# Lesson Plan

**Course Title:** Concepts of Engineering and Technology

**Session Title:** Reading Rulers

**Performance Objective:**
By the end of the lesson all students will be able to make precise measurements using the "Inch" and the "Metric." The degree of precision will be determined by each student's educational level to the satisfaction of the teacher. (*For example, beginners would be able to make measurements at 1/4 of an inch, whereas more advanced would be able to make measurements at 1/32" or 1/16".)*

**Specific Objectives:**

- Day 1 = Take Pre-test to access each student's current knowledge level.
- Day 2 = Students who don't get 80% passing rate or better will receive one-on-two or three help from the teacher on what they missed
- Create their own Big Inch Manipulative
- Day 2-4 = Play the assigned online games and complete them.
  Everyone will complete all the levels of Fun Brain Measure it for Centimeters and Inches
  http://www.funbrain.com/measure/
  Select three (3) of the remaining online games to play
  http://www.funbrain.com/measure/;
  http://www.thekidzpage.com/learninggames/online_games/measurement_game/Measurement.html ; http://www.rsinnovative.com/rulergame/ ;
  http://www.hbschool.com/activity/elab2004/gr5/25.html; or
  http://www.hbschool.com/activity/length_strength1_centi/
  Day 5 = Take and pass the Ruler Test with 80% or better OR make a gain of 30%+

## Preparation

**TEKS Correlations:**
This lesson, as published, correlates to the following TEKS. Any changes/alterations to the activities may result in the elimination of any or all of the TEKS listed.

**Concepts of Engineering and Technology:**

- **130.362(c)(2)(A)**
  …use clear and concise written, verbal, and visual communication techniques

- **130.362(c)(3)(B)(G)**
  …follow safety guidelines as described in various manuals, instructions, and regulations;
  …demonstrate the use of precision measuring instruments.

**Interdisciplinary Correlations:**

**Algebra I:**

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- **111.32(b)(1)** - **Basic understandings**
  Foundation concepts for high school mathematics. As presented in Grades K-8, the basic understandings of number, operation, and quantitative reasoning; patterns, relationships, and algebraic thinking; geometry; measurement; and probability and statistics are essential foundations for all work in high school mathematics. Students will continue to build on this foundation as they expand their understanding through other mathematical experiences.

- **111.32(b)(3)(A)(B)**
  …use symbols to represent unknowns and variables; and
  …look for patterns and represent generalizations algebraically.

- **111.32(b)(10)(A)(B)**
  …solve quadratic equations using concrete models, tables, graphs, and algebraic methods; and
  …make connections among the solutions (roots) of quadratic equations, the zeros of their related functions, and the horizontal intercepts (x-intercepts) of the graph of the function.

**Geometry:**

- **111.34(b)(6)(A)(C)**
  …describe and draw the intersection of a given plane with various three-dimensional geometric figures;
  …use orthographic and isometric views of three-dimensional geometric figures to represent and construct three-dimensional geometric figures and solve problems.

- **111.34(b)(8)(A)(C)(D)(E)(F)**
  …find areas of regular polygons, circles, and composite figures;
  …find areas of sectors and arc lengths of circles using proportional reasoning;
  …derive, extend, and use the Pythagorean Theorem;
  …find surface areas and volumes of prisms, pyramids, spheres, cones, cylinders, and composites of these figures in problem situations;
  …use area models to connect geometry to probability and statistics; and
  …use conversions between measurement systems to solve problems in real-world situations.

**Integrated Physics and Chemistry:**

- **112.38(c)(2)(C)(E)**
  …collect data and make measurements with precision;
  …communicate valid conclusions.

**Physics:**

- **112.39(c)(2)(H)**
  …make measurements with accuracy and precision and record data using scientific notation and International System (SI) units;

**Teacher Preparation:**
At the end of class the day before you begin this lesson, ask students to give you some examples of why accurate measurement is needed. Hint = clothing, building wall height, etc. The teacher should have 4 Big Inch Manipulative examples made to show the students.

