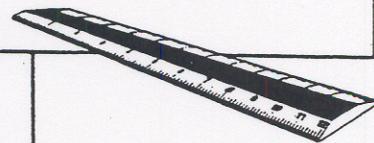# Centimeters : Inches

Institute Notes

Concept: Determine that the relationship between inch measurement and centimeter measurement is a proportional relationship and use the characteristics of the proportional relationship to solve problems.

TEKS Focus: **6.3**—The student solves problems involving proportional relationships.
7.3—The student solves problems involving proportional relationships.
8.3—The student identifies proportional relationships in problem situations and solves problems.

Also:
Grade 6:
1B, 2C, 2D, 4A, 4B, 5, 8A, 8B, 8D, 10D, 11A-D, 12A, 13A
Grade 7:
1B, 2B, 2D, 4A, 4B, 5A, 9, 11B, 13A-D, 14A, 15A
Grade 8:
1B, 2D, 4, 5A, 14A-D, 15A, 16A

Overview: Participants will measure the lengths of objects in the classroom using inches and centimeters, compute the ratio between the number of centimeters in the length and the number of inches in the length. They will graph the ordered pairs (number of inches, number of centimeters) on the graphing calculator or by hand and draw conclusions about the proportional relationship between inches and centimeters. Participants will then use the properties of the proportional relationship to find equivalent measurements.

Materials: Tools for measuring length, such as rulers, measuring tape, meter sticks, yardsticks
Graphing calculators or 1" graph paper
Markers
Peel-and-stick dots

Procedure: 1. Divide the group into pairs.
2. Distribute activity sheets, measuring tools, graph paper, and calculators.
3. Let participants complete the table in Activity 1 and discuss the questions.
4. Have participants represent the data on the graph in Activity 2.

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Extension: Repeat the activity using measurements, tables, and graphs to show that there is a proportional relationship between decimeters and feet.

Assessment: Use the following prompts for journal entries.

Describe the relationship between centimeters and inches. How can you use your knowledge about this relationship?

Consider the relationship between a measurement in ounces and the measurement in pounds. Explain how this is a proportional relationship.

Notes:

Centimeters : Inches

Centimeters : Inches

Activity 1

You must find two measurements for the length of nine objects in the classroom. First measure to the nearest tenth of a centimeter and then measure to the nearest one-eighth of an inch. Record your information in the table and use your calculator to determine the ratio of the number of centimeters to the number of inches in each length. Express each ratio as a unit rate. Round the unit rate to the nearest hundredth.

Name of Object	Length in cm	Length in inches	Ratio of cm : inch	Unit Rate (cm per inch)
book length	26.4	$10\frac{3}{8}$	26.4 : 10.375	2.54:1
book width	21.0	$8\frac{1}{4}$	21 : 8.25	2.55:1
desk length	61.0	24	61 : 24	2.58:1
tissue box length	24.2	$9\frac{1}{2}$	24.2 : 9.5	2.54:1
tissue box width	12.1	$4\frac{3}{4}$	12.1 : 4.75	2.55:1
notebook width	25.8	$10\frac{1}{4}$	25.8 : 10.25	2.52:1
notebook length	29.4	$11\frac{5}{8}$	29.4 : 11.625	2.53:1
pencil length	17.1	$6\frac{3}{4}$	17.1 : 6.75	2.53:1
pen length	14.0	$5\frac{1}{2}$	14 : 5.5	2.55:1
	y	x		

a. Why does the data in the table make you think there is a proportional relationship between the number of centimeters and the number of inches in a given length?

b. Write an equation that best describes the proportional relationship.

Reason and Communicate:

If you had been measuring objects in feet and in yards, what would you expect to find as the ratio of the number of feet to the number of yards in a measurement?
The ratio found in the data would be close to 3 :1.

Explain how the ratios in the last column are unit rates.
They are equivalent ratios written with a denominator of 1. For example, in the first entry of the sample data, 26.4 centimeters per 10 3/8 inches is equivalent to the unit rate of 2.54 cm per 1 inch.

If you had been measuring objects in feet and in yards, what would be the unit rate (or constant of proportionality) for feet per yard?
3 feet per 1 yard

What would be an equation which describes the proportional relationship of feet to yards?
y = 3x where x is the number of yards and y is the number of feet.

