LessonTitle: Measurement Estimation	**Pre 7.0**
Utah State Core Standard and Indicators	
Summary In this lesson, students research where measurement comes from. They estimate and measure a variety of objects and figure their margins of error between the estimates and the actual measurement. They graph their estimates vs. the actual measurements and compare the margin-of-error numbers to the graph. Finally they match distances to objects they believe are close to the given distances. Again, they examine their margins of error.	
Enduring Understanding We can improve measurement accuracy through estimation. Measurement is practical application of mathematics	**Essential Questions** Where did our measurement come from? How do we measure?
Skill Focus Measuring using standard and metric units.	**Vocabulary Focus** All measurement units
Assessment	
Materials All kinds of measurement tools	
Launch Where does measurement come from? Initiate the discussion (see info below) and then provide as much time for research as you're your time frame permits.	
Explore	
Summarize	
Apply	

Info on weights and measures (source: New Jersey Office of Weights and Measures)

- The Beginning: Primitive man used parts and movements of his body to describe lengths and quantities. When the first "fish story" was told, the catch's measurements were probably scrated on a cave wall to prove its size.
- The yard: King Henry I decreed that the lawful yard was the distance from the point of his nose to the end of his thumb. King Henry VII ruled that it measured three feet.
- The Meter: During the French Revolution, the metric system was proposed. The basic unit of length was the meter, defined as exactly one ten-millionth of the distance from the earth's equator to either pole.
- The Rod: Today, we say that the rod is 5.5 yards or 16.5 feet long. But in the sixteenth century, the length of the rod was determined by lining up 16 men, left-foot-to-left-foot, as they left church on Sunday morning.

- The Foot: Two-thirds of the Olympic cubit was the first unit to be called a foot. As the Roman legions marched across the world, they brought the foot to the nations they conquered.
- The Inch: The Greeks subdivided the foot into twelve thumbnail breadths, “Unices”. Anglo-Saxon King Edward II decreed that the inch was the length of 3 barley corns laid end to end.
- The yard: The English devised the yard to measure cloth. It equaled the distance from the middle of the chest to the finger-tip of an outstretched arm. Unfortunately, short-armed merchants sold shorter yards of fabric.
- The Fathom: English sailors used the fathom to measure the depth of water. The word “fathom” meant outstretched arms, and one fathom equaled the length across a man’s two arms outstretched from side to side.
- Scientific Terms: Today, scientists use infinitesimally small as well as astronomically large measurements. The angstrom measures 264 mmillionth of an inch; a light-year measures approximately six trillion miles.

Pre 7.0 Measurement Estimation

1) Where does measurement come from?

List all the units of measure you can think of—then research the history of one of them. Share your results with the class.

2) How do we measure? Estimate the following measurements. Then measure. Find your estimation error margin.

Pencil length

Unit of measure	Your estimate (E)	Your measurement (M)	Your estimation error margin (E – M)
Inches (in)			
Feet (ft)			
Millimeters (mm)			
Centimeters (cm)			

Perimeter of the room

Unit of measure	Your estimate (E)	Your measurement (M)	Your estimation error margin (E – M)
Yards (yd)			
Feet (ft)			
Meters (m)			
Dekameters (dk)			

Length of the Hallway (or part of the hallway)

Unit of measure	Your estimate (E)	Your measurement (M)	Your estimation error margin (E – M)
Yards (yd)			
Feet (ft)			
Meters (m)			
Dekameters (dk)			

Desktop Diagonal

Unit of measure	Your estimate (E)	Your measurement (M)	Your estimation error margin (E – M)
Inches (in)			
Foot (ft)			
Centimeters (cm)			
Decimeters (dm)			

Desktop Area

Unit of measure	Your estimate (E)	Your measurement (M)	Your estimation error margin (E – M)
Square inches (in^2)			
Square feet (ft^2)			
Square centimeters(cm^2)			
Square decimeters (dm^2)			