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**References:**

1. http://www.funbrain.com/measure/
2. http://www.funbrain.com/measure/
3. http://www.thekidzpage.com/learninggames/online_games/measurement_game/Measurement.html
4. http://www.rsinnovative.com/rulergame/
5. http://www.hbschool.com/activity/elab2004/gr5/25.html
6. http://www.hbschool.com/activity/length_strength1_centi/

**Instructional Aids:**

1. Reading the Ruler Pre-test grading PowerPoint presentation
2. Calculator
3. (4) The Big Inch Manipulative examples to show students
4. Computer with links to the online games
5. Reading The Ruler Pre-test answer key
6. Ruler test answer key (10 and 20 questions)

**Materials Needed:**

1. Reading A Ruler: The Big Inch Manipulative handout for each student
2. 2 sheets of white computer paper, marker/crayons, scissors, and tape for students to create the Big Inch.
3. Reading The Ruler Pre-test for each student
4. Ruler test for each student (10 questions)
5. Ruler test for each student (20 questions)
6. Class set of printout hard copies of Reading The Ruler Pre-test PowerPoint for students to use
7. Division of Inch handout
8. Writing utensils for students who don't have any
9. Computer with internet access

**Equipment Needed:**

1. Data projector for PowerPoint presentation
2. Computer with internet access

**Learner Preparation:**

At the end of class the day before they begin this lesson, students should share with the class some examples of why accurate measurement is needed. Hint= clothing, building wall height, etc.
At the end of the lesson the students should all be able to pass the Ruler Test with 80% or better OR make a gain of 30%+

## Introduction

**Introduction (LSI Quadrant I):**

*NOTE: The class discussion is meant to be Socratic in nature and not true/false, or this is the only correct answer. Encourage your students to explain WHY they think the way they do! There is NO wrong answer if they can explain the WHY!*

**SAY:** Today you will be taking the Reading The Ruler Pre-test.

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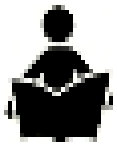
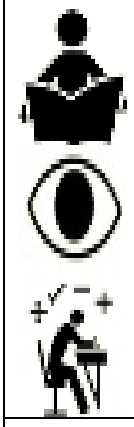
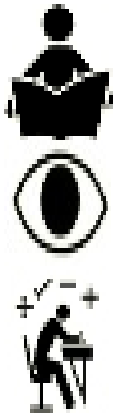
**SAY/SHOW:** The students the test and how to use the calculator on the computer.
**SAY:** Tomorrow we will grade and go over what the correct answers are. For those of you who don't make 80% or better on the Pre-test, I will be working one-on-three with you on what you miss.
**SAY/SHOW:** Tomorrow you will all make your own Big Inch Manipulative in class.
**SAY/SHOW:** As I am working with students, you will be playing online measurement games to help improve your knowledge.
**SAY:** At the end of this lesson, you will all take the Ruler Test and pass it with 80% or better OR make a gain of 30%+

## Outline

**Outline (LSI Quadrant II):**
Instructors can use the PowerPoint presentation, slides, handouts, and note pages in conjunction with the following outline.

| MI | Outline | Notes to Instructor |
|---|---|---|
|  | At the end of class the day before ask students to give you some examples of why accurate measurement is needed. Hint = clothing, building wall height, etc. | Socratic discussion on whether or not it is a good example or not. Allow enough time for input so that every student gives an example. |
|  | I. Reading The Ruler Pre-test<br>A. Take the Pre-test<br>B. Exchange test and go over correct answers | Walk around and make sure they do their own work.<br>Have students grade in pen so as to not "help" a friend's grade.<br>Teacher should work with students on what they missed on the Pre-test. |
|  | II. Students make their your own Big Inch Manipulative | Students will need 2 sheets of white computer paper, marker/crayons, scissors, and tape for students to create the Big Inch Manipulative. Teacher should have 4 examples of the Big Inch Manipulative for students to look at in groups of 2-4 when they make theirs. |
| | | |

