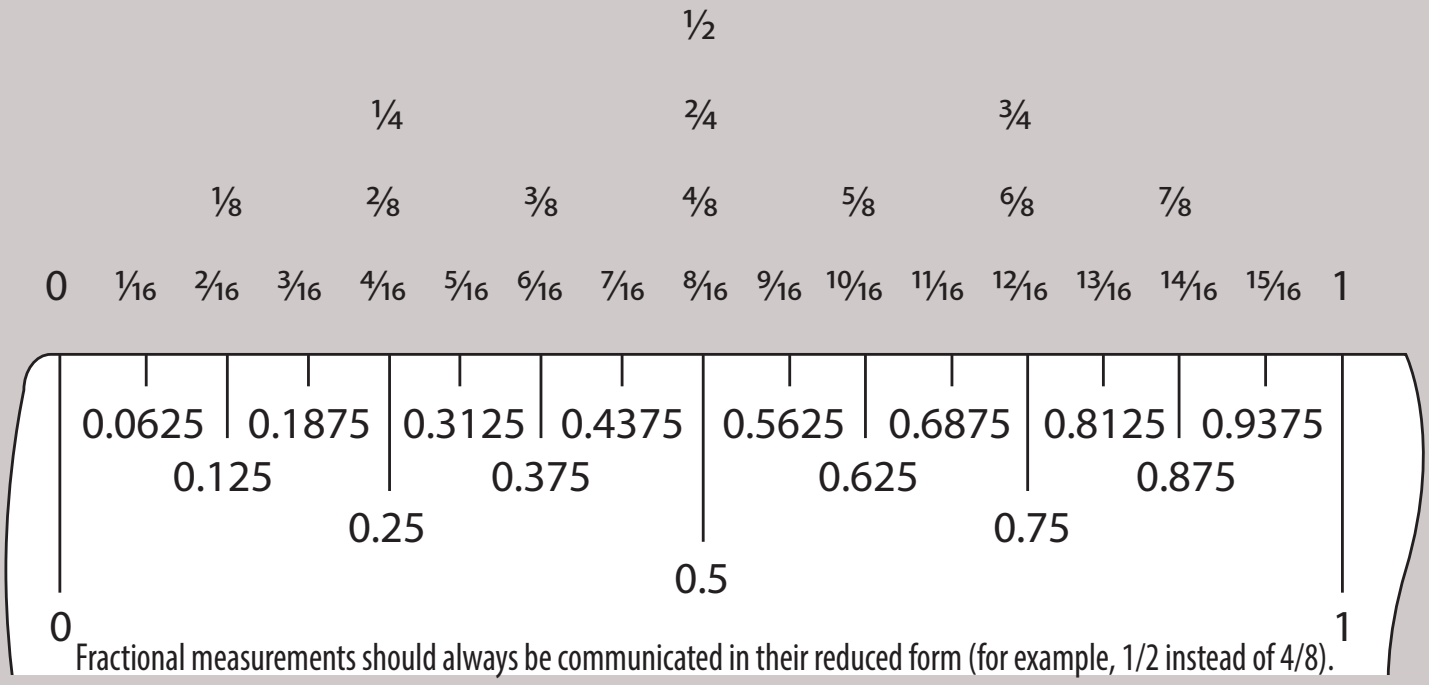
1/8″ The next shortest marks represent eighths of an inch. The 1/4″, 1/2″, and 3/4″ are shown, as these eighths fractions can be reduced.



1/16″ The smallest marks on this ruler represent sixteenths of an inch. The eighths, quarters, and halves can be reduced.



The image below shows the relationship between the fractional and decimal values of each mark between 0 and 1 inch.



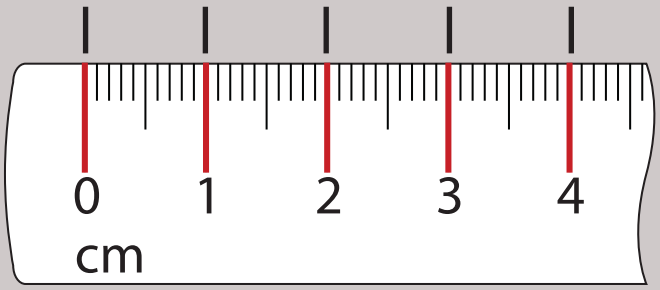
Fractional measurements should always be communicated in their reduced form (for example, 1/2 instead of 4/8).

Using a Ruler

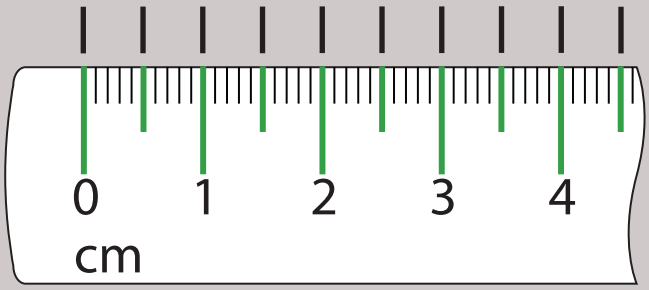
Measurement Units on a Ruler (Metric)

Metric rulers typically measure distances in centimeters and millimeters. Each centimeter is broken down into ten sections called millimeters.

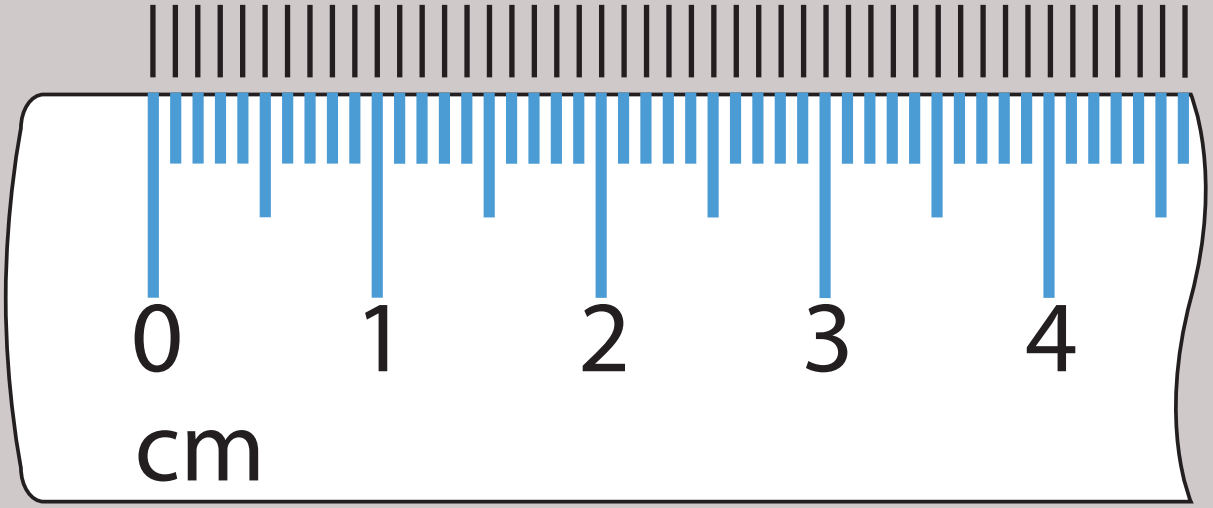
1 cm The longest marks on a metric ruler represent whole centimeters.



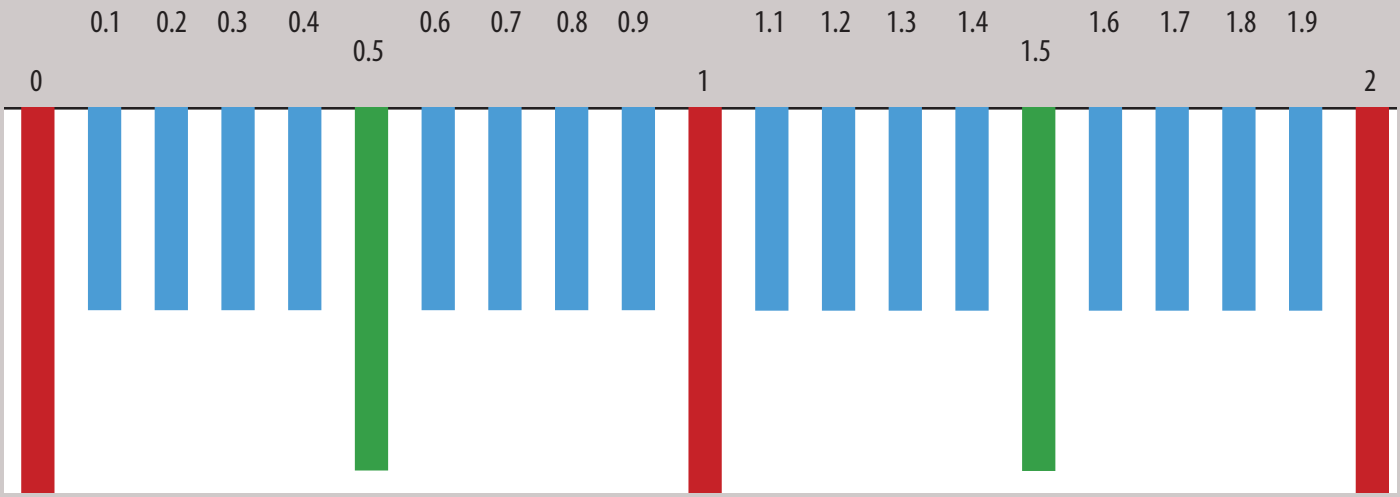
0.5 cm Metric rulers typically break the whole centimeters into half centimeters.



1 mm Metric rulers also break each centimeter into 10 millimeters.

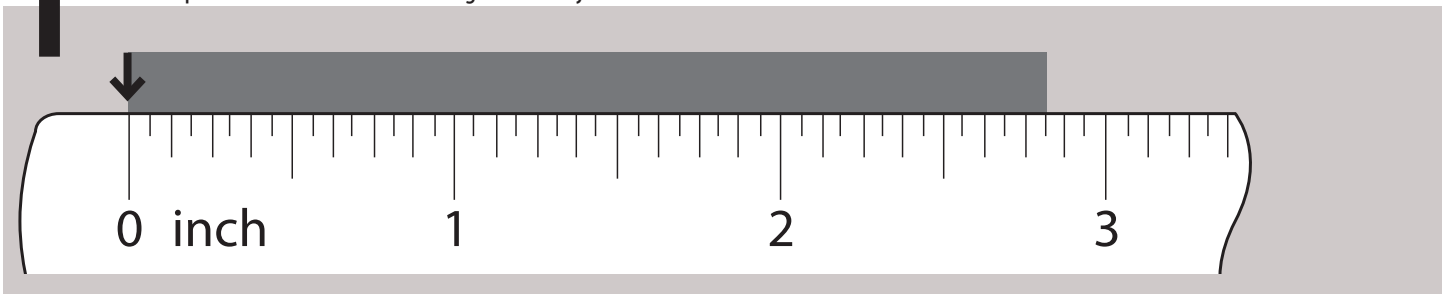


The image below shows the relationship between the decimal values of each mark between 0 and 2 centimeters.

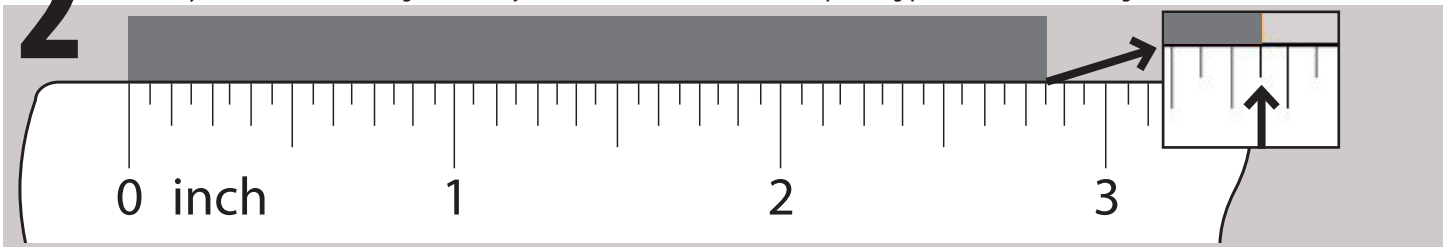


Measuring an Object with a Ruler

1 Line up the 0-mark with the first edge of the object.

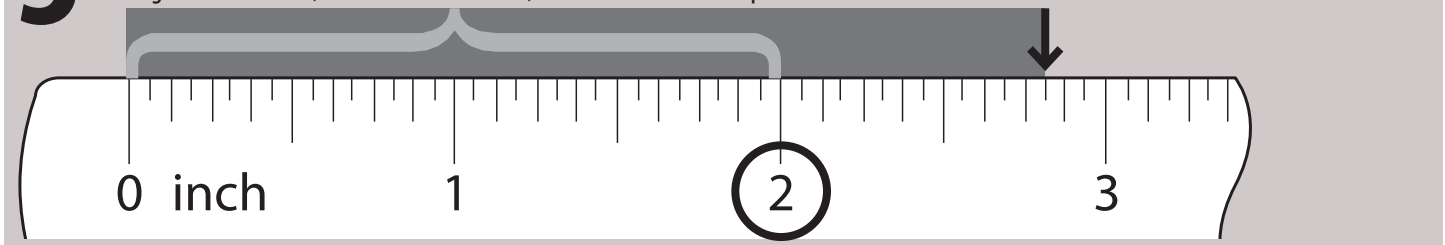


2 Identify where the second edge of the object lands on the ruler. The corresponding point on the ruler will give us our measurement.

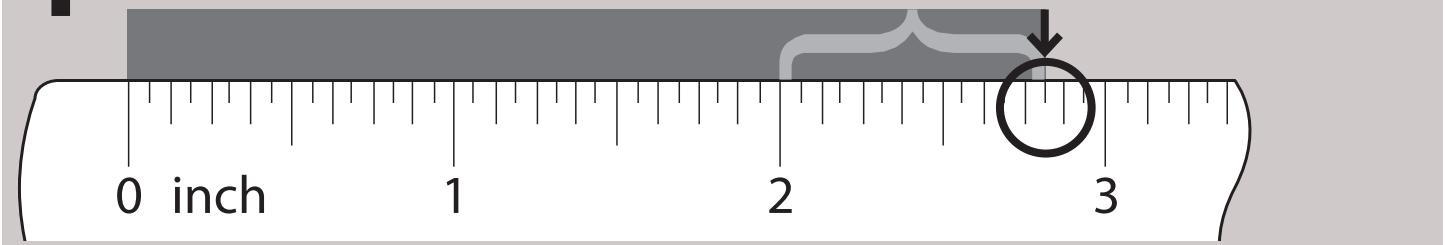


Rounding – If the object does not line up exactly with a mark, choose the mark that is closest to the edge of the object.