Capacity of a Jar

Unit of measure	Your estimate (E)	Your measurement (M)	Your estimation error margin (E – M)
Cups (c)			
Ounces (oz)			
Milliliters (ml)			
Liters (l)			

Volume (capacity) of a Box

Unit of measure	Your estimate (E)	Your measurement (M)	Your estimation error margin (E – M)
Cubic inches (in^3)			
Cubic Feet (ft^3)			
Cubic centimeters (cm^3)			
Cubic meters (m^3)			

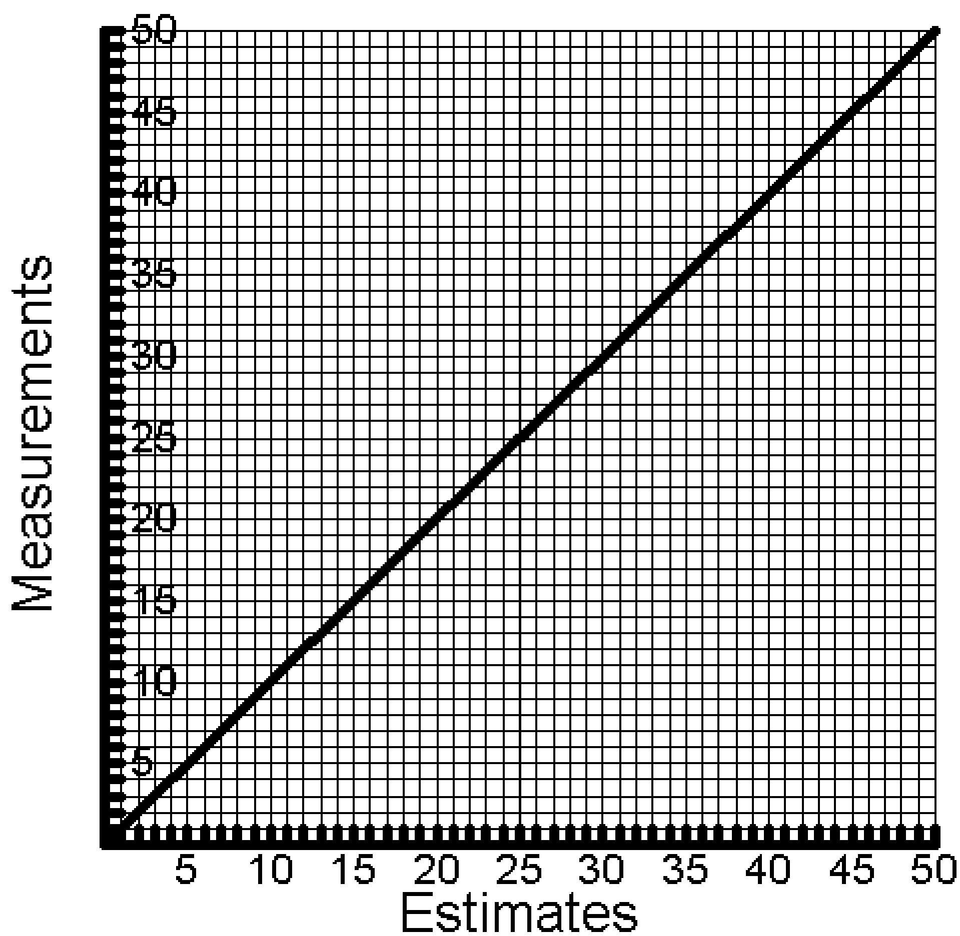
3) a. How accurate are your estimates?

- What does it mean when the difference E – M is positive? Negative?
- Do you make better estimates on short things or on long ones?

  Length or area? Area or capacity?

b. Graph your estimates and exact measurements (E,M)below. Compare your "E – M" positives and negatives to the graph

- How is the graph like the "E – M" values?
- Do you tend to overestimate or underestimate?
- If your estimate was perfect, where is the point?
- How many objects did you estimate closely?