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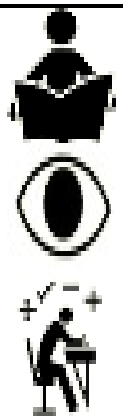
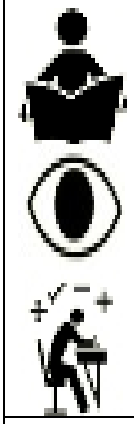
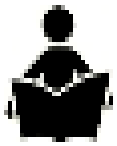
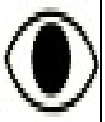
|---|---|---|
|  | III. Students play the online games as teacher works with other students.<br>A. Everyone will complete all the levels of Fun Brain Measure it for Centimeters and Inches:<br>http://www.funbrain.com/measure/<br><br>B. Select three (3) of the remaining online games to play:<br><br>http://www.funbrain.com/measure/ ;<br>http://www.thekidzpage.com/learninggames/online_games/measurement_game/Measurement.html ;<br>http://www.rsinnovative.com/rulergame/ ;<br>http://www.hbschool.com/activity/elab2004/gr5/25.html; or<br>http://www.hbschool.com/activity/length_strength1_centi/ | Teacher should have students show they have completed levels, for 25 points, each one they complete as a daily grade.<br><br>See Performance Objectives for online resources for students to use. |
|  | IV. Take the Ruler Test and pass it with 80% or better OR make a gain of 30%+<br>A. Ruler Test – 10 questions<br>B. Ruler Test – 20 questions | Sometimes a student still can't "pass" but if he/she goes from 20% to say 55% = that's major improvement! Walk around and make sure they do their own work during the test. |

**Copy and paste Multiple Intelligences Graphic in appropriate place in left column.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
|  | |  | | | | | | |
| **Verbal Linguistic** | **Logical Mathematical** | **Visual Spatial** | **Musical Rhythmic** | **Bodily Kinesthetic** | **Intra-personal** | **Inter-personal** | **Naturalist** | **Existentialist** |

## Application

**Guided Practice (LSI Quadrant III):**
Go through the Reading The Ruler Pre-test grading PowerPoint presentation and have students check

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their work.
Demonstrate how to create the Big Inch Manipulative and have 4 examples for students to look at/use.
Work one-on-three with students over what they missed on the Pre-test.

**Independent Practice (LSI Quadrant III):**

1. Take Reading The Ruler Pre-test
2. Create the Big Inch Manipulative
3. Play online measurement games
4. Take the Ruler Test

## Summary

**Review (LSI Quadrants I and IV):**
By the end of the lesson, all students will be able to make precise measurements using the "Inch" and the "Metric." The degree of precision will determined by each students educational level and to the satisfaction of the teacher. *For example, beginners would be able to make measurements at 1/4 of an inch, whereas more advanced would be able to make measurements at 1/32" or 1/16".*

## Evaluation

**Informal Assessment (LSI Quadrant III):**
Make sure everyone has input or discussion at least once; and they demonstrate good teamwork when making the Big Inch Manipulative.

**Formal Assessment (LSI Quadrant III, IV):**
Reading The Ruler Pre-test and Ruler Test.

**Extension/Enrichment (LSI Quadrant IV):**
**Offer for BONUS:**
The online games

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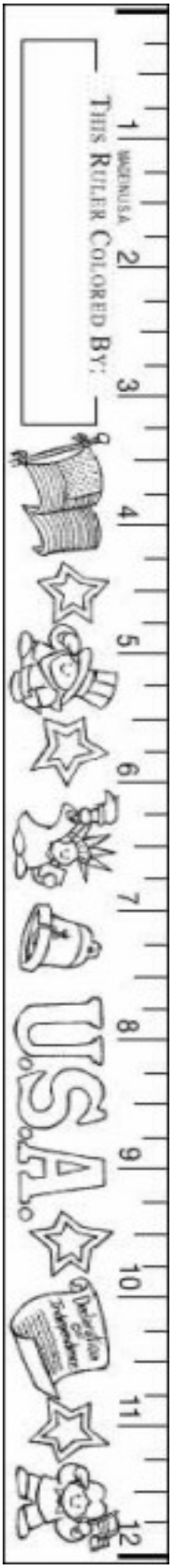


