

COMPACTED MATHEMATICS

CHAPTER 8

MEASUREMENT

TOPICS COVERED:

- Customary units (Gallon Guy)
- Metric units
- Metric Olympics

Numbers are ADJECTIVES. The label (or the unit of measure) is the NOUN.

Activity	Measurement	NAME:
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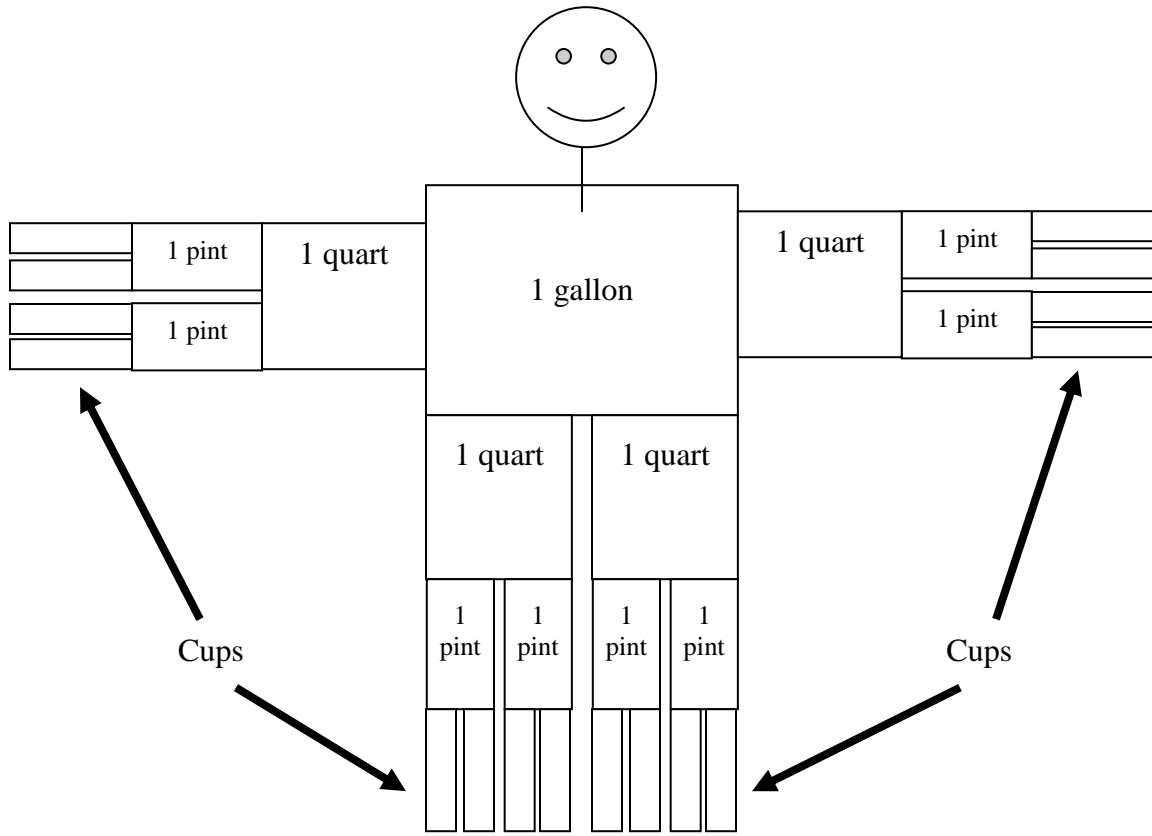
“Let’s see how old you weigh. Hmm...five till.”

Attributes That Can Be Measured

- Time/Age
- Weight/Mass
- Temperature
- Length – height, distance, depth, perimeter, circumference, width
- Density
- Capacity/Volume
- Speed/Velocity
- Area/Surface Area
- Value/Money
- Energy/Light/Heat
- Economy
- Central Tendancy
- Sound
- Force
- Acceleration
- Momentum
- Inertia
- Viscosity
- IQ
- Pressure
- Buoyancy
- Probability
- Gravity
- Radiation
- Strength
- Acidity
- Memory
- Power/Work
- Magnetism
- Humidity

Teaching measurement as part of fraction/decimal conversions.