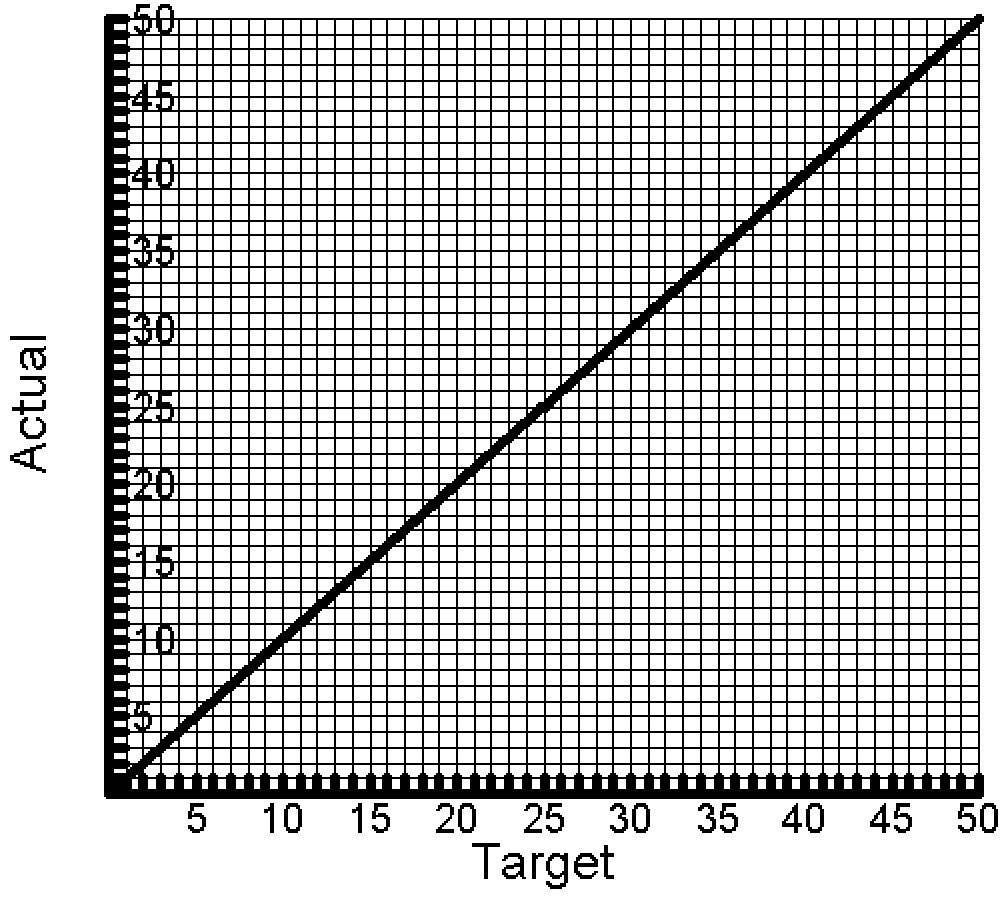
4) Target Measurements. Look for objects which you think matches the target measurement (T). Then measure the object (M). Find the difference T – M.

Target Measurement (T)	Object	Actual Measurement (M)	T – M
24 inches (in)			
24 centimeters (cm)			
4 feet (ft)			
4 meters (m)			
9 square feet (sq. ft or ft^2)			
9 square meters (m^3)			
400 square inches (sq in or in^2)			
400 square centimeters (cm^2)			
200 cubic inches (in^3)			
200 cubic centimeters (cm^3)			

5) How accurate were your matches?

a. What does it mean when the difference T – M is positive? Negative?

b. Graph your estimates and exact measurements (E,M) below. Compare your "T – M" positives and negatives to the graph



- How is the graph like the "T – M" values?

- Did you tend to overestimate or underestimate?

- How many objects did you estimate closely?

6) Which were you better at—estimating measurement for a given object or finding an object to match a measurement? Why do you think this is so?

Which was easier? Why do you think this is so?