# Divisions Of One Inch

**1/16”**

2/16 **1/8”**

**3/16”**

4/16 2/8 **1/4"**

**5/16”**

6/16 **3/8”**

**7/16”**

8/16 4/8 2/4 **1/2"**

**9/16”**

10/16 **5/8”**

**11/16”**

12/16 6/8 **3/4"**

**13/16”**

14/16 **7/8”**

**15/16”**

16/16 8/8 4/4 2/2 **1”**

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# Reading A Ruler:
# The Big Inch Manipulative

**OBJECTIVE:** By the end of the lesson, all students will be able to make precise measurements using the "Inch" and the "Metric." The degree of precision will be determined by each student's educational level. *For example, beginners would be able to make measurements at 1/4 of an inch, whereas more advanced would be able to make measurements at 1/32" or 1/16".*

**TIMELINE:** 1/2 Day of regular 45 minute class period

Step 1 = Start with a blank sheet of printer paper

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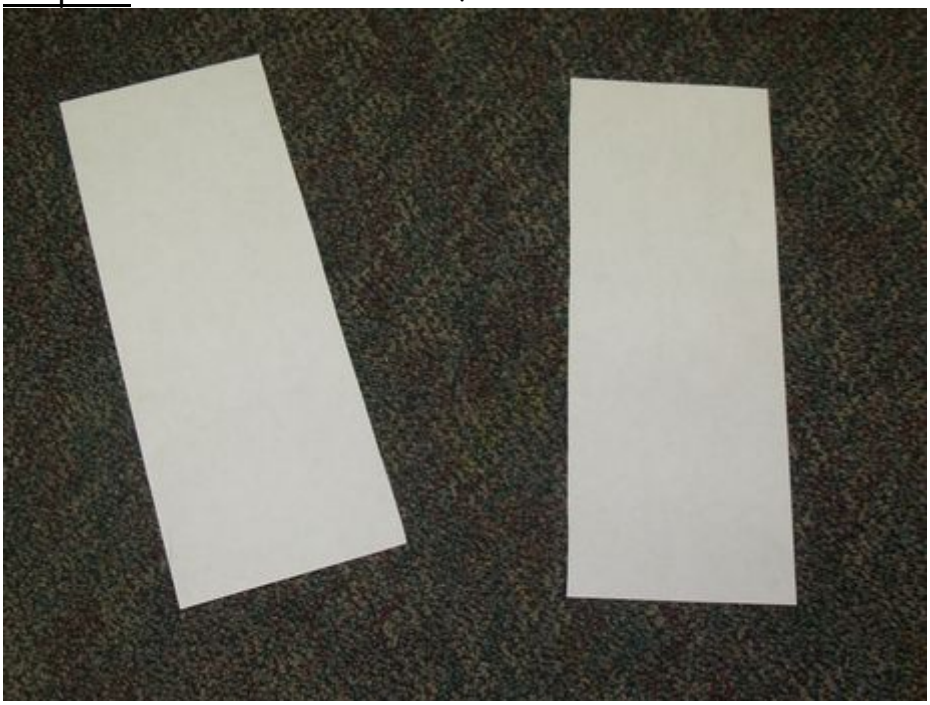
Step 2 = Fold it in half long ways or like a "hot dog"