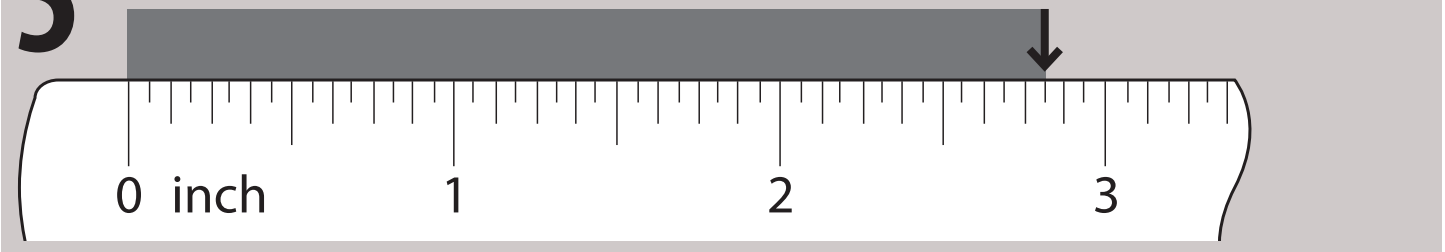
3 Find the whole inch component by counting how many whole inches fall within the object's boundary. In this example, the object is larger than 2 inches, but less than 3 inches, so our whole inch component is 2.



4 Find the fractional inch component by determining at what fraction of an inch the object edge ends. This fraction needs to add to the whole inch. In this example, the object is closest to the 13⁄16 inch line.



5 Add the findings together. The answer for this example is: $2 + 13/16 = 2\ 13/16$ inches.

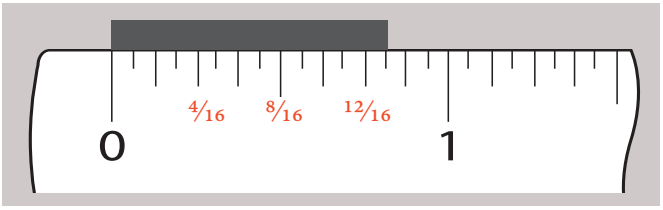


Using a Ruler

A Simpler Way to Find a Fractional Component

If the fractions and marks are confusing to you, simplify even further.

Just count the number of ANY marks from the previous inch mark, and you will have found the sixteenths! You can make this easier by remembering that the long half inch mark is equal to 8 sixteenths, and that the quarter marks are at 4 and 12 sixteenths.



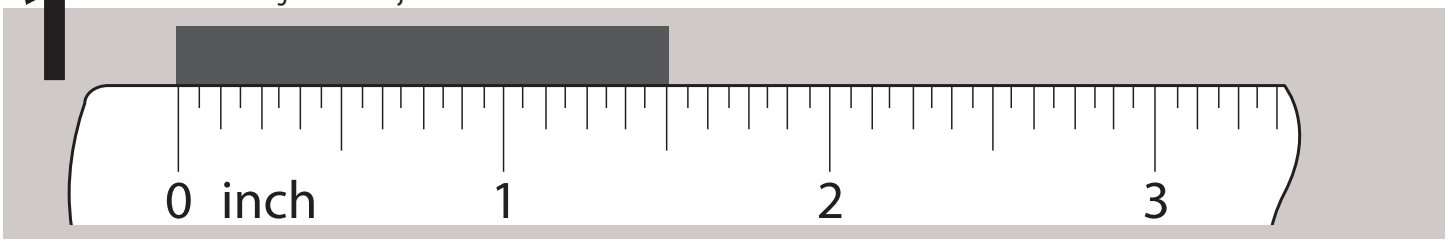
In our example, we see that our object is one sixteenth longer than the ¾ mark, so it is 1 more than 12. . . or 13 sixteenths.

If the resulting fraction can be reduced down to eighths, quarters, or halves, do so to arrive at your final answer.

Using a Ruler

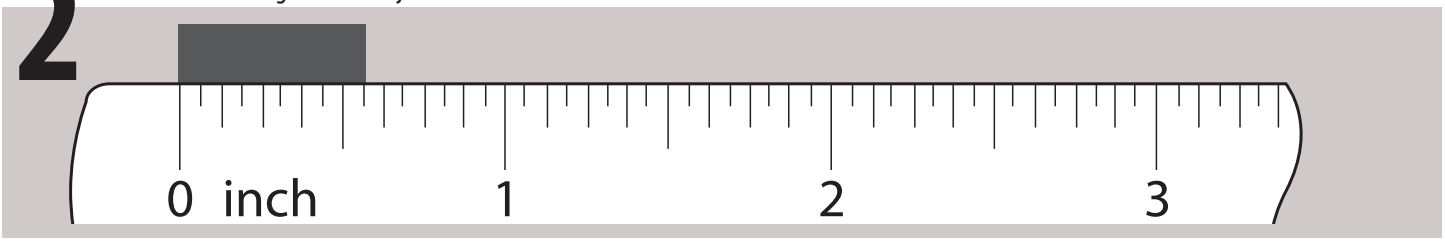
Example Measurements

1 Measure the length of the object.



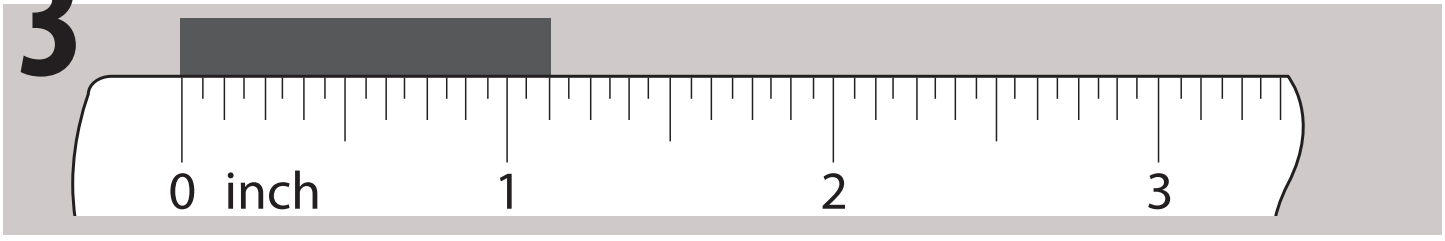
The left side of the object is properly aligned with the zero mark. The right side of the object is aligned perfectly with the longest mark between 1 and 2 inches, so we do not need to round. The whole inch component is 1 inch, since the object is between 1 and 2. The fractional inch component is ½ inch, since it aligns perfectly with the longest (half inch) mark. Alternatively, we could have counted 8 of the sixteenths marks to get 8/16, which reduces down to ½! Our answer is **1 ½ inches**.

2 Measure the length of the object.



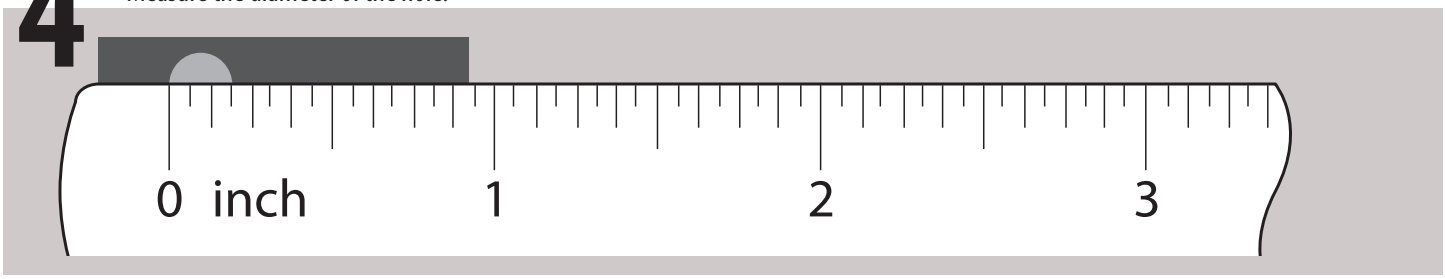
The left side of the object is properly aligned with the zero mark. The right side of the object aligns with first sixteenth mark after the half inch mark, so we do not need to round. The whole inch component is 0 inches, since the object is between 0 and 1. The fractional inch component is 9/16 inch, since it aligns perfectly with the ninth mark, and 9/16 is not reducible. Our answer is **9/16 inches**.

3 Measure the length of the object.



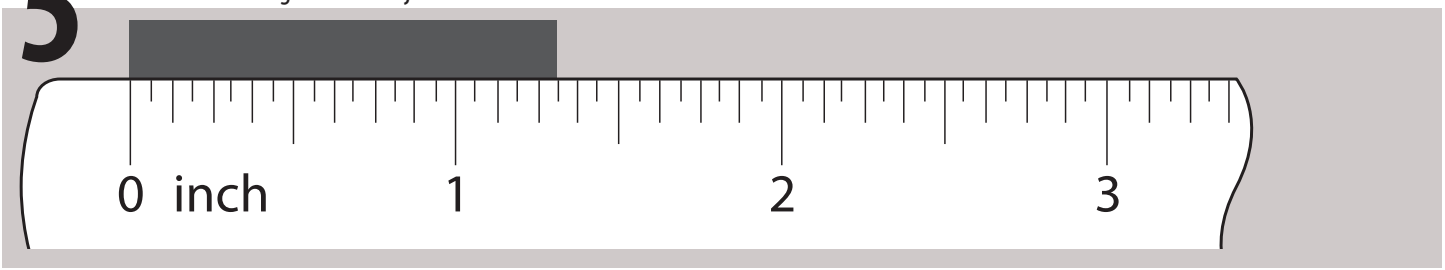
The left side of the object is properly aligned with the zero mark. The right side of the object lands between the 1/16 and 1/8 marks, but is closer to the 1/8 mark. The whole inch component is 1 inches, since the object is between 1 and 2 inches. The fractional inch component is 1/8 inch, since we rounded up to 1/8 inch. Our answer is **1 1/8 inches**.

4 Measure the diameter of the hole.



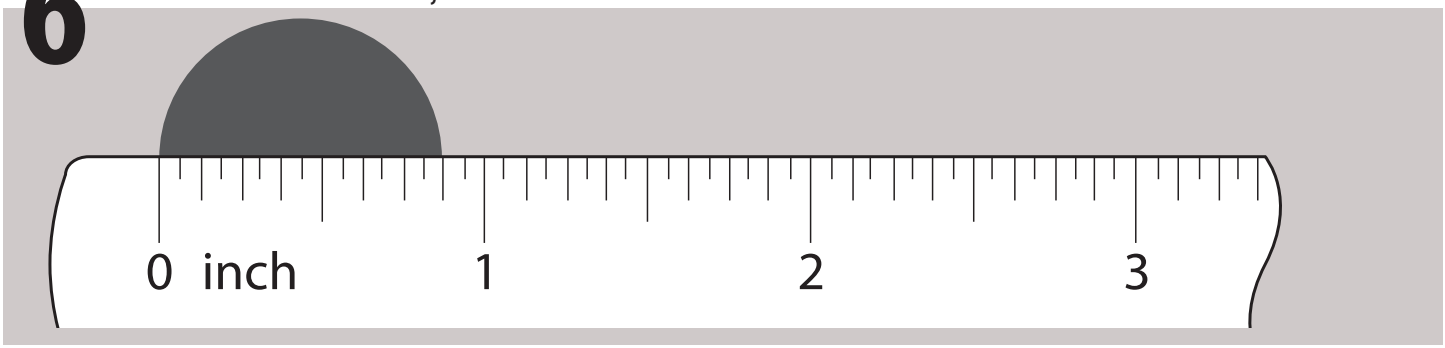
First, we need to align the zero mark with the left edge of the hole. The distance to the right side of the hole will be the diameter. The right side of the hole lands on the third mark, so we do not need to round. The whole inch component is 0 inches, since the hole diameter is less than 1 inch. The fractional inch component is 3⁄16 of an inch. Our answer is **3⁄16 inch.**

5 Measure the length of this object in decimal form.



The left side of the object is properly aligned with the zero mark. The right side of the object lands on a mark, so we do not need to round. The whole inch component is 1 inch, since the object is between 1 and 2 inches. The fractional inch component is 5⁄16 of an inch, since it lands on the fifth mark after the 1 inch mark. Referring to the image on page 5, we see that 5⁄16 corresponds to 0.3125 inches. We could also find this using a calculator by dividing 5 by 16. Our answer is **1.3125 inches.**

6 Measure the diameter of this object in decimal form.



First we need to align the zero mark with the left edge of the circular object along the centerline so that we are measuring the diameter. The right side of the object lands on a mark, so we do not need to round. The whole inch component is 0 inch, since the object is less than 1 inch in diameter. The fractional inch component is 7⁄8 of an inch, since it lands on last eighth inch mark before 1 whole inch. Referring to the image on page 5, we see that 7⁄8 corresponds to 0.875 inches. We could also find this using a calculator by dividing 7 by 8. Our answer is **0.875 inches.**

Using a Caliper

Caliper Basics

Calipers are measuring tools commonly used for the following:

- Measuring thickness
- Measuring internal/external diameters
- Measuring the inside/outside, or depth of an object

Standard Units on a Caliper

- The scale on a caliper should be labeled with a unit, typically centimeters or inches
- Most calipers are divided up into ten parts instead of the typical 16 seen on a ruler

