



What's So Singaporean About Geometry?

Cassy Turner

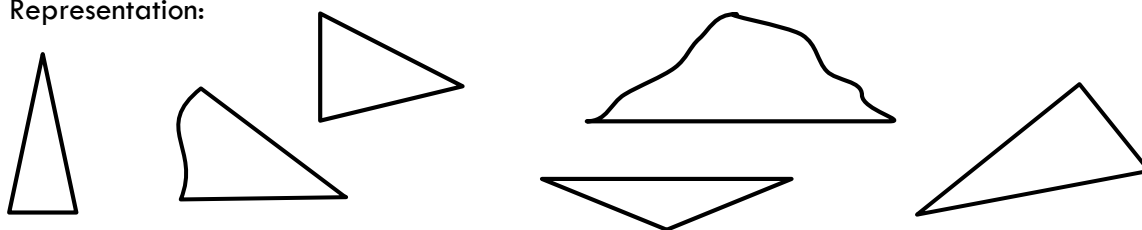
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What is Geometry?

Four Aspects of Geometry (Usiskin):

1. Visualization - Drawing and construction of figure
2. Study of the spatial aspects of the physical world
3. As a vehicle for representing non-visual mathematical concepts
4. Relationships and representation as a formal mathematical system (not in elementary school!)

Representation:



Measurement

Measurement procedure:

1. Choose a standard unit.
2. Express measurements as multiples of that unit.
 - 7 units of 8 ones = 56 ones
 - 7 units of length 8 cm long
 - 56 cm is how many units of 8cm?
 - 6 units of $1/7$ m piece of fabric is a piece of fabric $6/7$ m long

Teaching sequence (Parker & Baldrige):

1. a) Students directly compare objects according to their length, weight, etc.
b) A simple non-standard unit is used to measure objects.
c) A standard unit is introduced and students learn to read measurements along a scale.
2. Bigger and smaller standard units are introduced and students learn to convert between measurements expressed in different units.
3. In each step, students solve problems - both calculation problems and word problems. The problems are initially simple, and build to multi-step problems.

Measurement Topics - Length

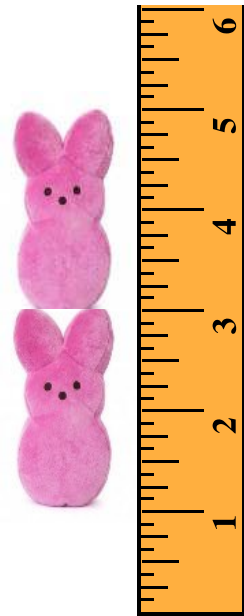
1. b) Comparing with non-standard units:



The unit is paper clips. How many paperclips tall is one bunny? Two bunnies?

1. c) Comparing with standard units - Grade 2

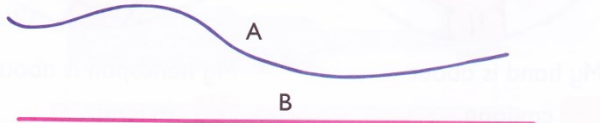
The unit is inches. How many inches tall is one bunny? Two bunnies?



5. Cut a piece of string as long as the line below.
Then measure the length of the string with your ruler.



6. Measure these lines.



- (a) Line A is about cm long.
- (b) Line B is about cm long.

2. Convert between measurements expressed in different units - Grade 3



Activity

Use outdoor chalk or tape in the gymnasium to mark 6 lines 1 - meter apart on the floor. Have students take turns standing at the starting line and throwing a paper airplane. Measure the distance traveled by each plane in meters and centimeters. Whose plane travelled the longest distance?