Step 3 = Cut it in half with scissors



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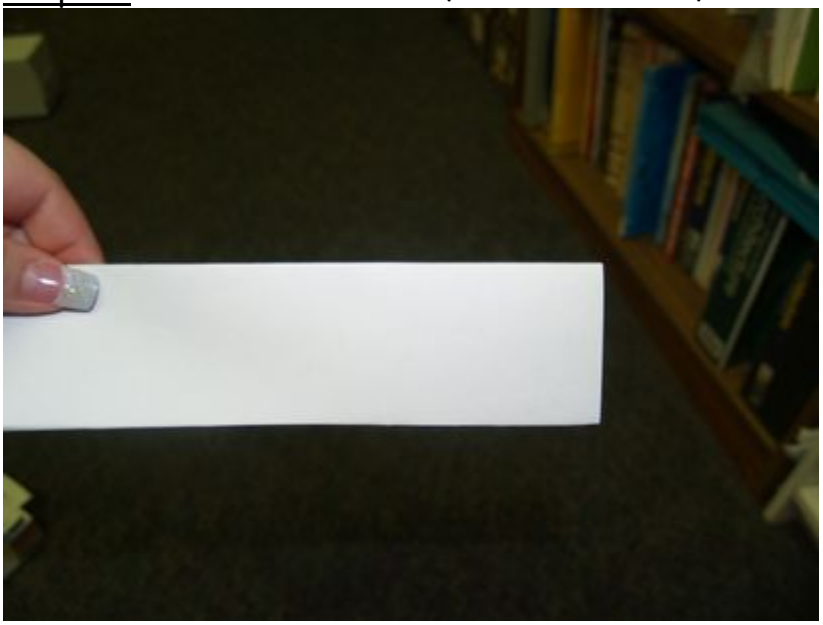
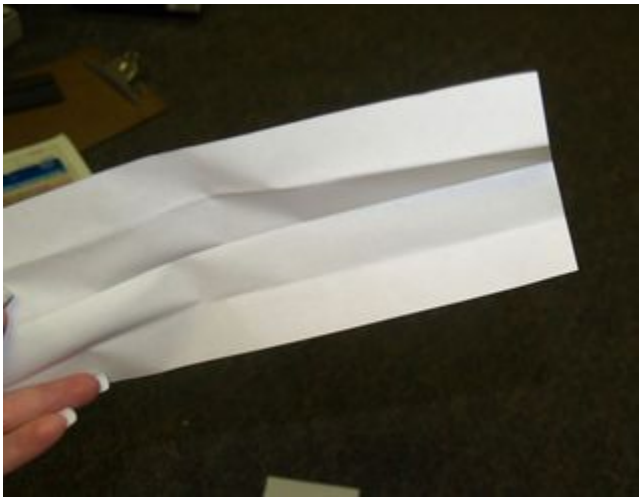
Step 4 = Take one of the halves and fold it in half two times like a "hot dog"





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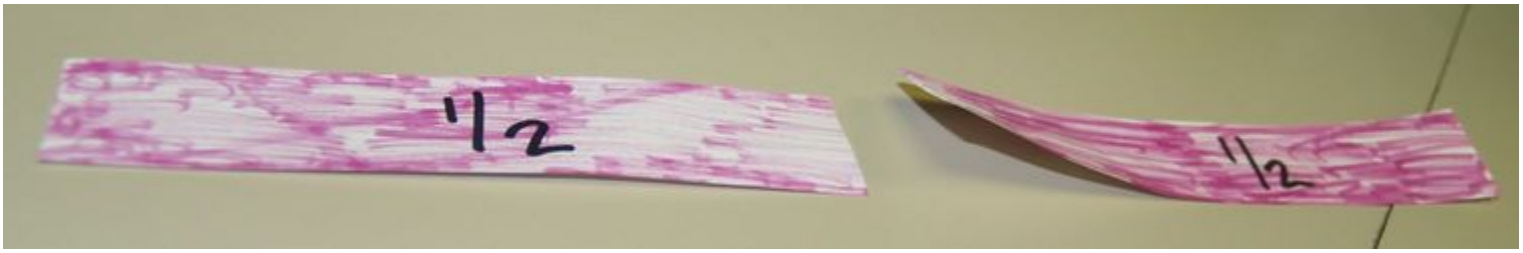
Step 5 = Now cut out those strips and color them using four (4) different colors.