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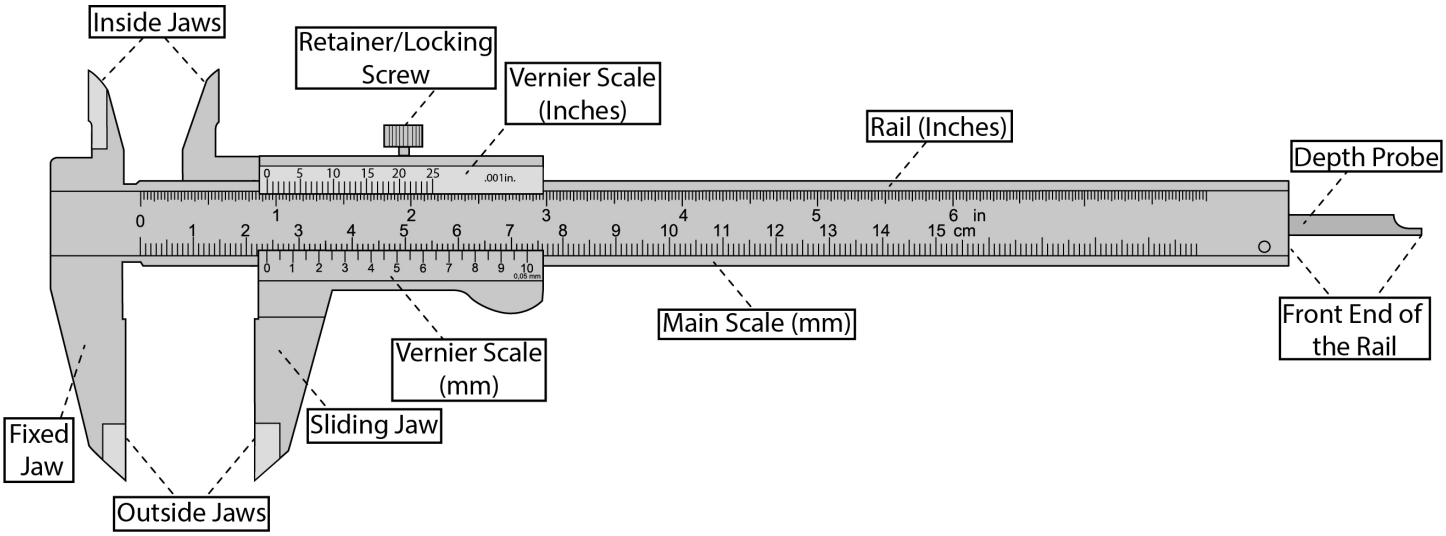
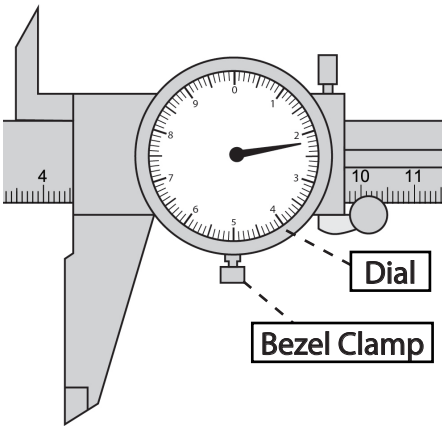
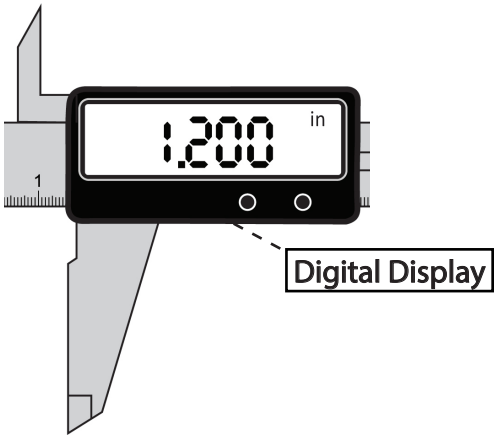
Using a Caliper

Caliper Parts







Using a Caliper

Reading a Caliper

Reading Vernier Calipers

1. Read the main scale measurement.
2. Read the secondary scale measurement.
3. Find the sum of the two measurements.

Reading Dial Calipers

1. Zero out the dial.
2. Adjust the jaws to measure the object.
3. Look at the sliding jaw and note the last main scale that it passed.
4. Look at the dial and determine which number the hand is pointing to.
5. The sum of the two readings is the final measurement.

Reading Digital Calipers

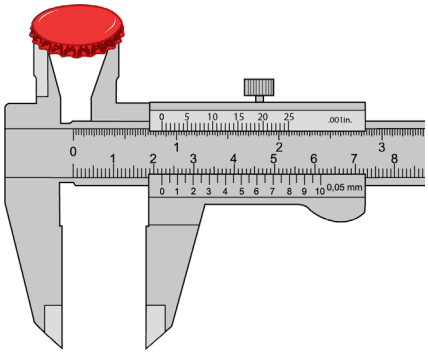
Digital calipers are the easiest to read; however, they are often more expensive than a dial or Vernier caliper.

1. Select the preferred measurement scale (inches or centimeters) and read the number displayed.
2. Most digital calipers will read up to a thousandth of an inch or millimeter.

Using a Caliper

Measuring with a Caliper

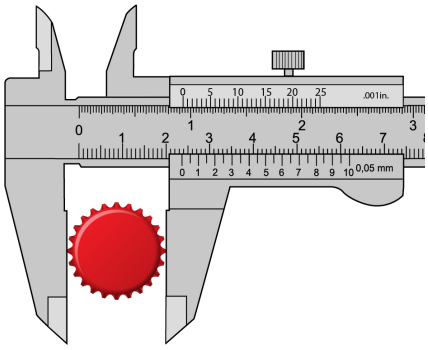
Steps to Measuring Inside Dimensions



The upper set of jaws on the caliper are used to measure the inside diameter of a hole.

1. Loosen the top screw.
2. Adjust the upper jaws so that they are slightly smaller than the hole being measured.
3. Slide the jaws into the hole.
4. Adjust the upper jaws until they hit the walls of the hole.
5. Turn the lock screw to set the jaws in place.
6. Take the measurement.

Steps to Measuring Outside Dimensions



The lower set of jaws are used to measure the outside diameter of a cylinder or the length/width of an object.

1. Unlock the top screw and adjust the jaws to fit around the object being measured.
2. Slide the jaws until they are clamped tightly around the object.
3. Turn the lock screw so that the lower jaws are set.
4. Take the measurement.

Conversions

Metric and Standard Conversions

Common Standard Conversions

1 foot (ft) = 12 inches (in)

1 yard (yd) = 3 feet (ft)

1 mile (mi) = 5,280 feet (ft)

Common Metric Conversions

1 centimeter (cm) = 10 millimeters (mm)

1 meter (m) = 100 centimeters (cm)

1 kilometer (km) = 1,000 meters (m)

Conversion Table

Convert from:	Convert to:	Multiply by:
Kilometer (km)	Mile (mi)	0.621371
Millimeter (mm)	Inch (in)	0.0393701
Centimeter (cm)	Inch (in)	0.393701
Meter (m)	Foot (ft)	3.28084
Meter (m)	Yard (yd)	1.09361
Mile (mi)	Kilometer (km)	1.609347
Inch (in)	Millimeter (mm)	25.4
Inch (in)	Centimeter (cm)	2.54
Foot (ft)	Meter (m)	0.3048
Yard (yd)	Meter (m)	0.9144

Converting Metric Units

Convert the following metric measurements. Round to the nearest ten-thousandth.

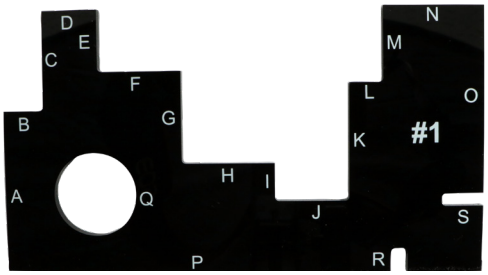
1. 3 km= **3,000** m
2. 150 cm= **1.5** m
3. 22 m= **2,200** cm
4. 1.76 m= **1,760** mm
5. 7,000 m= **7** km
6. 8 cm= **80** mm
7. 2,000 m= **2** km
8. 600 km= **600,000** m
9. 4,950 mm= **4.95** m
10. 49 cm= **0.49** m
11. 9,994 mm= **999.4** cm
12. 0.45 km= **450** m

Measure the following sides of **Object 1** in millimeters, then place the values in order from least to greatest.

13. **F=32 mm, H=35 mm, N=38 mm**

14. **K=44 mm, A=62 mm, O=70 mm**

15. **M=28 mm, N and C =38 mm**



Measure the following sides of **Object 1**, fill in the distance on the line, then compare the numbers with greater than (<), less than (<), or equal to (=) symbols.

16. **1.6** cm (B) [>] **1.3** cm (L)
17. **2.8** cm (J) [<] **3.5** cm (H)
18. **7.0** cm (O) [>] **6.2** cm (A)
19. **3.5** cm (G) [<] **4.4** cm (K)
20. **1.4** cm (I) [<] **2.4** cm (E)
21. **2.9** cm (M) [<] **3.2** cm (F)

Application:

22. Marcus is making homemade bread for 15 members of his family. Each recipe calls for 600 g of flour; however, the bags of flour only come in 1 kg in size. In order to make all 15 recipes of bread, how many bags of flour does Marcus need to buy?

Total flour needed: 15(600 g)=9,000 g 9,000 g=9 kg 9 kg=9 bags of flour

Lesson One – Metric and Standard Readings

Converting Standard Readings

Convert the following standard measurements. Round to the nearest ten-thousandth.

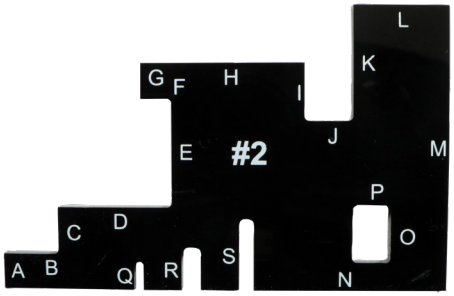
1. 3 ft=__**36**__ in
2. 200 in=__**5.55**__ yd
3. 2 mi=__**10,560**__ ft
4. 1 mi=__**63,360**__ in
5. 428 ft=__**0.08**__ mi
6. 302 in=__**25.17**__ ft
7. 17 yd=__**51**__ ft
8. 3.4 mi=__**5,984**__ yds
9. 4,350 yd=__**2.47**__ mi
10. 45 ft=__**540**__ in
11. 2,045 yd=__**1.16**__ mi
12. 2.8 mi=__**14,784**__ ft

Measure the following sides of **Object 2** in inches, then place the values in order from least to greatest.

13. **E=1 7/16 in, H=2 1/8 in, N=2 1/2 in**

14. **A and G=7/16 in, I=3/4 in**

15. **L=1 1/4 in, D and K=1 1/2 in**



Measure the following sides of **Object 2**, fill in the distance on the line, then compare the numbers using >, <, or = .

16. __**1/2**__ in P [<] __**3/4**__ in O
17. __**1 7/16**__ in K [>] __**1 3/8**__ in E
18. __**7/16**__ in G [<] __**2 1/2**__ in N
19. __**3/4**__ in O [>] __**5/8**__ in J
20. __**3/4**__ in B [>] __**5/8**__ in J
21. __**1 7/16**__ in E [>] __**1 1/4**__ in L

Application:

22. Mario is the foreman at a construction site. To maintain his health, his doctor wants him to wear a step counter, and log four miles a day while at work. Mario has a step counter that only measures in feet. Today Mario walked 25,000 feet. Did he meet his goal? How many feet above or below his goal was he?

    Mario met his goal of 4 miles by 3,880 feet.

    25,000 ft·(1 mi)/(5,280 ft)≈4.73 mi 5,280(4)=21,120 25,000-21,120=3,880 ft

Standard to Metric Conversion

1 inch = 2.54 centimeters	1 yard = 0.9144 meters
1 foot = 30.48 centimeters	1 foot = 0.3048 meters
1 mile = 1.609347 kilometers	1 inch = 25.4 millimeters

Following the prompts below, convert each measurement provided from standard to metric. Round to the nearest hundredth.

1. How many centimeters are in 204 inches?

   518.16 cm

2. How many meters are in 40 yards?

   36.58 m

3. How many meters are in 5 yards?

   4.57 m

4. How many centimeters are in 18 inches?

   45.72 cm

5. How many kilometers are in 3 miles?

   4.83 km

6. How many centimeters are in 22 feet?

   670.56 cm

7. How many meters are in 102 feet?

   31.09 m

8. How many millimeters are in 14 inches?

   355.60 mm

Which of the following units of measure is the most appropriate in the metric system?

9. Measuring a 30-foot mobile home:

   A. Millimeters

   B. Centimeters

   C. Meters

   D. Kilometers

10. Measuring the length of the Nile River:

    A. Millimeters

    B. Centimeters

    C. Meters

    D. Kilometers

Lesson One – Metric and Standard Readings

Metric to Standard Conversion

1 centimeter = 0.394 inches	1 meter = 1.094 yards
1 meter = 3.281 feet	1 centimeter = 0.0328 feet
1 kilometer = 0.6214 miles	1 millimeter = 0.0394 inches

Following the prompts below, convert each measurement provided from metric to standard. Round to the nearest hundredth.

1. How many inches are in 24 centimeters?

   9.45 in

2. How many yards are in 32 meters?

   35.00 yds

3. How many miles are in 3 kilometers?

   1.86 mi

4. How many feet are in 338 centimeters?

   11.09 ft

5. How many yards are in 4,056 millimeters?

   4.44 yds

6. How many inches are in 2 kilometers?

   78,740.81 in

7. How many miles are in 15,000 meters?

   9.32 mi

8. How many feet are in 6 kilometers?

   19,685.00 ft

Which of the following units of measure is the most appropriate in the standard system?

9. Measuring the width of a 68-meter soccer field:

   A. Inches

   B. Feet

   C. Yards

   D. Miles

10. The length of a 4,235-kilometer race:

    A. Inches

    B. Feet

    C. Yards

    D. Miles

Conversion Applications

1. Luigi swam 3.2 km every day at swim practice for five days straight. How many miles did Luigi swim in the five days? Round to the nearest hundredth.

   16 km≈9.94 mi

2. Marco is shingling his 72-foot-long roof. If each shingle is one meter in length, how many shingles will Marco need for one row?

   22 shingles

3. James has a goat pasture with a perimeter of 402 meters. If the fencing he wants is sold by the foot, how many feet of fencing does James need? Round to the nearest foot.

   1,319 ft

4. Hamish is making a railing for his deck, and the plans recommend one screw every 15 cm. To the nearest tenth of an inch, how far apart should Hamish place his screws?