Activity	Customary Volume/Gallon Guy	NAME:
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Measurement Conversions	
<p><i>Customary – Length</i> 1 mile = 1760 yards 1 mile = 5280 feet 1 yard = 3 feet 1 foot = 12 inches</p>	<p><i>Metric – Length</i> 1 kilometer = 1000 meters 1 meter = 100 centimeters 1 centimeter = 10 millimeters</p>
<p><i>Customary – Volume</i> 1 pint = 2 cups 1 quart = 2 pints 1 gallon = 4 quarts 1 cup = 8 ounces 1 gallon = 128 ounces</p>	<p><i>Metric – Volume</i> 1 liter = 1000 milliliters</p>
<p><i>Customary – Mass/weight</i> 1 ton = 2,000 pounds 1 pound = 16 ounces</p>	<p><i>Metric – Mass/Weight</i> 1 kilogram = 1000 grams 1 gram = 1000 milligrams</p>

When converting a larger unit to a smaller unit, **multiply**. (LoneSoMe)
 When converting a smaller unit to a larger unit, **divide**. (SLiDe)

Activity	Measurement Comparisons	NAME:
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Name	Abbreviation	Approximate Comparison
inch	in	length of half a thumb
foot	ft	length of an adult male foot
yard	yd	length from nose to outstretched fingertip
mile	mi	length of 14 football fields
ounce	oz	weight of a birthday card
pound	lb	weight of three apples
quart	qt	amount in a medium container of milk
gallon	gal	amount in a small bucket
kilometer	km	9 football fields
meter	m	half the height of a door
centimeter	cm	length of a raisin
millimeter	mm	width of a period at the end of a sentence
kilogram	kg	mass a cantaloupe
gram	g	mass a raisin
liter	L	half of a large bottle of soda
milliliter	mL	half an eyedropper

Activity 8-1	Customary Measurement	NAME:
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When you need to change units of measure-gallons to quarts, ounces to pounds, and so on-you can start by writing a proportion.

Example 14 gallons = x qt.
 Use the fact that 1 gal = 4 qt.

$$\frac{1 \text{ gallon}}{4 \text{ quart}} = \frac{14 \text{ gallons}}{x \text{ quarts}}$$

$$1 \bullet q = 4 \bullet 14$$

$$q = 56 \text{ quarts}$$

Example #2 14 qt. = x gal.

$$\frac{1 \text{ gallon}}{4 \text{ quart}} = \frac{x \text{ gallons}}{14 \text{ quarts}}$$

$$\frac{1 \bullet 14}{4} = \frac{4x}{4}$$

$$3.5 \text{ gal} = x$$

Complete the following table. Solve all problems with proportions and show all steps.

1.	4 lb. = oz	2.	12 qt. = gal.	3.	10 c. = pt.
4.	10,000 lbs. = tons	5.	16 fl. oz. = c.	6.	32 oz. = lbs.
7.	5 c. = fl. oz.	8.	12 gal. = qt.	9.	12 pt. = qt.
10.	7 c. = pt.	11.	5 tons = lb.	12.	6 gal. = qt.
13.	3 gal. = qt.	14.	24 pt. = c.	15.	17 tons = lb.
16.	24 fl. oz. = c.	17.	9 gal. = qt.	18.	53 qt. = gal.
19.	9.5 tons = lb.	20.	15 c. = pt.	21.	3.5 c. = fl. oz.
22.	11 c. = pt.	23.	23 pt. = qt.	24.	0.5 qt. = pt.
25.	24 in. = ft.	26.	6 yd. = ft.	27.	24 ft. = in.
28.	3 mi. = yd.	29.	13 yd. = in.	30.	100 in. = ft.
31.	At liftoff, the space shuttle weighed 100 tons. How many pounds is this?				
32.	The gasoline tank of a minivan holds 18 gallons. How many quarts is this?				
33.	The average weight of a baby at birth is 7 pounds. How many ounces is this?				
34.	Cell phones can weight less than 8 ounces. How many pounds is this?				
35.	Milk is sold is 8 fl. oz., 16 fl. oz., 32 fl. oz., and 64 fl. oz. cardboard containers. Change these sizes to cups.				
36.	The United States exports over 200 billion pounds of coal. How many tons is this?				