Step 6 = Take one (1) piece and fold it in half like a "hamburger"

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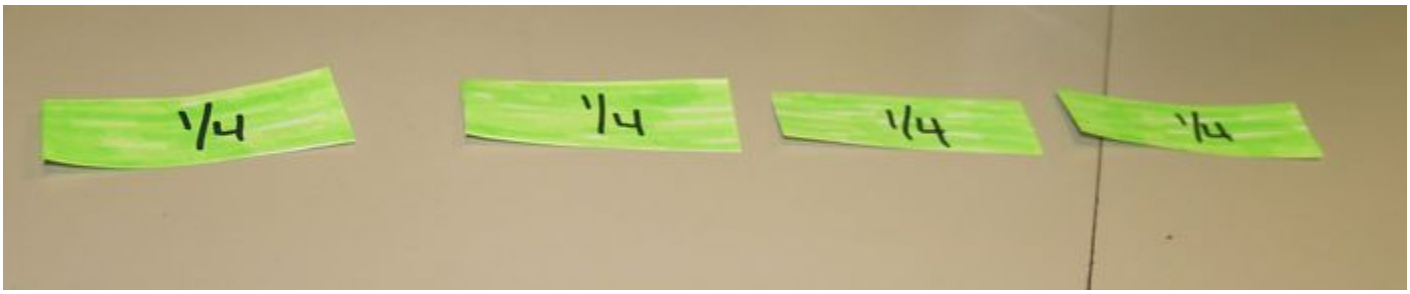
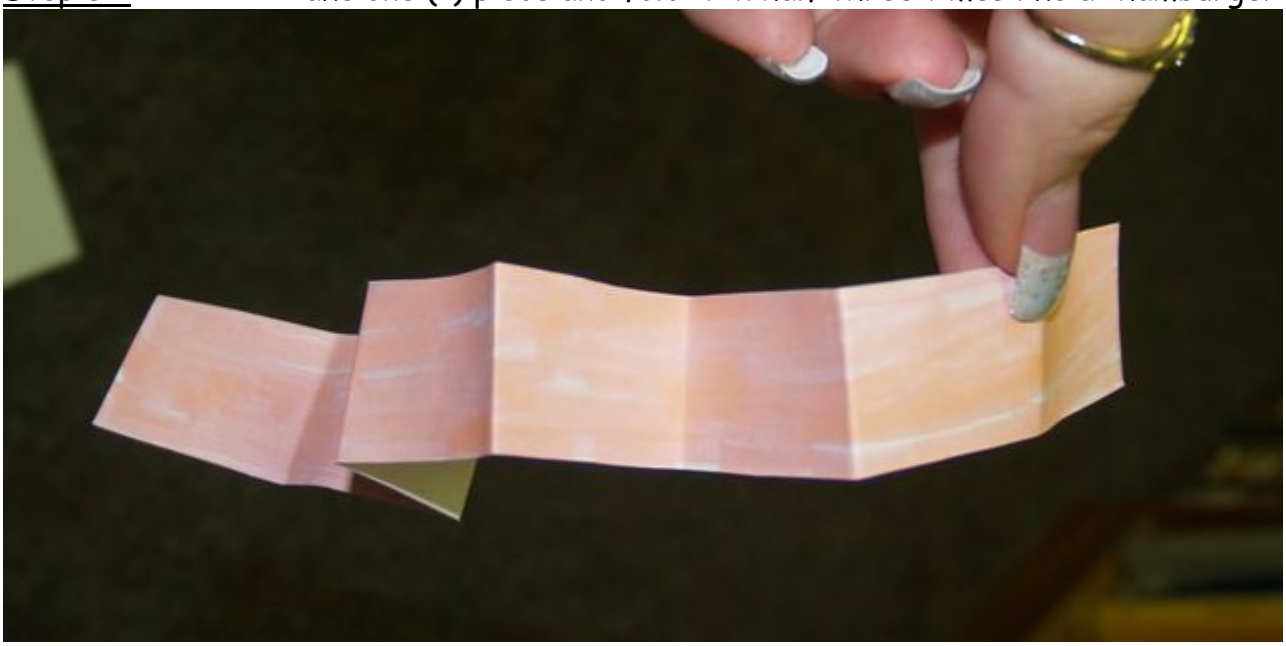
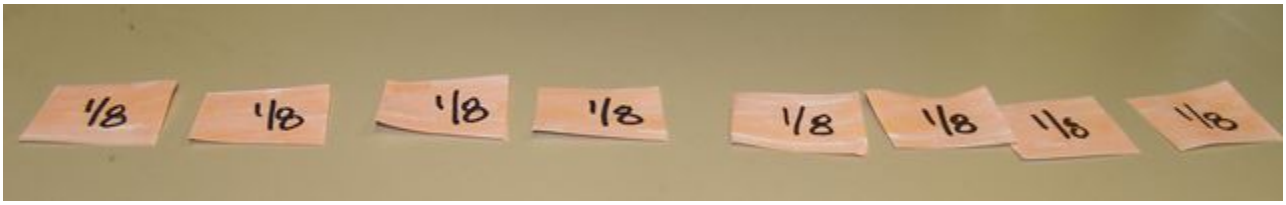
Step 7 = Take one (1) piece and fold it in half two times like a "hamburger"