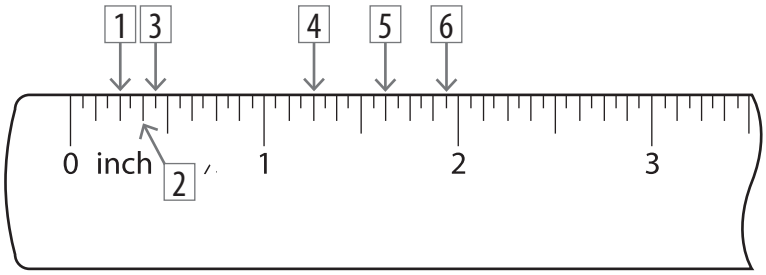
   5.9 in

5. Three companies are building apartment complexes in the city of Houston. Each company claims that their apartments will be the tallest in the city. Company A's building will be 800 feet tall. Company B's building will be 373 yards tall, and Company C's building will be 350 meters tall. Whose building will be the tallest?

   Company "C" at 1,148 ft

Fractions on a Ruler

Use the diagram below to label the missing fractions on the ruler.



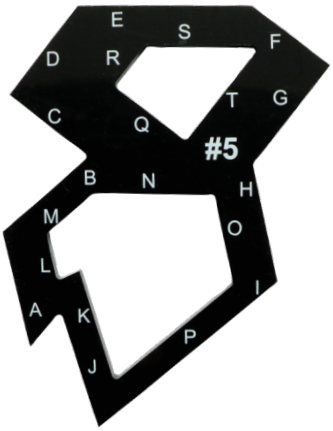
1. **¼**
2. **⅜**
3. **7⁄16**
4. **1 ¼**
5. **1 ⅝**
6. **1 15⁄16**

Measure the following sides of **Object 4**, fill in the distance as a fraction, then compare the fractions with < , > , or =.

7. **5 5⁄16** cm (B) **>** **3 ⅝** cm (F)
8. **1 ⅜** cm (E) **>** **1 ¼** cm (O)
9. **1 ⅜** cm (C) **=** **1 ⅜** cm (H)
10. **1 ⅝** cm (I) **<** **1 7⁄8** cm (D)
11. **1 ¾** cm (A) **>** **1 ¼** cm (G)
12. **2 1⁄16** cm (L) **<** **2 ½** cm (M)

Measure the following sides of **Object 5** as fractions of an inch, then place the numbers in order from least to greatest.

13. **O=1 5⁄16 in, C=1 7⁄16 in, G= 1 ¾ in, M=1 7⁄8 in**



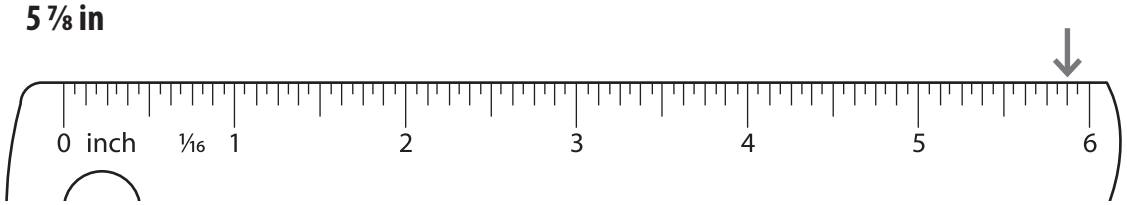
14. **D= 1 ⅝ in, H= 1 11⁄16 in, J=1 13⁄16 in, P=2 ¼ in, E= 2 7⁄16 in**

Lesson Two – How to Read a Ruler and Tape Measure

Reading a Ruler (Standard)

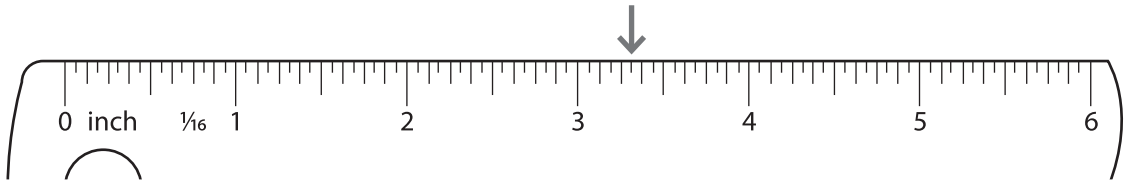
1. What is the measurement shown on the ruler below?

5 7/8 in



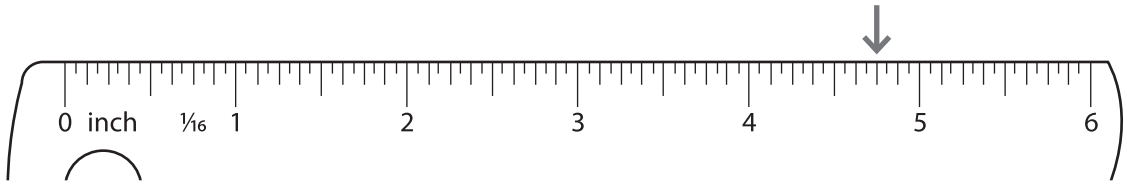
2. What is the measurement shown on the ruler below?

3 5/16 in



3. What is the measurement shown on the ruler below?

4 3/4 in



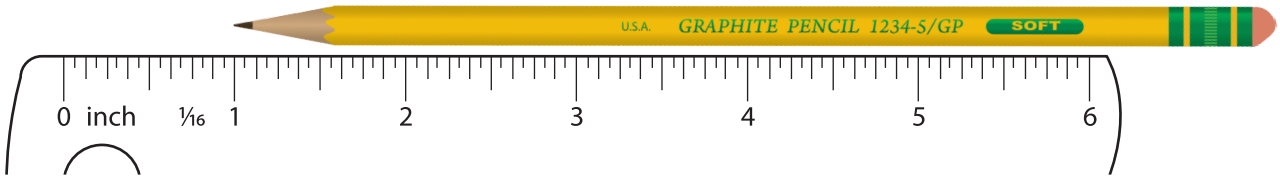
4. Which option best describes the mistake in the image below?

A. The ruler is too short.

B. The pencil should be lined up with the 0 mark on the ruler.

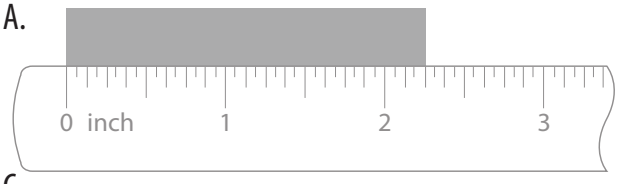
C. The pencil should be measured from the eraser side.

D. The pencil should start at the 2-inch mark on the ruler.

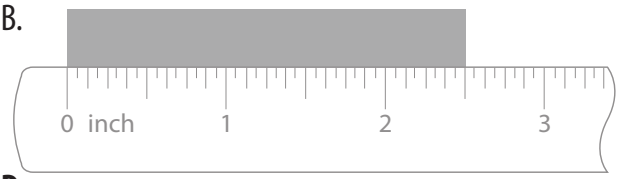


5. Which of the following images shows a measurement of 2 3/16 inches?

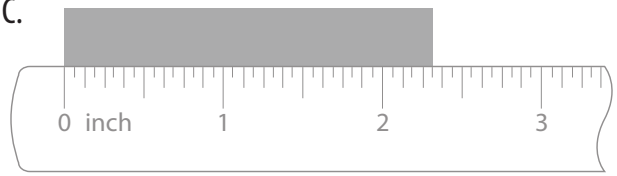
A.



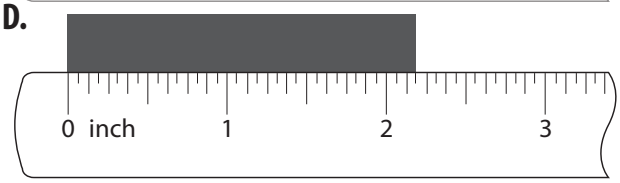
B.



C.

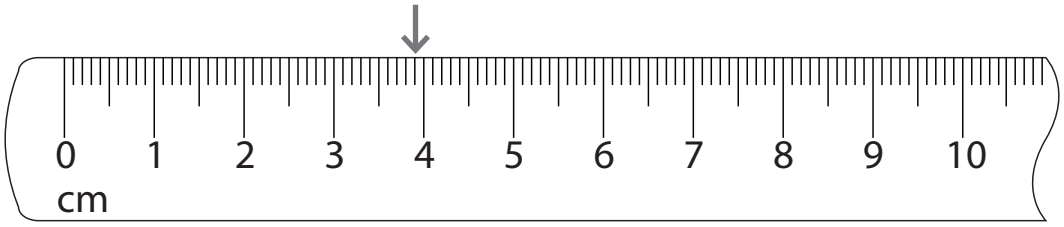


D.

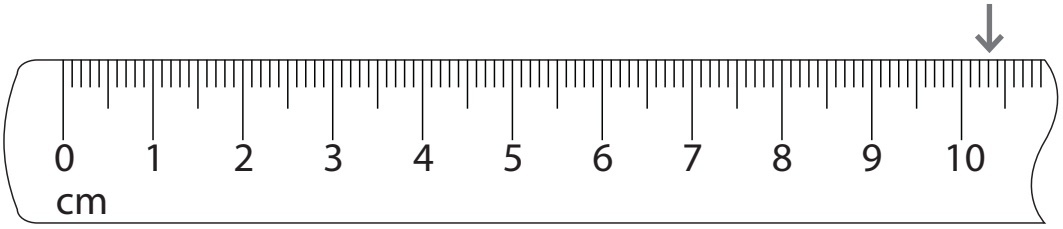


Reading a Ruler (Metric)

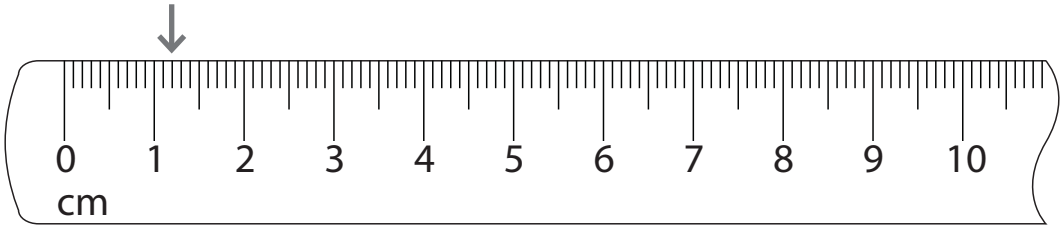
1. What is the measurement shown on the ruler below? **3.9 cm**



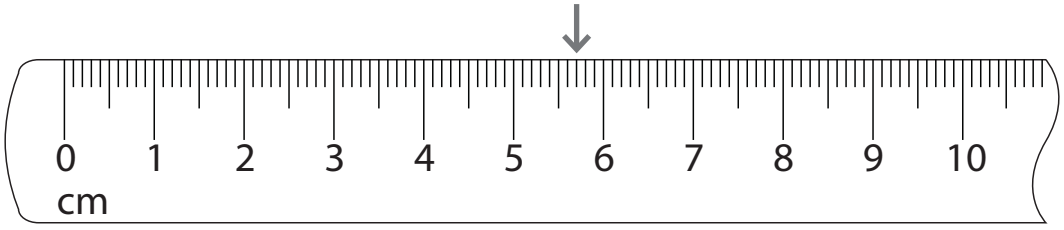
2. What is the measurement shown on the ruler below? **10.3 cm**



3. What is the measurement shown on the ruler below? **1.2 cm**

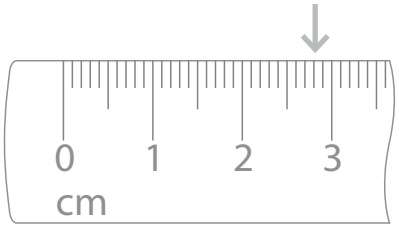


4. What is the measurement shown on the ruler below in millimeters? **57 mm**

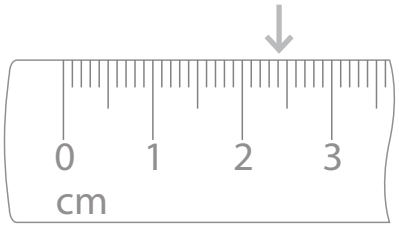


5. Which of the following images shows a measurement of 2.6 centimeters?

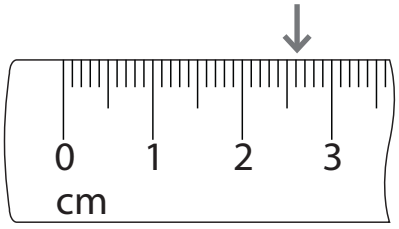
A.



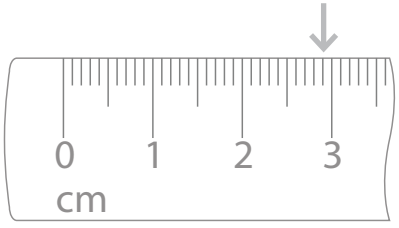
B.



C.



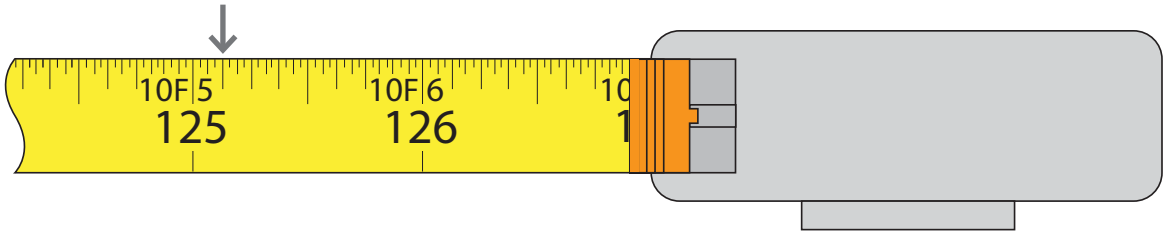
D.