3. Students solve problems - both calculation problems and word problems.

$$3 \text{ ft } 7 \text{ in} + 7 \text{ in} = 4 \text{ ft } 2 \text{ in}$$

5 in 2 in

$$1 \text{ km} - 350 \text{ m} = ?$$

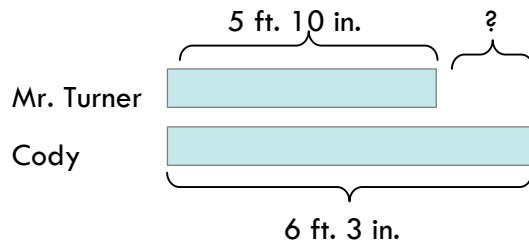
$$1000 \text{ m} - 350 \text{ m} = ?$$

$$1 \text{ km} = 1000 \text{ m}$$

$$1000 = 900 + 90 + 10$$

9 hundreds	10 tens
- 3 hundreds	5 tens
6 hundreds	5 tens

Mr. Turner is 5 ft 10 in. tall.
 His son Cody is 6 ft. 3 in tall.
 How much taller is Cody than his dad?



Measurement Topics - Weight

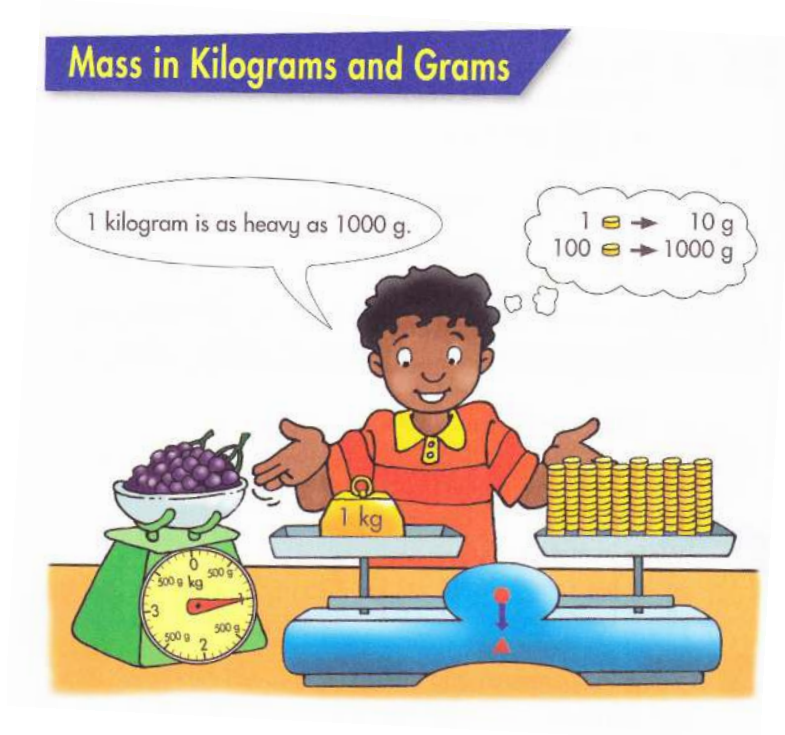
Weight is a more challenging topic as you can't tell what an object weighs by looking at it.

1. b) Comparing with non-standard units:
How many blocks does the bunny weigh?
Which is heavier?



1. c) Comparing weight with standard units
Grade 2 - reading scales

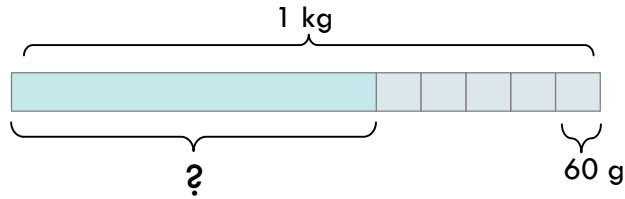
2. Convert between measurements expressed in different units - Grade 3