Activity 8-2	Customary Measurement	NAME:
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Complete the following table. Solve all problems with proportions and show all steps.

1.	6 pt. = c.	2.	20 qt. = gal.	3.	64 oz. = lb.
4.	7 c. = fl. oz.	5.	12 qt. = pt.	6.	12,000 lb. = T.
7.	8 gal. = qt.	8.	9 lb. = oz.	9.	72 fl. oz. = c.
10.	4 T. = lb.	11.	14 c. = pt.	12.	26 pt. = qt.
13.	10 qt. = gal.	14.	2 T. = oz.	15.	18 pt. = c.
16.	$3\frac{1}{2}$ c. = fl. oz.	17.	128 c. = gal.	18.	96 oz. = lb.
19.	21 qt. = pt.	20.	750 lb. = T.	21.	3 qt. = fl. oz.
22.	15 pt. = qt.	23.	7 T. = lb.	24.	2 gal. = c.
25.	19 c. = pt.	26.	4 qt. = c.	27.	$5\frac{1}{4}$ lb. = oz.
28.	6 gal. = qt.	29.	104 fl. oz. = c.	30.	64 pt. = gal.
31.	10,560 ft. = mi.	32.	20 yd. = ft.	33.	60 in. = ft.
34.	5 mi. = ft.	35.	10 yd. = in.	36.	18 in. = ft.

Which weighs more: an ounce of water or an ounce of lead?

Surprise! The water weighs more because it is measured by volume, while lead is measured by weight. If you set a cup with a fluid ounce of water on a balance scale across from an ounce of lead in an identical cup, the scale will tip toward the water.

Customary to Metric Conversions (all are approximate):

- 25 mm = 1 in
- 1 m = 3.3 ft
- 0.91 m = 1 yd
- 1.6 km = 1 mi
- 28 g = 1 oz
- 0.45 kg = 1 lb
- 1 kg = 2.2 lb
- 240 mL = 8 fl oz
- 1 L = 34 fl oz

Activity 8-3	Metric Measurement	NAME:
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Choose an appropriate metric unit of mass for each.

1.	a grain of rice		2.	a bag of groceries	
3.	a feather		4.	a cat	
5.	a leaf		6.	an eraser	

Choose an appropriate metric unit of capacity for each.

7.	a gasoline tank		8.	a coffee mug	
9.	6 raindrops		10.	a pitcher of juice	
11.	a swimming pool		12.	a can of paint	

State whether each of the following is best measured in terms of mass or capacity.

13.	a bag of potatoes		14.	water in a birdbath	
15.	an apple		16.	a box of raisins	
17.	a cup of hot cider		18.	the inside of the refrigerator	
19.	juice in a baby's bottle		20.	water in a fish tank	
21.	water in a watering can				

Write true or false.

22.	The mass of a horse is about 500 kg.		23.	Jason drank 5.8 L. of juice at breakfast.	
24.	A mug holds 250 mL. of hot chocolate.		25.	A penny is about 3 kg.	
26.	A teaspoon holds about 5 L.		27.	A textbook is about 1 kg.	

Choose the most reasonable measurement.