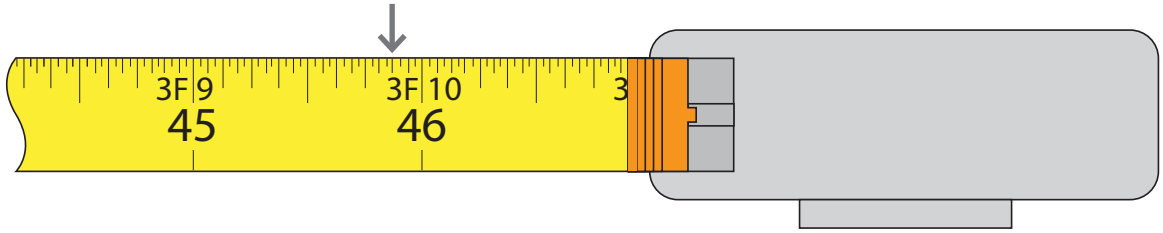
Lesson Two – How to Read a Ruler and Tape Measure

Reading a Tape Measure (Standard)

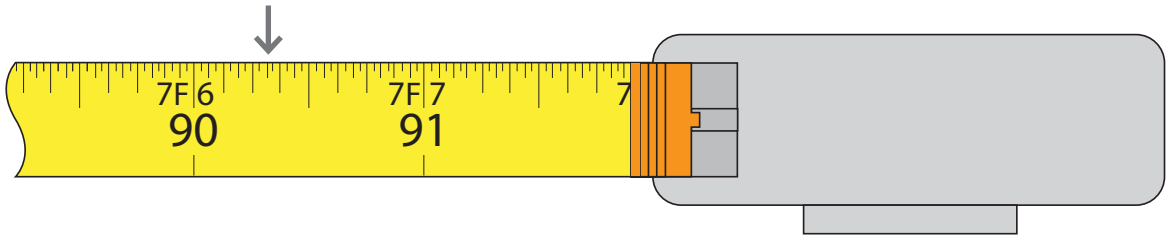
1. What is the measurement on the tape measure shown below? Answer in feet and inches. **10 ft 5 ⅛ in**



2. What is the measurement on the tape measure shown below? Answer in feet and inches. **3 ft 9 ⅞ in**



3. What is the measurement on the tape measure shown below? Answer in feet and inches. **7 ft 6 5⁄16 in**



4. Which of the following values is equivalent to 142 inches?

A. 10 ft 6 in

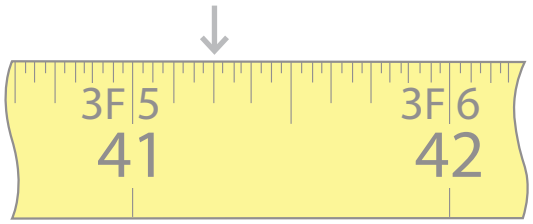
B. 10 ft 10 in

C. 11 ft 2 in

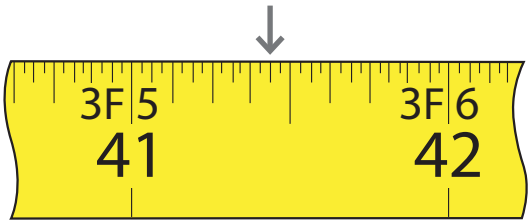
D. 11 ft 4 in

5. Which of the following images shows a measurement of 3 feet 5 7⁄16 inches?

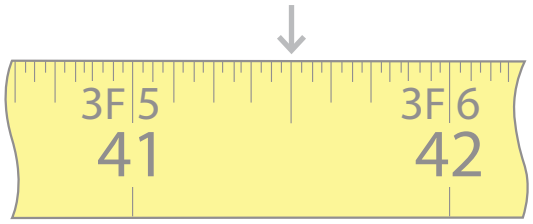
A.



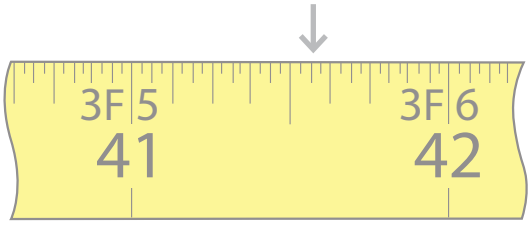
B.



C.

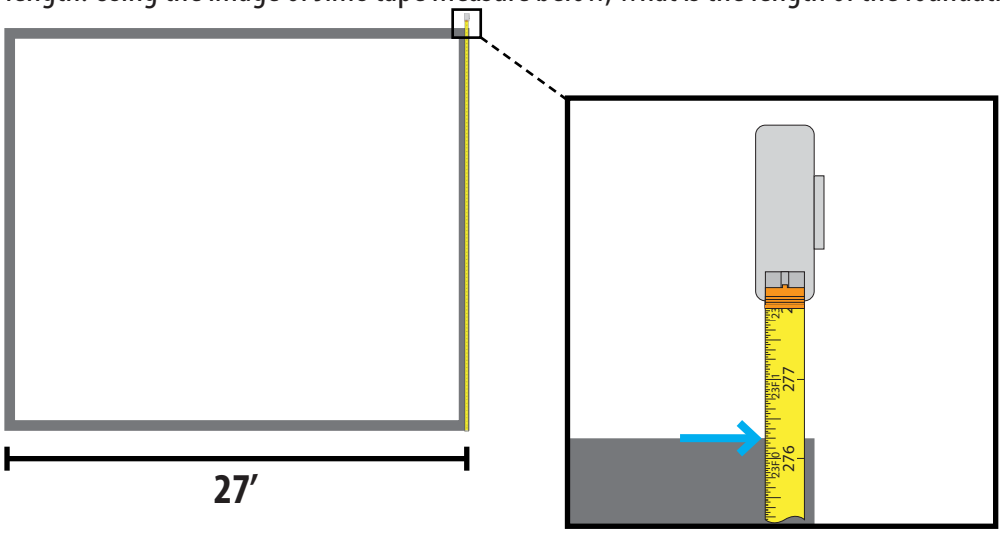


D.



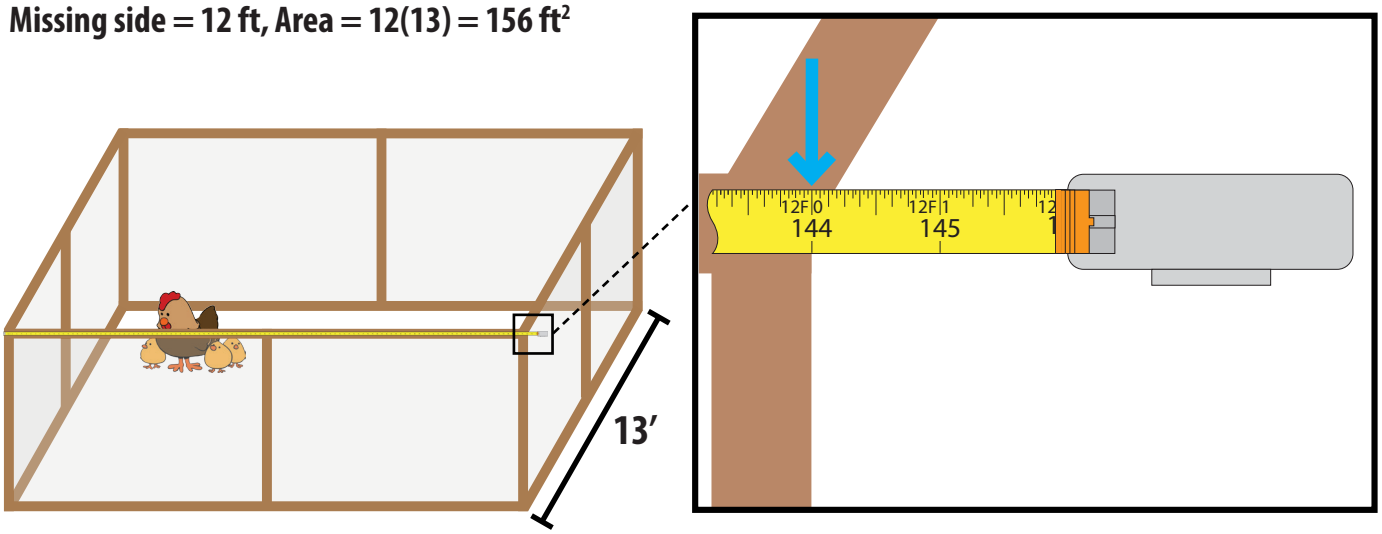
Ruler/Tape Measure Application

1. Jim is pouring concrete for a foundation at his new job site. He knows that the width is 27 feet and is now measuring the length. Using the image of Jim's tape measure below, what is the length of the foundation? **23 ft ¼ in**



2. Sal needs to know the area of his chicken run in order to know how many chickens to buy. Sal has already measured the length, which is 13 feet. Find the area of the chicken run using the image of Sal's tape measure to first determine the width.

Missing side = 12 ft, Area = 12(13) = 156 ft²



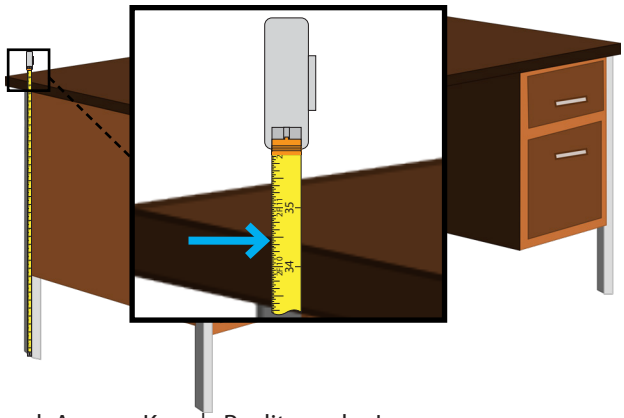
3. Marco is hiring some extra help for his construction business during the busy season. He interviews four applicants and asks them to measure the height of his desk in inches. Which one of the applicants has the correct measurement?

A. Rob, 34 ⅝ inches

B. Drew, 34 3⁄16 inches

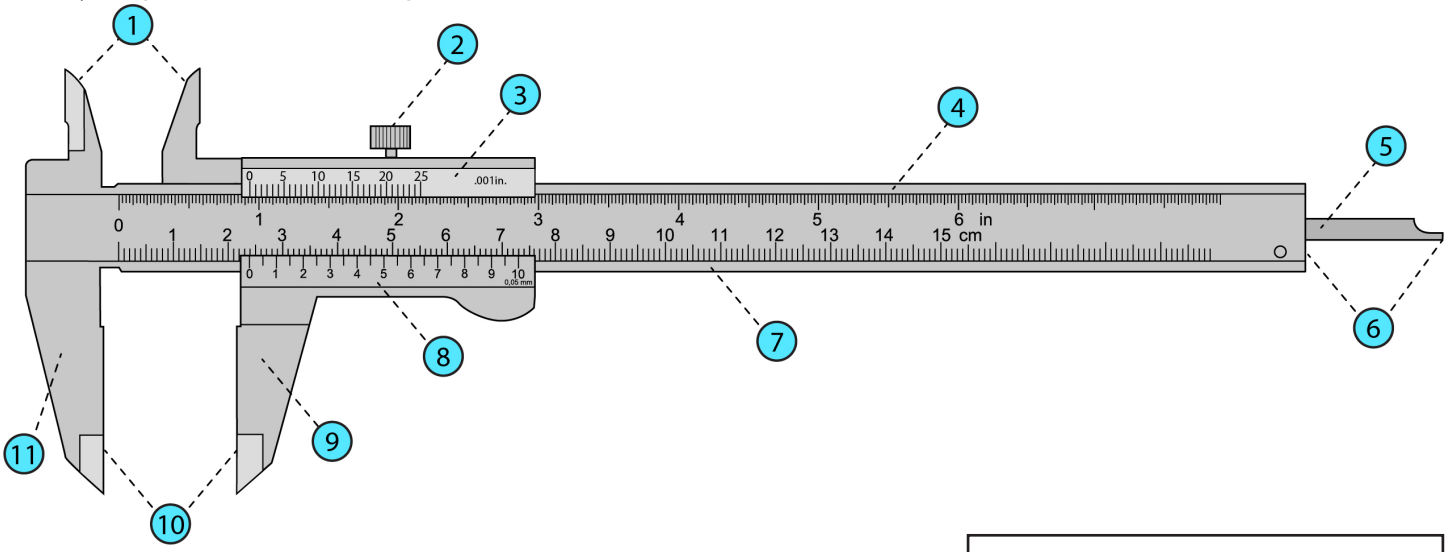
C. Megan, 34 ⅛ inches

D. Andrea, 34 7⁄16 inches



Parts of a Caliper

Identify the parts of the Vernier caliper shown below:



1. **Inside Jaws**
2. **Retainer or Locking Screw**
3. **Vernier Scale (inches)**
4. **Rail (inches)**
5. **Depth Probe**
6. **Front End of the Rail**
7. **Main Scale (millimeter)**
8. **Vernier Scale (millimeter)**
9. **Sliding Jaw**
10. **Outside Jaws**
11. **Fixed Jaw**

Word Bank

Rail (inches)

Inside Jaws

Sliding Jaw

Retainer or Locking Screw

Outside Jaws

Vernier Scale (inches)

Fixed Jaw

Front End of the Rail

Vernier Scale (millimeter)

Main Scale (millimeter)

Depth Probe

Lesson Three – How to Read and Use a Caliper

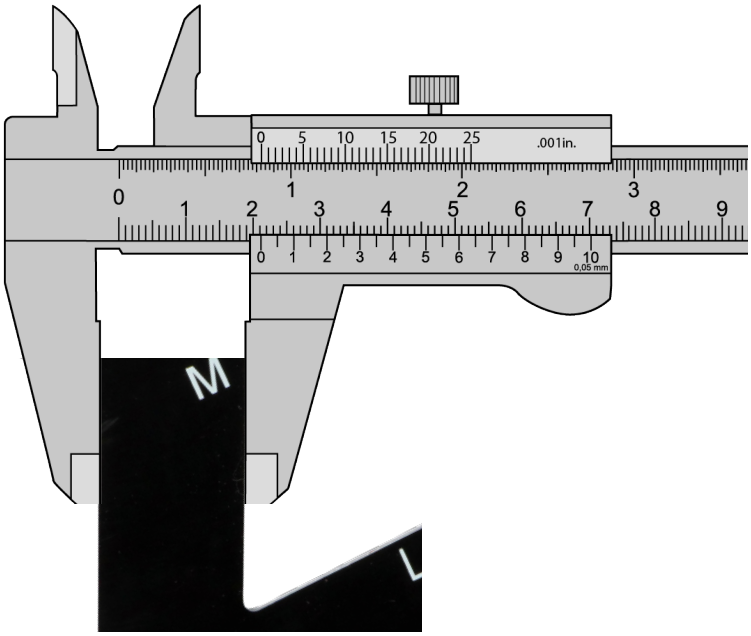
Reading Measurements on a Metric Vernier Caliper

Use **Object 4** and a caliper to measure the length listed below and write down the measurements.