3. Students solve problems - both calculation problems and word problems.

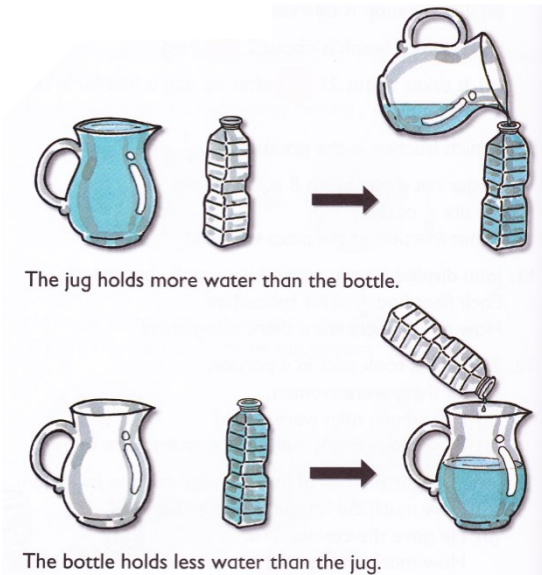
$$\begin{array}{r}
 3 \text{ lbs } 7 \text{ oz} + 12 \text{ oz} = 4 \text{ lbs } 3 \text{ oz} \\
 \phantom{3 \text{ lbs } 7 \text{ oz} +} \swarrow \searrow \\
 \phantom{3 \text{ lbs } 7 \text{ oz} +} 9 \text{ oz } 3 \text{ oz}
 \end{array}$$

The total weight of a grapefruit and 5 tennis balls is 1 kg. If the weight of each orange is 60 g, find the weight of the grapefruit.



Measurement Topics - Capacity

1. b) Comparing with non-standard units:



1. c) Comparing weight with standard units:

Gallon Man: <http://bit.ly/gallonman>



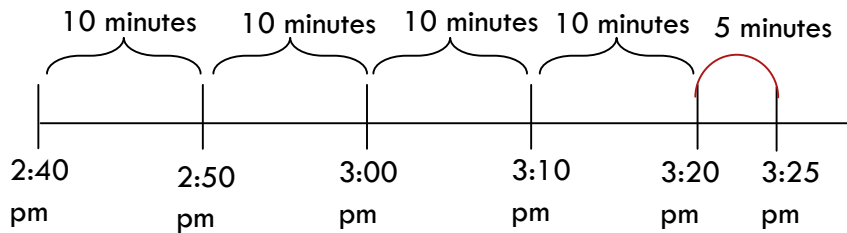
Measurement Topics - Time

It's not possible to compare non-standard units of time so the first two steps in the teaching sequence are skipped:

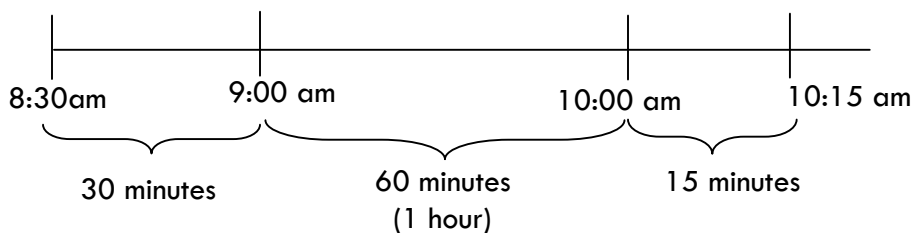
“Mommy will be home in 2 sleeps”

1. c) Students learn to tell time with both an analog and digital clock.
2. Converting units of time
3. Solving problems for elapsed time:

John took 45 minutes to ride his bike to the park. He left at 2:40pm. When did he arrive at the park?



Minnie watched a TV program that started at 8:30am and ended at 10:15 am. How long did the program last?