Math Notes:

Emphasize that the focus of this activity is NOT to develop a conversion ratio between centimeters and inches, but to point out that the relationship between the same measurements using different units is always a proportional relationship.

The ratio of the number of centimeters in the measurement of the length of an object to the number of inches in the same length, expressed as a unit rate, is approximately 2.54 cm to 1 inch.

$$\frac{y}{x} = \frac{2.54}{1} \qquad y = 2.54x$$

2.54 is the constant of proportionality.

When the data is graphed in Activity 2, the constant of proportionality, 2.54, will approximate the slope of the line of best fit.

Answers:

a. The ratios (unit rates) in the last column are very close together, so there is almost a constant ratio of about 2.5:1. (The average of the unit rates in the third column of the sample data is 2.542.) Having a constant ratio between y and x is a characteristic of a proportional relationship.

b. Answers will vary. If the unit rate is estimated to be 2.5, then the equation would be $y = 2.5x$. (For the sample data, one might generalize $y = 2.542x$.)

Centimeters : Inches

Activity 1

You must find two measurements for the length of nine objects in the classroom. First measure to the nearest tenth of a centimeter and then measure to the nearest one-eighth of an inch. Record your information in the table and use your calculator to determine the ratio of the number of centimeters to the number of inches in each length. Express each ratio as a unit rate. Round the unit rate to the nearest hundredth.

| Name of Object	Length in cm	Length in inches	Ratio of cm : inch	Unit Rate (cm per inch)
	y	x		

a.   Why does the data in the table make you think there is a proportional relationship between the number of centimeters and the number of inches in a given length?

b.   Write an equation that best describes the proportional relationship.

Centimeters : Inches

Activity 2

Make a graph of the ordered pairs (the measurement in inches, the measurement in centimeters). Use the graph below or your graphing calculator.

Number of Centimeters (vertical axis)

Number of Inches (horizontal axis)
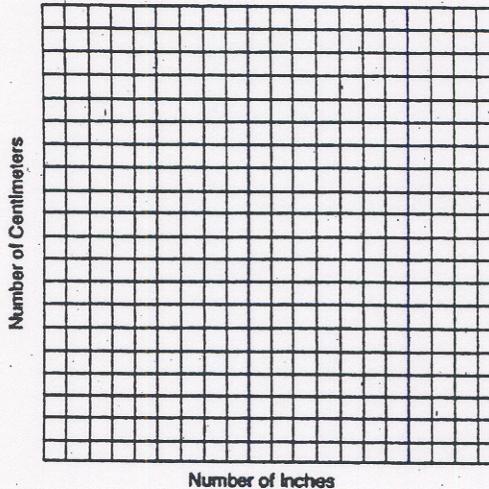
a.   What does the ordered pair (5.5, 14) mean on the graph?

b.   What are your conclusions about the relationship between a measurement in inches and the same measurement in centimeters?

c.   If an object measures 12 centimeters long, approximately how many inches long would you expect it to be?

d.   If an object measures 8 inches long, approximately how many centimeters long would you expect it to be?

TEXTEAMS Rethinking Middle School Mathematics: Proportionality   Activity-5

Math Notes:

The participants may be asked to graph the data with the graphing calculator. Show participants how to enter the data into two lists. Let L_1 list the number of inches in each measurement, and let L_2 list the number of centimeters in each measurement. Participants can record the ratios of centimeters to inches in each measurement by using the third list and setting $L_3 = L_2/L_1$. (Make sure the corresponding measurements are in corresponding positions in the lists so that the ratios formed are correct.) Participants then can plot the data. Emphasize that the graph is a set of points which lie approximately on a line. Participants can find a line of best fit to describe the relationship between L_1 and L_2. A line of best fit for the set of data should be close to the graph of $y = 2.54x$ where x is the number of inches and y is the number of centimeters. This equation can be used to convert a measurement in inches to a measurement in centimeters.

A line of best fit for the sample set of data is $y = 2.54015x - 0.01715$ where x is the number of inches and y is the number of centimeters.