28.	About how tall would your friend be? A. 1.5 mm B. 1,500 cm C. 1.5 km D. 1,500 mm	
29.	About how wide would your desk be? A. 50 mm B. 50 m C. 5 m D. 50 cm	
30.	A tree is about how tall? A. 20 km B. 20 m C. 20 cm D. 2 km	
31.	An envelope is about how long? A. 24 cm B. 2.4 cm C. 24 mm D. 2.4 m	

Activity 8-4	Metric Measurement	NAME:
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Complete the following table. Solve all problems with proportions and show all steps.

1.	3.72 L = mL	2.	9.75 m = cm	3.	6.8 g = kg
4.	0.018 kg = g	5.	149 cm = m	6.	524 cm = m
7.	0.56 kg = g	8.	3 mm = cm	9.	2.4 m = mm
10.	6.7 g = mg	11.	9.3 L = mL	12.	0.89 m = cm
13.	0.085 g = mg	14.	4,600 mm = m	15.	7,124 m = km
16.	205 g = kg	17.	609 mg = g	18.	0.0019 m = mm
19.	38 mL = L	20.	720 m = km	21.	150 cm = mm
22.	40 mm = cm	23.	7 km = m	24.	0.0817 L = mL
25.	480 mL = L	26.	53 cm = mm	27.	3,020 mg = g
28.	26 km = m	29.	6.1 mm = m	30.	3.904 L = mL
31.	7 cm = m	32.	14 L = mL	33.	49 km = m
34.	6.5 L = mL	35.	850 mg = g	36.	9.1 mm = cm

What unit of measure would you use to measure each item?

37.	the height of an office building A. km B. cm C. m D. mm	
38.	the width of a page of text A. km B. cm C. m D. mm	
39.	the length of an ant A. km B. cm C. m D. mm	
40.	the depth of a lake A. km B. cm C. m D. mm	

41. Draw a figure that has a perimeter of 14 cm.

Activity 8-5	Metric Treasure Hunt	NAME:
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To become more familiar with metric units of measurement, the class is going to take a walk around the school. During your walk around the school find three items to fit into each category. Choose items that *best fit* into the category given. For example, one could measure the distance from DIS to EIS in millimeters, but kilometers would be a more appropriate choice.

For one of your three items in each category make an estimate of its metric measurement.

<i>Metric Length</i>			
	Item 1	Item 2	Item 3
Meters			
Centimeters			
Millimeters			

<i>Metric Volume/Capacity</i>			
	Item 1	Item 2	Item 3
Liters			
Milliliters			

<i>Metric Weight/Mass</i>			
	Item 1	Item 2	Item 3
Kilograms			
Grams			
Milligrams			

Activity 8-6	Metric Measurement	NAME:
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Helpful reminders:

A shovel is about a meter long. The head of a thumbtack is about a centimeter wide. The point of a thumbtack is about a millimeter wide. The landing strip at an airport is about a kilometer long.

The mass of a hammer is about a kilogram. The mass of a nail is about a gram. The mass of a piece of sawdust is about a milligram.

A can of motor oil contains 1 liter. The spill of a drop of oil is about 1 milliliter.

Write the unit that you would use to measure each of the following.

1.	mass of a bicycle		2.	mass of a pencil	
3.	glass of juice		4.	grain of sand	
5.	mass of a penny		6.	water in a swimming pool	
7.	mass of a feather		8.	mass of a bowling ball	
9.	hot chocolate in a large thermos		10.	loaf of bread	
11.	mass of a watermelon		12.	cup of hot cider	
13.	water in an aquarium		14.	mass of a car key	
15.	mass of a vitamin pill		16.	can of soup	
17.	mass of an egg		18.	mass of a cat	
19.	water in a team's cooler		20.	mass of a sewing needle	
21.	mass of a mosquito		22.	liquid in a test tube	
23.	mass of student's desk		24.	mass of a sandwich	
25.	bottle of expensive perfume		26.	mass of a sugar cube	
27.	water in a washing machine		28.	mass of a bag full of groceries	
29.	mass of an apple		30.	mass of a leaf	

Circle the appropriate measure.