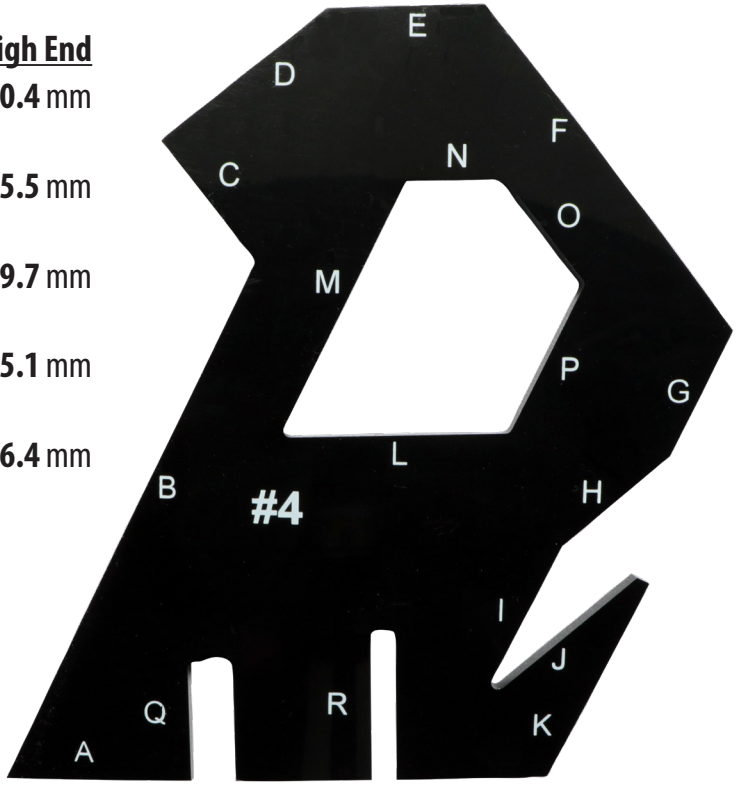
NOTE: Due to the caliber used, we have created ranges for correct answers, the middle underlined number is the closest answer or tolerance

	Low End	Closest Answer	High End
1. Side B to Side M	**20.2** mm	**23.0** mm	**22.5** mm

Example:



	Low End	Closest Answer	High End
2. Side F to Side O	**19.9** mm	**20.9** mm	**20.4** mm
3. Side C to Side F	**75.0** mm	**76.0** mm	**75.5** mm
4. Side E to Side N	**39.2** mm	**40.2** mm	**39.7** mm
5. Side G to Side P	**34.6** mm	**35.6** mm	**35.1** mm
6. Side M to Side P	**45.9** mm	**46.9** mm	**46.4** mm

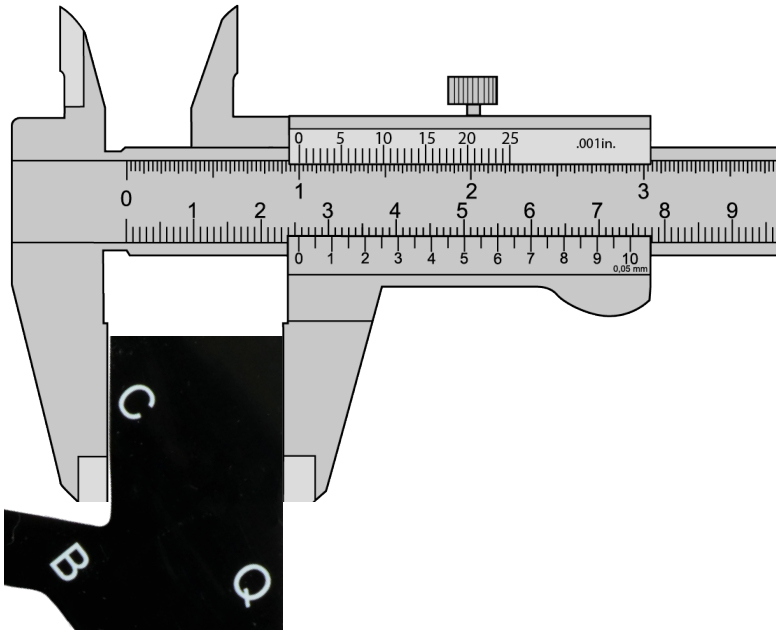


Reading Measurements on a Standard Vernier Caliper

Use **Object 5** and a caliper to measure the length listed below and write down the measurements.

Use the caliper readings shown below and write down their measurements.

1. Side C to Side Q **1.00** in Example:



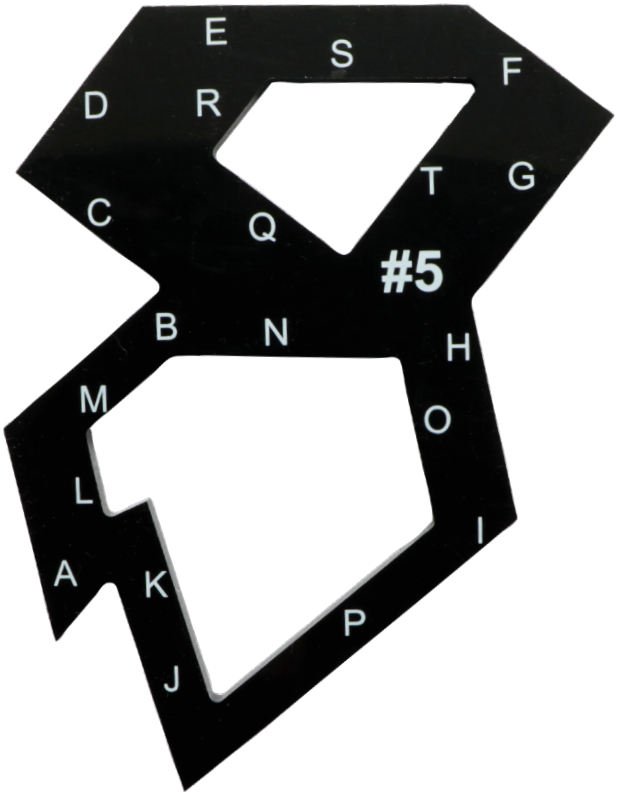
2. Side H to Side O **0.616** in

3. Side A to Side H **3.684** in

4. Side C for Side F **3.0625** in

5. Side E to Side S **0.564** in

6. Side R to Side T **1.290** in

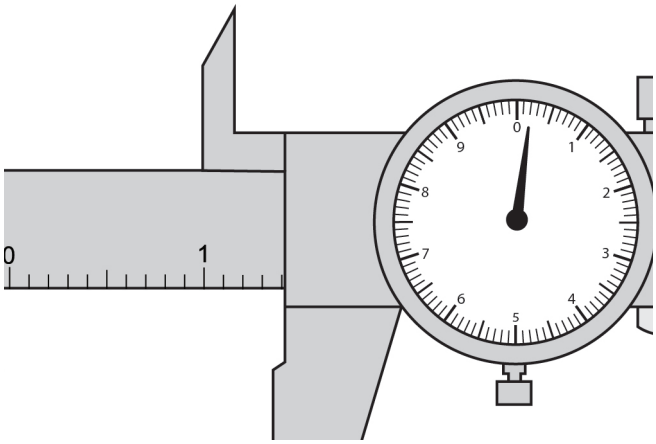


Lesson Three – How to Read and Use a Caliper

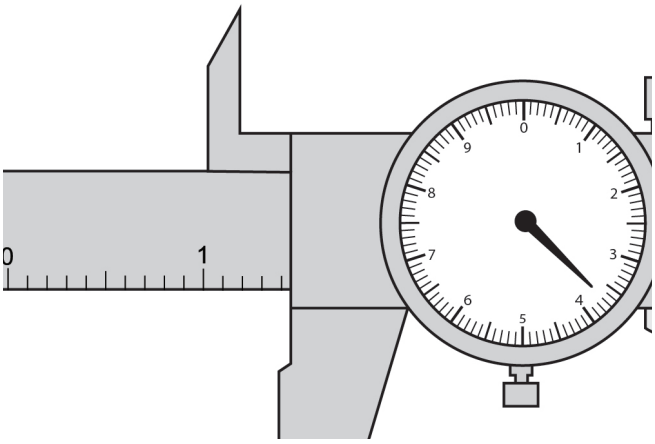
Miscellaneous Caliper Measurements

Use the caliper readings shown below and write down the measurements.

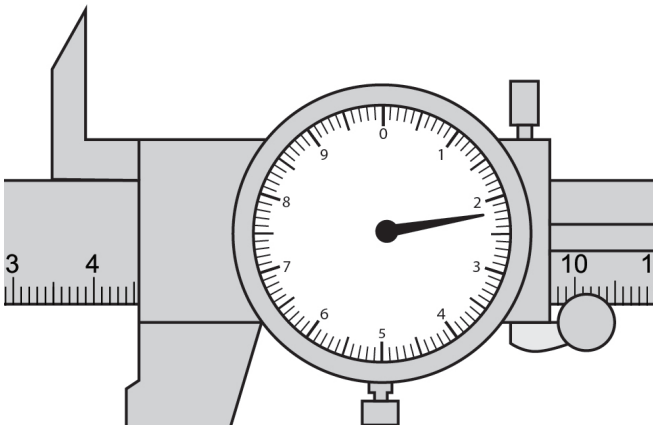
1. **1.402** in



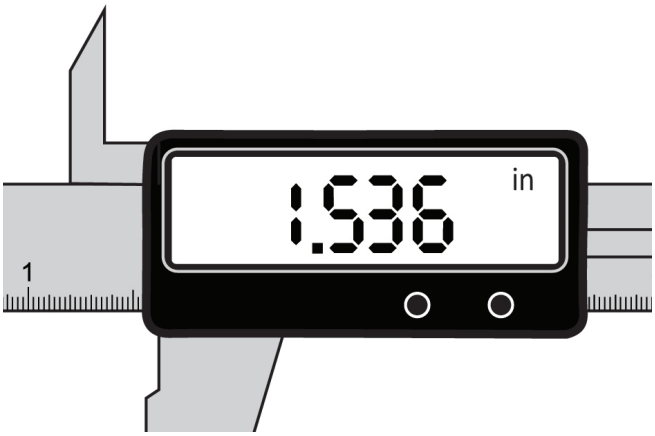
2. **1. 437** in



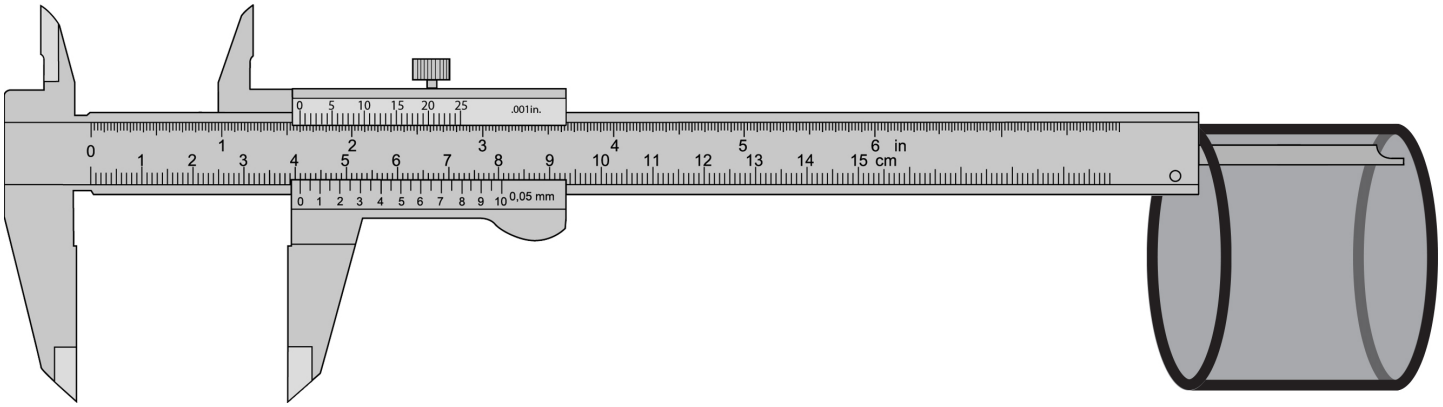
3. **4.522** cm



4. **1.536** in



5. **1.615** in

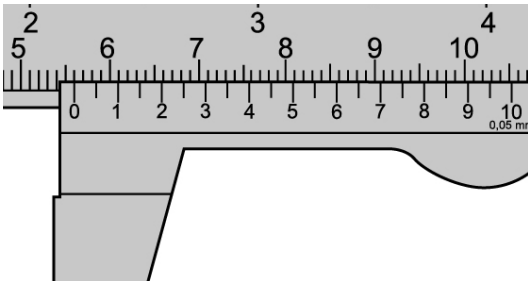


Caliper Conversions

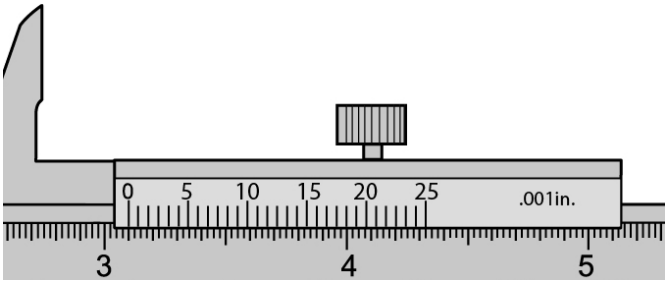
Find the measurement on the caliper shown. Convert the measurements to the unit listed and round to the nearest hundredths.