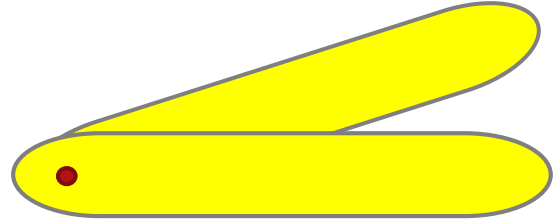
$30 \text{ min} + 60 \text{ min} + 15 \text{ min} = 75 \text{ min}$ **The program lasted 1 hour 45 minutes.**

Measurement Topic - Angles

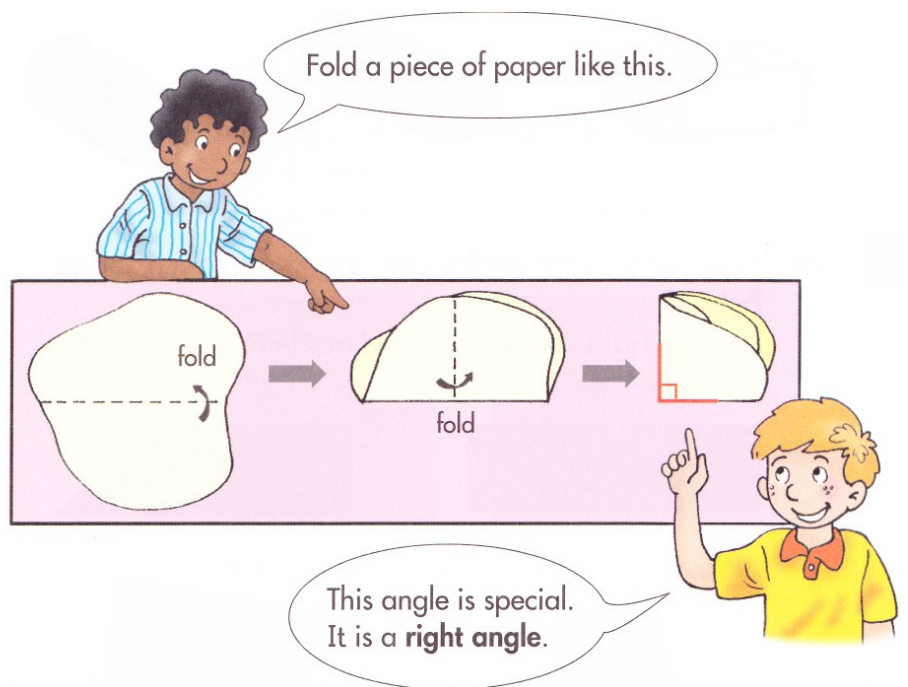
1. a) Students directly compare objects according to their length, weight, etc.

Activity

Join two strips of cardboard with a brad to form an "angle maker." Look for three angles around you and use your angle strips to compare them.



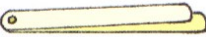
1. c) Comparing angles with standard units:



Look around you.

Can you find any right angles in your surroundings?

How do you check if they are right angles?

- 1 Use your  to form
- an angle smaller than a right angle.
 - an angle bigger than a right angle.

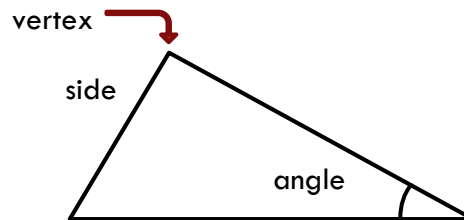
How do you check that you have formed the angles correctly?

Geometric Topics - Shapes & Figures

Two levels of identifying & drawing figures in a plane (2-d)

1. Sight recognition: a circle is a shape that looks like a circle. (Grades k-2)
2. Precise definition: a pentagon is a figure with five straight sides. (Grades 3 and up!)