31.	mass of a screwdriver	46 mg	46 g	46 kg
32.	mass of a tennis racket	5 g	50 g	500 g
33.	mass of a baby	75 g	7.5 kg	0.75 kg
34.	mass of a dictionary	0.2 kg	2 kg	20 kg
35.	mass of a grain of sand	1 mg	1g	1 kg
36.	paint can	4 L	4mL	
37.	drinking glass	250 L	250mL	
38.	bath tub	400 mL	400 L	
39.	soup spoon	1.5 mL	15 mL	
40.	length of a road race	6 m	6 km	

Helpful reminders:

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The mass of a hammer is about a kilogram. The mass of a nail is about a gram. The mass of a piece of sawdust is about a milligram.

A can of motor oil contains 1 liter. The spill of a drop of oil is about 1 milliliter.

Circle the appropriate measure.

1.	A pen is about 14 ____ long.	km	m	cm	mm
2.	A pencil point is about 1 ____ wide.	km	m	cm	mm
3.	A coffee mug is about 90 ____ tall.	km	m	cm	mm
4.	An ear of corn is about ____ long.	km	m	cm	mm
5.	Two cities could be 12 ____ apart.	km	m	cm	mm
6.	Motion picture film is 35 ____ wide.	km	m	cm	mm
7.	A discus is thrown 56 ____.	km	m	cm	mm
8.	A person can jump 1.5 ____ high.	km	m	cm	mm
9.	A pilot flew 5,000 ____ yesterday.	km	m	cm	mm
10.	A newborn baby is about 50 ____ long.	km	m	cm	mm

Find three objects or activities that you estimate are close to each measurement below. Write the names of the objects or activities next to the appropriate measure.

1.	weighs 2 pounds			
2.	is 16 inches in diameter			
3.	holds 2 pints when full			
4.	takes 25 seconds to complete			
5.	is 8 feet long			
6.	requires 2 cups to fill			
7.	can be recited in 12 minutes			
8.	is 6 centimeters wide			
9.	weighs 7 ounces			
10.	is half a yard long			
11.	takes 5 minutes to walk to			
12.	is one meter long			
13.	holds 10 gallons when full			
14.	can drive to in half an hour			
15.	weighs 5 grams			
16.	holds 5 liters when full			
17.	weighs 10 kilograms			
18.	takes 5 seconds to do			

Follow the directions, measure carefully, and you will get the picture!

1.	Draw rectangle ABCD on another sheet of paper. The rectangle is 7 in. wide and $9\frac{1}{2}$ in. high. Place Point A at the top left, B at the top right, C at the bottom right, and D at the bottom left.
2.	Place your ruler on \overline{AB} . Measure $3\frac{1}{8}$ in. across from point A. Make a dot at this point and label it Point E.
3.	Place your ruler on \overline{BC} . Measure down $1\frac{1}{4}$ in. from point B. Make a dot at this point and label it point F.
4.	On \overline{BC} , measure down $5\frac{7}{8}$ in. from B. Label this Point G.
5.	Point H is on \overline{BC} , $7\frac{1}{2}$ in. from B.
6.	Point I is on \overline{BC} , $8\frac{3}{8}$ in. from B.
7.	Point J is on \overline{AD} , 7 in. from A. Connect points H and J.
8.	Point K in on \overline{AD} , $8\frac{1}{2}$ in. from A. Connect points I and K.
9.	Point L is on \overline{JH} , $3\frac{1}{8}$ in. from J. Draw \overline{EL} .
10.	Point M is on \overline{EL} , $\frac{7}{8}$ in. from E. Draw \overline{GM} .
11.	Point N is on \overline{AD} , $5\frac{3}{4}$ in. from A. Draw \overline{MN} .
12.	Line up your ruler on Points E and F. Mark a point 1 in. from E and label it point O. Connect points E and O.
13.	Point P is on \overline{EL} , $\frac{5}{8}$ in. from E. Draw \overline{OP} .
14.	Point Q is on \overline{EL} , $6\frac{1}{4}$ in. from E. Draw \overline{GQ} .
15.	Point R is on \overline{EL} , $6\frac{5}{8}$ in. from E. Draw \overline{NR} .
16.	Point S is on \overline{NR} , $2\frac{3}{4}$ in. from N. Draw \overline{MS} .
17.	Point T is on \overline{KI} , $1\frac{1}{8}$ in. from K. Draw \overline{JT} .
18.	Point U is on \overline{KI} , 6 in. from K. Draw \overline{HU} .