1. 10 mm = **1.00** cm
2. 10 in = **25.40** cm
3. 42 mm = **1.65** in

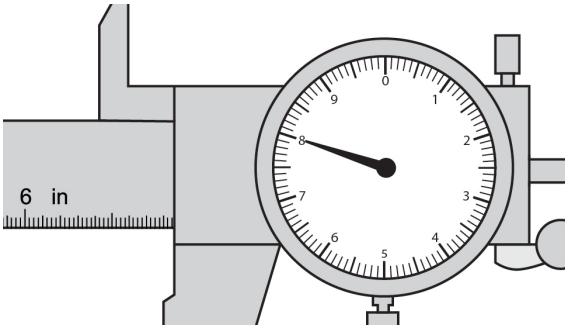
4. **56.00** mm



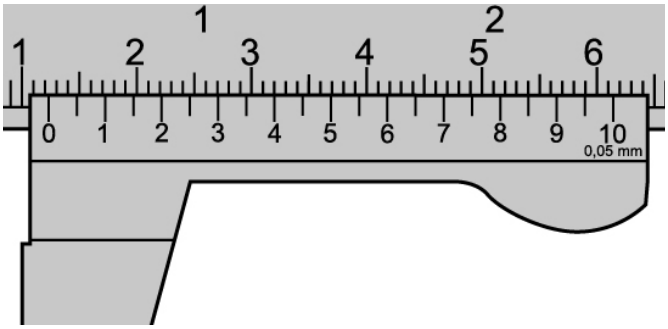
5. **7.874** cm



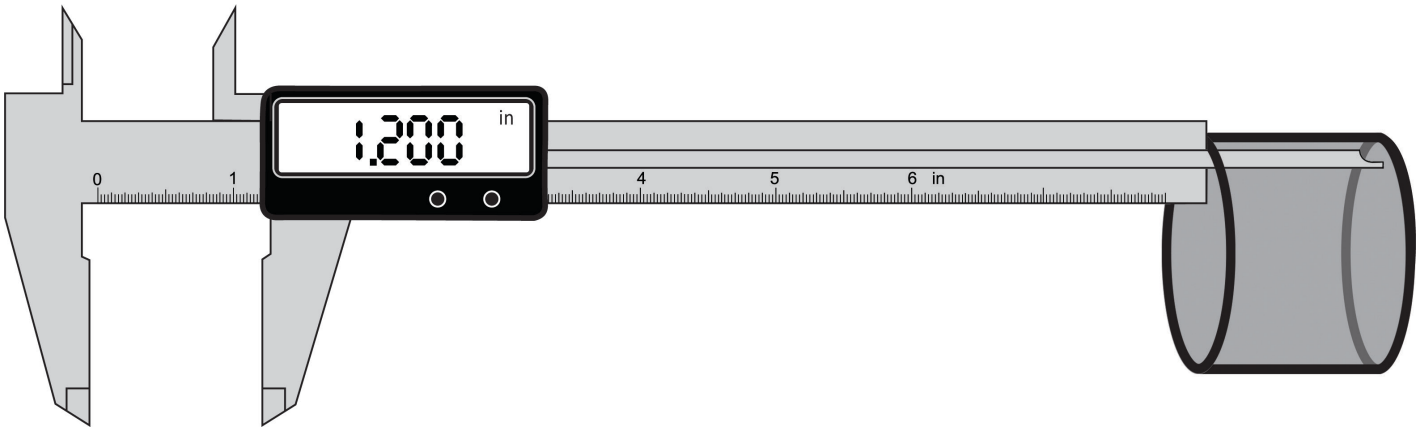
6. **174.75** mm



7. **1.24** cm



8. **30.48** mm



Lesson Four – Decimals

Place Value

Identify the place value of the highlighted numbers below:

1. 3.23**4**7 **Thousandths**
2. 5.**2**378 **Tenths**
3. 9.223**2** **Ten-thousandths**
4. 0.8**2**41 **Hundredths**
5. **2**.8250 **Ones**
6. 3.0**2**24 **Hundredths**

7. Which of the following numbers has a 3 in the ten-thousandths position?

   A. 3.3981

   B. 0.9314

   C. 1.2493

   D. 4.2439

For numbers 8-10, write a number with the following criteria:

8. A 2 in the hundredths position, 3 in the tenths position, and a 9 in the thousandths position. **0.329**

9. A 6 in the ten-thousandths position, 4 in the ones position, 7 in the thousandths position, 1 in the hundredths position, and 5 in the tenths position. **4.5176**

10. A 7 in the ones position, 6 in the hundred-thousandths and tenths position, 8 in the hundredths position, 3 in the ten-thousandths position, and 2 in the thousands position. **2,007.68036**

Lesson Four – Decimals

Reading/Writing Decimals

For problem numbers 1-4, write the decimals as if you were reading them.

1. 2.428

   Two and four hundred twenty-eight thousandths

2. 3.2901

   Three and two thousand nine hundred one ten-thousandths

3. 2.84

   Two and eighty-four hundredths

4. 0.024

   Twenty-four thousandths

For numbers 5-8, write the decimals from their word form.

5. Two and three hundred forty-two thousandths.

   2.342

6. Thirty-seven ten-thousandths.

   0.0037

7. Five and one thousand four hundred sixty-seven ten-thousands

   5.1467

8. Nine and fifty-eight thousand two hundred eleven hundred-thousandths.

   9.58211

Adding/Subtracting Decimals

Find the sum and/or difference of the following decimals.

1. 2.129+3.291 = **5.42**

2. 8.21-7.219 = **0.991**

3. 2.012+7.024 = **9.036**

4. 4.925-3.047 = **1.878**

5. 9.04-4.02+1.11 = **6.13**

6. 7.892-1.922+3.028 = **8.998**

7. Identify and explain the error in the following addition of decimals.

$$\begin{array}{r} 4.1264 \\ +\ 3.22 \\ \hline 4.1586 \end{array}$$

When adding/subtracting decimals, line up the decimal point vertically, and add/subtract the appropriate place values. In this case the decimals were not lined up vertically. The correct answer should be 7.3464.

Fill in the blank to complete each equation.

8. 4.28+ **5.18** =9.46

9. 9.124- **6.181** =2.943

10. 4.098- **3.075** =1.023

11. 5.201+ **3.257** =8.458

Lesson Four – Decimals

Multiplying/Dividing Decimals

Find the product or quotient of the following equations. Round to the nearest ten-thousandth.

1. 4.35 x 2.12 = **9.222**

2. 3.09 x 1.943 = **6.0039**

3. 4.524 x 6.7 = **30.3108**

4. 1.12 x 7.88 = **8.8256**

5. 4.29 ÷ 2.2 = **1.95**

6. 9.23 ÷ 2.22 = **4.1577**

7. 8.24 ÷ 5.29 = **1.5577**

8. 1.25 ÷ 6.2 = **0.2016**

9. Identify and explain the error in the following multiplication of decimals.

$$\begin{array}{r} 4.12 \\ \times\ 2.3 \\ \hline 94.76 \end{array}$$

The decimal should be 3 places from the left. Two places from the first number and one from the second number, making the answer 9.476.

Applications

1. Gustavo is extending the deck on the back of his house. The original deck is 11.45 feet and he wants to add an extension of 17.75 feet. What will the total length of the deck be after the extension is built?

   29.2 ft

2. In preparation for Thanksgiving dinner, you purchase a 22-pound turkey for $1.98 a pound. How much did the whole turkey cost?

   $43.56

3. Julio is getting ready to make brownies for the school bake sale. The recipe for one batch of brownies calls for 3.25 cups of sugar, and Julio would like to make seven batches. How much sugar total will Julio need?

   22.75 c

4. Carmen is at the local feed store to buy feed for her chickens. There is a 50-pound bag that sells for $14.68. How much is the chicken feed per pound?

   Approximately $0.29 per pound

5. Mrs. Harris walks after work every day. In the last seven days, she has walked 32.19 miles. What is the average number of miles Mrs. Harris walks per day? Round the answer to the nearest thousandth.

   4.599 mi per day

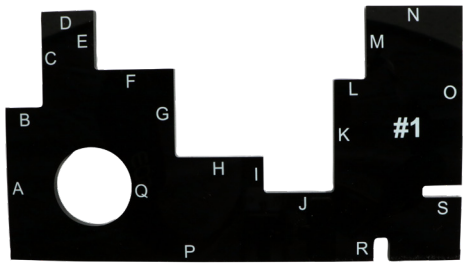
6. Stewart is 3.456 meters tall and his brother is 4.025 meters tall. What is the difference in the brothers' height?

   0.569 m

Lesson Five – Conversions

Fractions ⟶ Decimals

Measure the following sides of **Object 1** as inches in fraction form, write the measurements in the space provided, then convert them to decimals.



1. A = **2 7/16** in (fraction)

   Convert: **2.4375** in

2. O = **2 3/4** in (fraction)

   Convert: **2.75** in

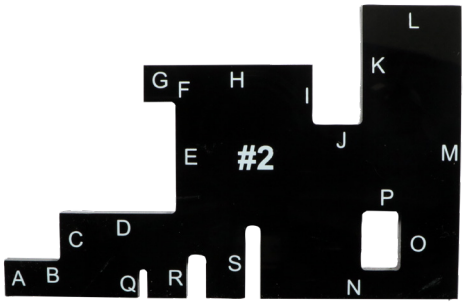
3. P = **5 13/16** in (fraction)

   Convert: **5.8125** in

4. D = **13/16** in (fraction)

   Convert: **0.8125** in

Measure the following sides of **Object 2** as inches in fraction form, write the measurements in the space provided, then convert them to decimals.



5. H = **2 1/16** in (fraction)

   Convert: **2.0625** in

6. M = **3 11/16** in (fraction)

   Convert: **3.6875** in

7. N = **2 1/2** in (fraction)

   Convert: **2.5** in

8. L = **1 1/4** in (fraction)

   Convert: **1.25** in

---

9. Which of the following is not equivalent to 3/8?

   A. 0.125

   B. 6/16

   C. 15/40

   D. 0.225

Lesson Five – Conversions

Decimals ⟶ Fractions

Convert the following decimals to fractions:

1. 0.12 = **$\frac{3}{25}$**

2. 0.394 = **$\frac{197}{500}$**

3. 3.2 = **$3\frac{1}{5}$ or $\frac{16}{5}$**

4. 5.2818 = **$5\frac{1409}{5000}$**

5. 1.67 = **$1\frac{2}{3}$ or $\frac{5}{3}$**

6. 1.3 = **$1\frac{1}{3}$ or $\frac{4}{3}$**

7. 1.125 = **$1\frac{1}{8}$ or $\frac{9}{8}$**

8. 9.28 = **$9\frac{7}{25}$ or $\frac{232}{25}$**

9. Which of the following is not equivalent to 9.45?

   A. $\frac{189}{20}$

   B. $9\frac{9}{20}$

   C. $9\frac{45}{100}$

   D. $\frac{176}{20}$

Decimals and Fractions

Compare the following numbers with <,>, or =.

1. 5/10 (>) 2/10

2. 3/8 (<) 1/2

3. 4/5 (<) .85

4. 0.22 (>) 1/12

5. 9/11 (<) .88

6. 0.45 (=) 9/20

7. 1.23 (>) 1.17

8. 1/3 (>) 1/4

9. 1.05 (<) 33/30

10. 7/10 (=) 0.70

Order the numbers from least to greatest.

11. **5/16, 0.34, 2/5**

12. **0.06, 1/16, 0.10**

13. **3/7, 9/14, 0.70**

14. **1/5, 0.22, 1/4**

15. Choose the decimal(s) that is greater than 9/20. More than one may be selected.

A. 0.415

B. 0.400

C. 0.342

D. 0.464

Lesson Five – Conversions

Applications #1

1. Stephanie got $\frac{2}{5}$ of the questions correct on her most recent math test. How would $\frac{2}{5}$ be written as a decimal?

   0.40

2. Riley scored a $19\frac{}{25}$ on his geography test last week. What is his score in decimal form?

   0.76

3. Mr. Freeman's gym class must ride 5 $\frac{4}{7}$ miles on the stationary bike. How many miles do the students have to ride in decimal form? Round the answer to the nearest ten-thousandth.

   5.5714 mi

4. Jimmy took $\frac{3}{8}$ of the pie that his mother made. How much of the pie did Jimmy take in decimal form?

   0.375

5. After a recent movie release, $14\frac{}{15}$ people said they enjoyed the movie. What decimal number represents the amount of people that enjoyed the movie?

   0.93

Lesson Five – Conversions

Applications #2

1. Megan has read 0.55 of her favorite book, *Outlander*. What fraction of her book has Megan read?

11/20

2. On a cold fall day, the soccer stadium was only 0.72 of the way full. What fraction of the stadium was full?

18/25

3. Sonia has completed 0.95 of her science project. What fraction of the science project has Sonia completed?

19/20

4. Tobias ate 0.36 of the pizza at his 3rd birthday party. What fraction of the pizza did Tobias eat?

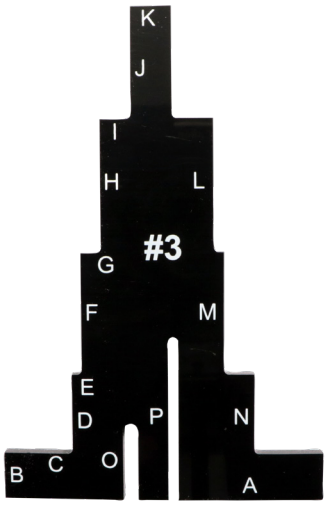
9/25

5. Lex won 0.67 of his net wealth playing online poker. What fraction of his wealth did Lex win playing online poker?

67/100

Taking Measurements with a Ruler (Standard)

Use Object 3



Find the length of the sides below in inches. Acceptable ranges of +/- 1/32 for each answer.:

1. Side A = **1 ¾ in**
2. Side L = **1 ⅝ in**
3. Side B = **9/16 in**
4. Side N = **1 in**
5. Side H = **1 ⅝ in**
6. Side D = **1 in**
7. Side M = **1 ½ in**
8. Side I = **⅜ in**

Find the combined measurements below.

9. Side K + Side F = 1 15/16 in **2 in** 2 1/16 in

10. Side E + Side G = 5/16 in **⅜ in** 7/16 in

11. Side I + Side L – Side C = 1 1/64 in **1 ⅛ in** 7/64 in

12. Which of the following sides is 1 5/8 inches?

A. Side H

B. Side F

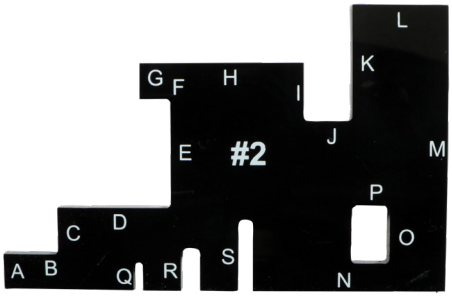
C. Side J

D. Side N

Lesson Six – Measurements Using a Tape Rule and Tape Measure

Taking Measurements with a Ruler (Metric)

Use Object 2



Find the following measurements in centimeters:

1. Side L = **3.1 cm**
2. Side N = **6.3 cm**
3. Side C = **1.6 cm**
4. Side O = **1.9 cm**
5. Side M = **9.4 cm**
6. Side E = **3.6 cm**
7. Side G = **1.1 cm**
8. Side J = **1.6 cm**

Order the side lengths from least to greatest, listing the measurements for each side.