Names of parts:



Triangles can be classified by both their angles: Acute, Right and Obtuse and their sides: Isosceles, Equilateral and Scalene

Activity

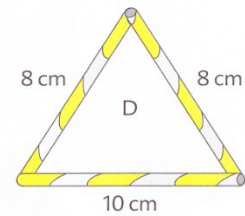
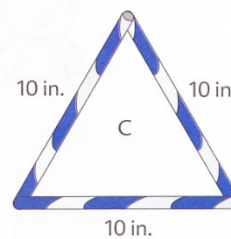
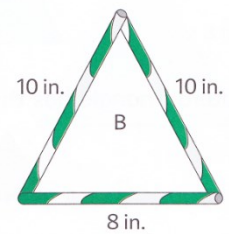
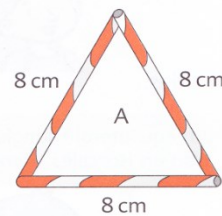
Try this activity without measurement units first! Have students bring in straws to make the different types of triangles. If you use bendable straws, they can insert one end inside the other to make the triangles

The CCSSM begins in grade 4 expecting students to:

Draw and identify lines and angles, and classify shapes by properties of their lines and angles.

6 Triangles

Courtney used straws of different lengths to make these triangles.



Which triangles have two equal sides? What are they called?



Which triangles have three equal sides? What are they called?



Geometric Measurement Topic: Area

Defining Area:

1. Fix a unit region and declare its area to be *1 unit of area*.
2. Express other areas of other regions as multiples of this unit area.

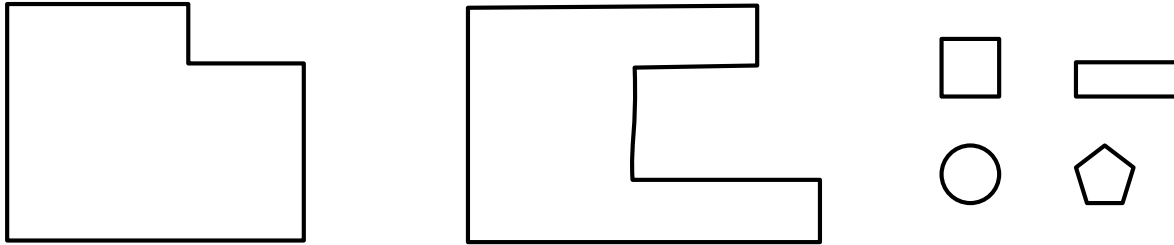
Length is a number times a unit of length: 4 cm is 4×1 cm

Area is always a *square unit*.

Activity

Why Square Units? An activity adapted from Parker & Baldrige

Provide students with two room shapes and four different tile shapes:
(Enlarge first!)



A designer wants to compare the areas of two rooms in a house to see how many tiles she will need to cover the floor. The rooms need to be covered with identical floor tiles. Which shape tile will work best to cover these floors with no gaps?

Squares and rectangles will fit the floors with no gaps. They Tessellate. Squares work better for defining area as smaller square tessellate larger ones.

Activity

Practicing finding and filling an Area:

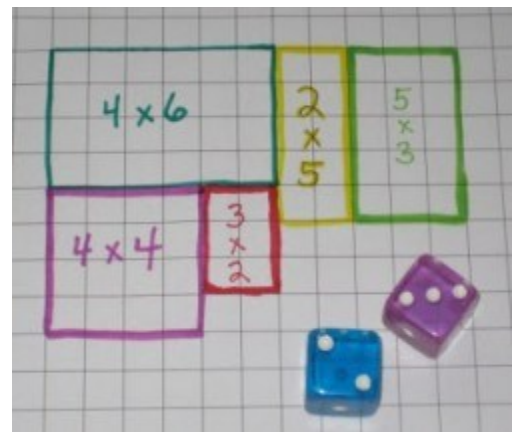
Students need graph paper (inside a whiteboard is great!)

Whole group version:

volume.

Two-player version:

Two players on one board- take turns to roll the dice and filling in the area (use two different color markers). The first player who can't use their dice roll loses.



Geometric Measurement Topic: Volume

Grades 1-3 focus on capacity. Volume of a liquid is easily measured as the capacity of a container. Grade 4 introduces volume of solids with the introduction of a unit cube.

Activity

1 cm connecting cubes. Have students create, then draw figures