Mission: Create a picture that includes the following.

1. A circle with an area of 78.5 cm^2
2. A square with an area of 64 cm^2
3. A triangle with an area of 24 cm^2
4. A trapezoid with an area of 22 cm^2

You will need to use a ruler with cm. on it and a compass to draw your shapes accurately.

Your picture should....

- Include a title
- Include geometric shapes with correct parts labeled with units
- Be at least somewhat colorful and represent something more than just 4 shapes sitting on a piece of paper

Activity	What It Takes To Be A Leader	NAME:
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(Taken from Credibility: How Leaders Gain and Lose It, Why People Demand It by Kouzes and Posner)

Based on a survey of more than 15,000 people, which of these traits do you think was selected as the key to effective leadership:

- Being fair?
- Being cooperative?
- Being honest?
- Being imaginative?

If you guessed “honest”, you get a high mark. It scored far above any of the others in a list of 20. In fact, the top four characteristics of admired leaders and the percentage of people who selected them are:

- Being honest – 87%
- Being forward-looking – 71%
- Being inspirational – 68%
- Being competent – 58%

Honest people have credibility and that’s what gives leaders the trust and confidence of their people. High credibility leaders foster such things as greater pride in organization, a stronger spirit of cooperation and teamwork, and more feelings of ownership and personal responsibility.

What are some of the other characteristics of credible leaders?

- They do what they say they will do. They keep their promises and follow through on their commitments.
- Their actions are consistent with the wishes of the people they lead. They have a clear idea of what others value and what they can do.
- They believe in the inherent self-worth of others.
- They are capable of making a difference in the lives of others and finding the leader in everyone.
- They admit their mistakes. They realize that attempting to hide mistakes is much more damaging and hurts credibility. But when they admit to making a mistake, they do something about it.
- They create optimistic feelings and enable people to hold positive thoughts about the possibilities of success.
- They create a climate of learning characterized by trust and openness.

Activity	Nonresistance	NAME:
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When I was a manager in the business world, one of my branch managers became involved in a dispute with a branch manager from another region. The two could not work it out, so the dispute went to the supervisory level. When the other supervisor called me, I was ready for him with both barrels loaded, and early on in the conversation I let him have it! Quietly he responded, "Very well." I waited for further argument. There was none. Total nonresistance. Somehow, I was not happy with my overwhelming victory of this man. It was a hollow victory. I had not given him a chance to express his point of view. I didn't even know what he thought. After a few moments of silence, I asked, "What more do you have to say?" He replied, "Nothing," quietly and without malice.

By this time all the wind had been taken out of my sails. "Oh, c'mon, Fred, let's talk about it." "Okay," he said, and we talked. I was much more receptive to his problem than I ever would have been if he had attacked me as I had attacked him. The result of our conversation was a solution in which both our branches became winners. Another result was that I found a friend. So did he.

I learned a lot from this encounter. So much energy is wasted in the struggle to be right. This does not mean we are doormats, but it does mean we are willing to listen and to discover merit in another's point of view. We may even learn something. And we will certainly gain something of far greater value than winning an argument: winning a friend.

Today I assert myself softly.