9. **Side A = Side G, Side P, Side J**
   1.1 cm = 1.1 cm, 1.3 cm, 1.6 cm
10. **Side E, Side D, Side H, Side M**
    3.7 cm, 3.8 cm, 5.3 cm, 9.4 cm

11. Which of the following has a length of 1.8 centimeters?

A. Side I

B. Side C

C. Side P

D. Side L

Adding/Subtracting Fractions

Add/subtract the following fractions:

1. $\frac{1}{4} + \frac{3}{9} = \mathbf{\frac{7}{12}}$

2. $\frac{7}{8} + \frac{1}{16} = \mathbf{\frac{15}{16}}$

3. $\frac{2}{3} + \frac{5}{16} = \mathbf{\frac{47}{48}}$

4. $\frac{1}{8} - \frac{3}{4} = \mathbf{-\frac{5}{8}}$

5. $\frac{7}{16} - \frac{3}{16} = \mathbf{\frac{1}{4}}$

6. $\frac{5}{8} - \frac{1}{2} = \mathbf{\frac{1}{8}}$

7. $\frac{9}{16} - \frac{5}{12} = \mathbf{\frac{7}{48}}$

8. $\frac{1}{2} - \frac{1}{3} = \mathbf{\frac{1}{6}}$

9. Which of the following fractions is equivalent to $\frac{3}{8}$?

   A. $\frac{6}{16}$

   B. $\frac{6}{8}$

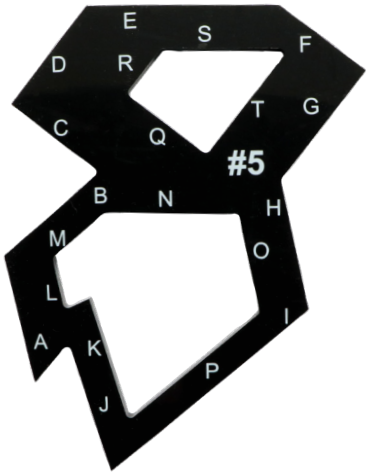
   C. $\frac{9}{16}$

   D. $\frac{1}{2}$

Lesson Six – Measurements Using a Tape Rule and Tape Measure

Combining Measurements

Use Object 5



Find the following combined measurements in inches:

1. Side N + Side H = **3 ⅜ in**
2. Side E + Side J = **4 ¼ in**
3. Side C – Side L = **¾ in**
4. Side G + Side O = **3 1⁄16 in**
5. Side B – Side F = **5⁄16 in**
6. Side I + Side M = **4 ¼ in**

Find the perimeter of the object in inches. Acceptable tolerance range may allow for +/- 1⁄32 to the answer:

7. **Object 5 = 19 9⁄16 in**

8. Which of the following sides measures 4.2 centimeters?

   A. Side N

   B. Side P

   C. Side C

   D. Side K

Applications

1. Mary is building a high rise in the shape of **Object 3**. She is trying to figure out the area of the top section, therefore she first needs to find the area of the model. What is the area of the rectangle formed by Sides K and J in square centimeters?

   4.2 cm^2

2. Sally is building a fort in the shape of **Object 2**. She needs to purchase a window for the space formed by Sides P and O. What are the dimensions, in centimeters, of the window that Sally needs to purchase?

   1.3 cm x 1.9 cm

3. Sally is building a fort in the shape of **Object 2**. She is preparing to put flooring down and needs to know the length of her fort. What is the length of Sally's fort in centimeters? (Side M)

   9.4 cm

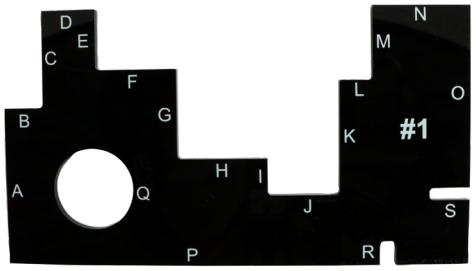
4. Steven is making a 3-D replica of **Object 1**. He knows all of the dimensions except for the depth. What is the depth (thickness of the object) of **Object 1** in centimeters?

   0.5 cm

5. Devin is trying to calculate the area of figure PO in **Object 2** in square centimeters. Assume the angle between P and O is a right angle.

   2.47 cm^2

Taking Outside Measurements with a Caliper



Using **Object 1** and a caliper, find the following measurements in inches. Answer in decimal form and round to nearest thousandth.

1. The outside measurement from Side A to Side G.

2.704 in **2.72 in** 2.736 in

2. The outside measurement from Side E to Side C.

.825 in **.84 in** .857 in

3. The outside measurement from Side K to Side O.

1.979 in **2.00 in** 2.011 in

4. Which of the following is the longest side listed on **Object 1**?

A. Side A

B. Side K

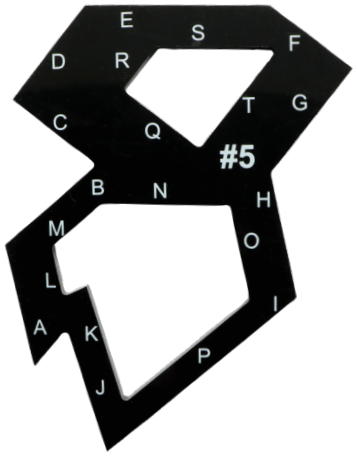
C. Side O

D. Side H

---

5. Using **Object 5**, place the following sides in order from least to greatest and include their length in inches. Answer in decimal form and round to the nearest thousandth.

Side D, Side H, Side J, Side M

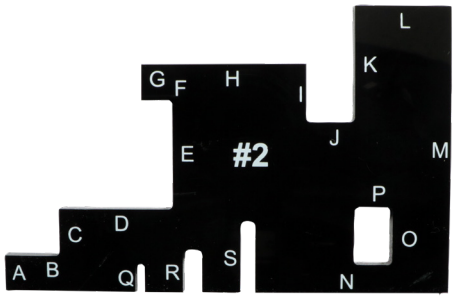


Side M = 0.875 in, Side D = 1.575 in, Side H = 1.688 in, Side J = 1.813 in

Lesson Seven – Measurements using a Caliper

Taking Inside Measurements with a Caliper

Using **Object 2** and a caliper, find the following measurements in inches.
Answer in decimal form and round to nearest thousandth.



1. The inside measurement from Side I to Side K.
   0.64 in

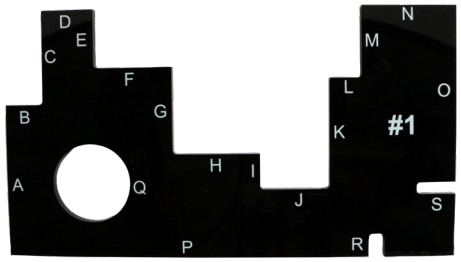
2. The inside measurement from Side F to Side D.
   1.43 in

3. The inside measurement from Side P to the opposite side of the rectangle.
   0.76 in

---

4. Using **Object 1** and a caliper, find the inside diameter of Circle Q in inches.
Answer in decimal form and round to nearest thousandth.

1.26 in



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5. Which of the following are the inside jaws of a caliper most useful in measuring?

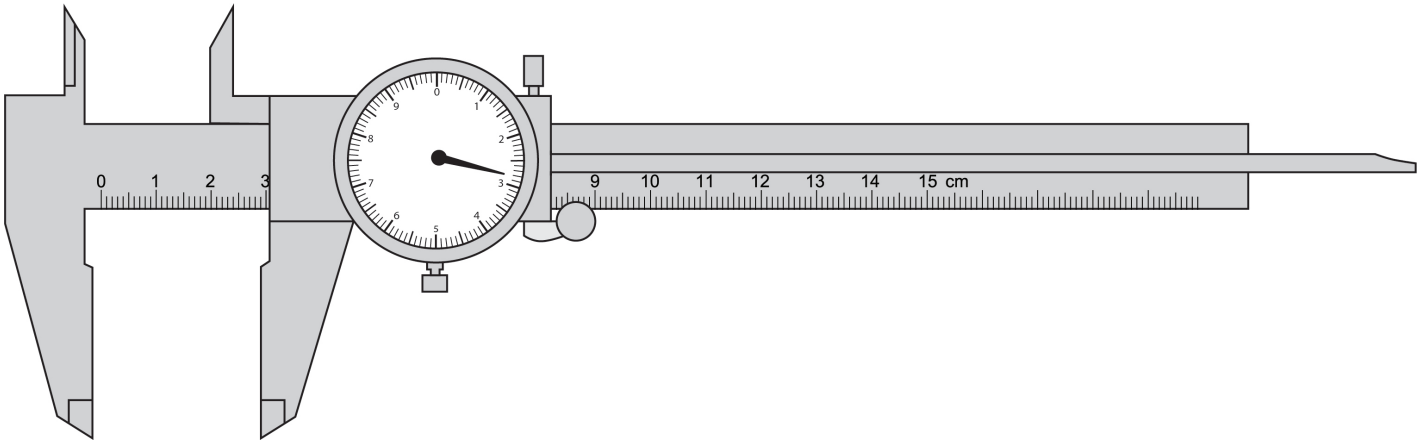
   A. The length of a line segment

   B. The inside diameter of PVC pipe

   C. The length of a pencil

   D. The diameter of a circle on a 2-dimensional coordinate plane

6. Identify the inside jaws on the diagram below. **The inside jaws are the smaller set of jaws on the top of the caliper.**



Adding/Subtracting Decimals

Add/subtract the following decimals:

1. 4.25 + 1.29 = **5.548** 8

2. 1.902 - 0.804 = **1.098**

3. 4.21 - 2.92 = **1.29**

4. 4.1 + 5.0218 = **9.1218**

5. 6.994 - 3.442 = **3.552**

6. 9.001 - 5.234 = **3.767**

7. 7.291 - 4.21 + 3.045 = **6.126**

8. 1.204 + 4.597 - 3.219 = **2.582**

9. Find the error in the addition of decimals below:

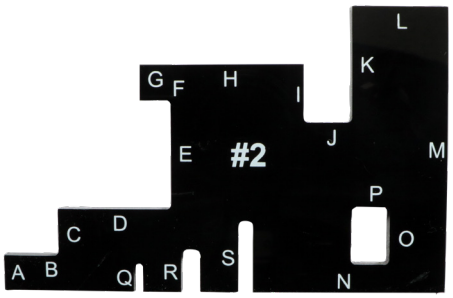
$$\begin{array}{r} 2.225 \\ +2.3 \\ \hline 2.248 \end{array}$$

When adding or subtracting decimal numbers, the decimal point should be lined up vertically to ensure the correct addition or subtraction according to place value.

Lesson Seven – Measurements using a Caliper

Combining Measurements

Using the **Object 2** and a caliper, find the combined measurements in inches. Answer in decimal form and round to nearest thousandth.



1. The sum of the outside measurement from Side G to Side M and the outside measurement from Side E to Side M.

   7.563 in **7.58 in** 7.625 in

2. The difference of the outside measurement of Side K to Side M from the outside measurement from Side C to Side M.

   3.810 in **3.85 in** 3.872 in

3. The perimeter of the rectangle formed by Side M and Side L.

   9.863 in **9.90 in** 9.987 in

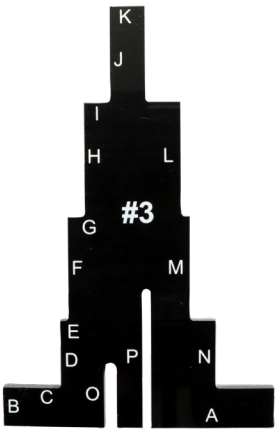
4. The area of the rectangle formed by Side G and Side H.

   .967 in^2 **.97 in^2** 1.029 in^2

---

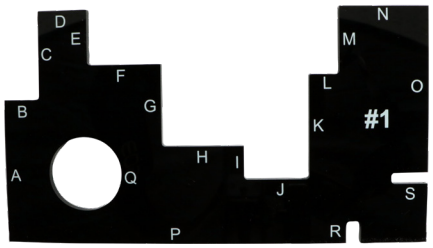
5. Using **Object 3**, find the sum of the outside measurement from Side A to Side I and the outside measurement from Side A to Side E. Answer in decimal form and round to nearest thousandth.

   6.262 in **6.305 in** 6.324 in



Applications

1. Mr. Smith is trying to create a wooden puzzle for his son. The top of the next piece he has to create needs to fit between Side E and Side M on **Object 1**. How wide should Mr. Smith make the top of the puzzle piece? Answer in decimal form and round to nearest thousandth.



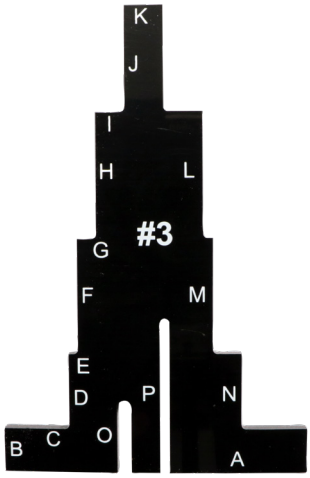
4.222 in **4.238 in** 4.254 in

2. Conner is trying to fit a wooden rod through Circle Q in **Object 1**. What is the maximum radius the rod can have to fit? Answer in decimal form and round to nearest thousandth. *Hint: d=2r*

0.623 in **0.631 in** 0.639 in

---

3. Ian created a model of a city building, **Object 3**. 1 inch on the model is equivalent to 100 feet on the real building. Use this information to find the following measurements of the city building. Answer in decimal form and round to nearest thousandth after converting.



a) How many feet wide is the building at its base?

397.7 ft

b) How many feet tall is the building?

609.0 ft

c) At the most narrow point, how wide is the building?

48.9 ft

d) How tall is the section between G and I?

162.5 ft

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