Answers:

a. A length of 5.5 inches is about 14 cm. The number of cm is about 2.5 times the number of inches. 14 cm is about $2\frac{1}{2}$ times 5.5 inches.

b. It appears to be a proportional relationship because the data lies close to a straight line that goes through the origin.

c. Using $y = 2.54x$, where y is centimeters and x is inches, 12 cm = (2.54 cm/in) x and $\frac{12}{2.54} = x = 4.7$ inches.
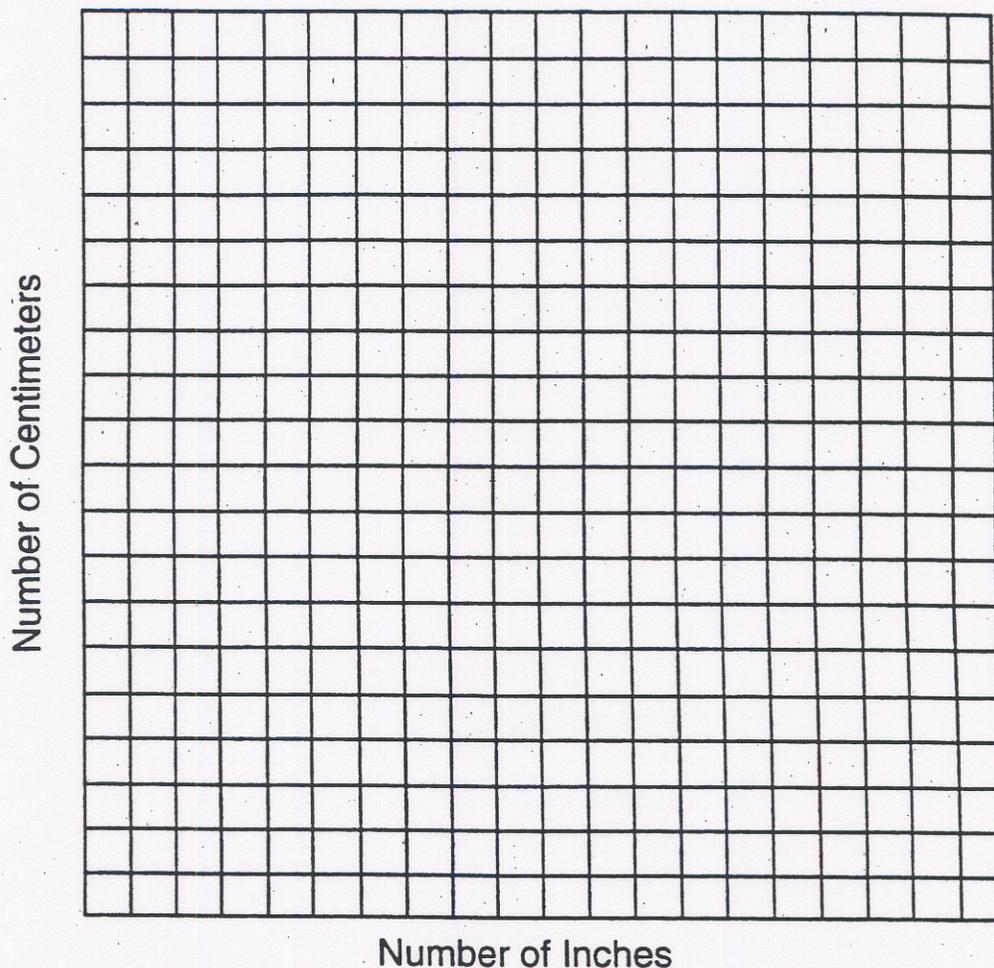
An object which measures 12 centimeters would measure about 4.7 inches.

d. Using $y = 2.54x$, where y is centimeters and x is inches, $y = (2.54 \text{cm/in})$ (8 in.) = 20 cm. An object which measures 8 inches would measure about 20 centimeters.

Centimeters : Inches

Activity 2

Make a graph of the ordered pairs (the measurement in inches, the measurement in centimeters). Use the graph below or your graphing calculator.

Number of Centimeters (y-axis)

Number of Inches (x-axis)

a. What does the ordered pair (5.5, 14) mean on the graph?

b. What are your conclusions about the relationship between a measurement in inches and the same measurement in centimeters?

c. If an object measures 12 centimeters long, approximately how many inches long would you expect it to be?

d. If an object measures 8 inches long, approximately how many centimeters long would you expect it to be?