Step 8 = Take one (1) piece and fold it in half three times like a "hamburger"



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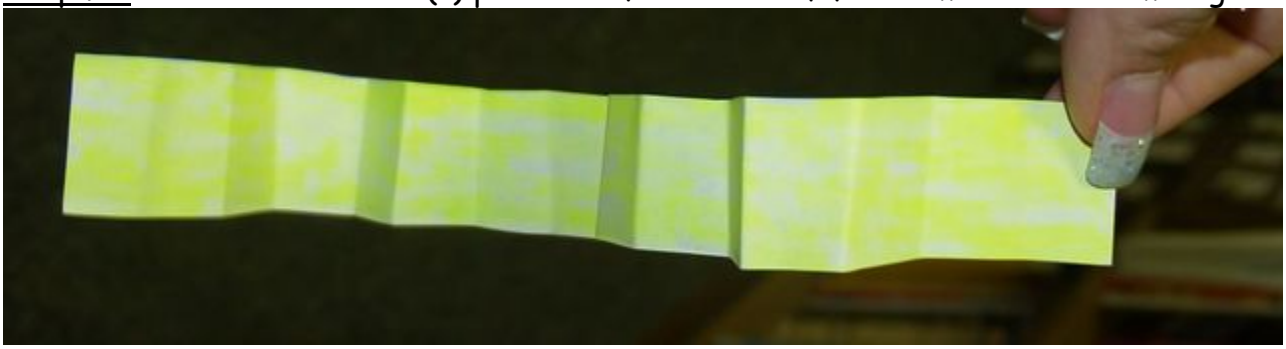
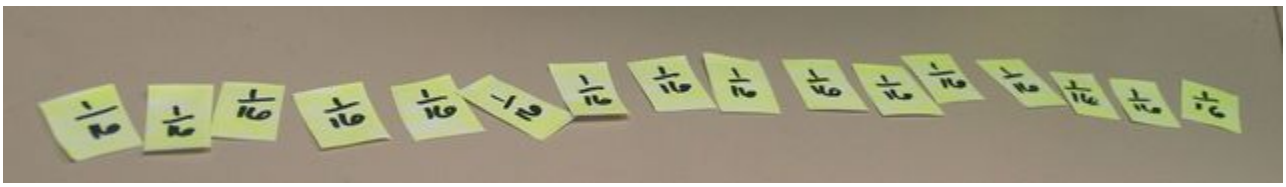
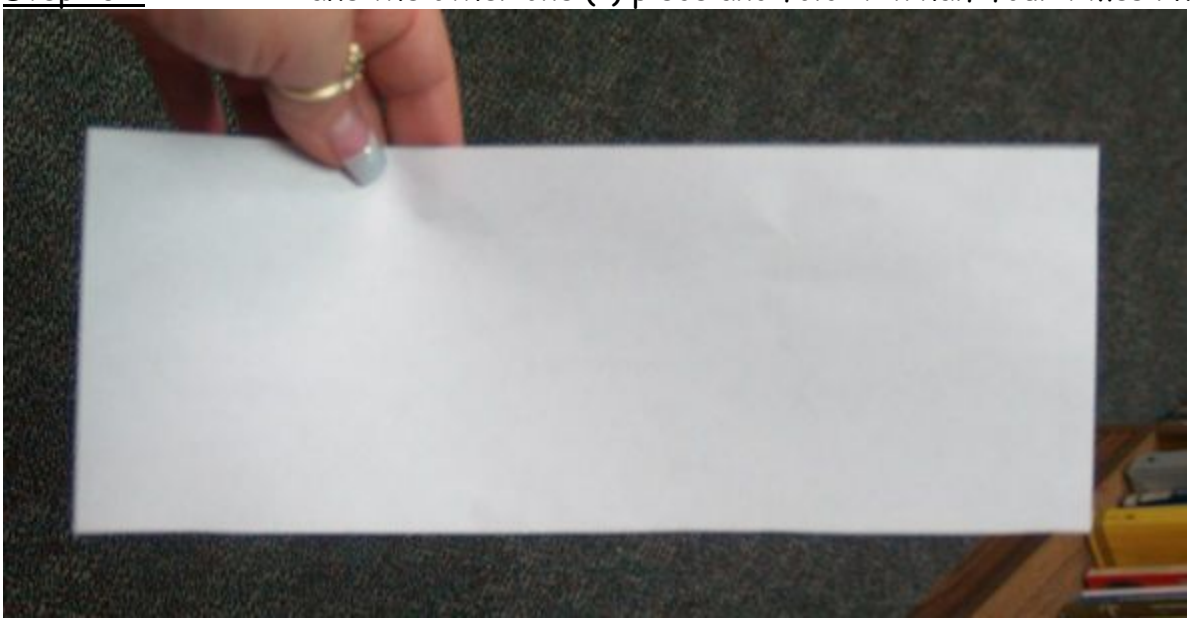
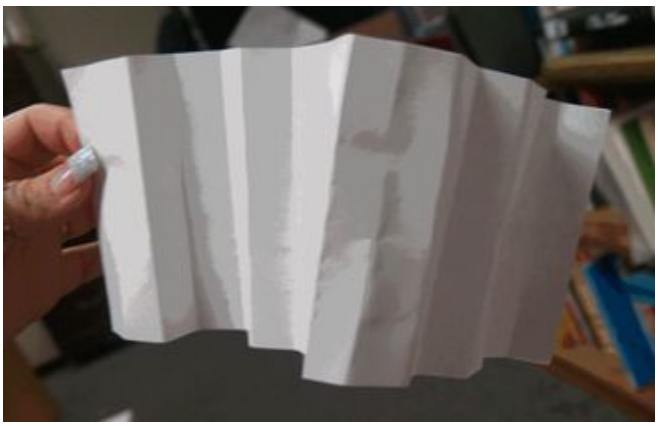
Step 9 = Take one (1) piece and fold it in half four times like a "hamburger"





Step 10 = Take the other one (1) piece and fold it in half four times like a "hamburger"





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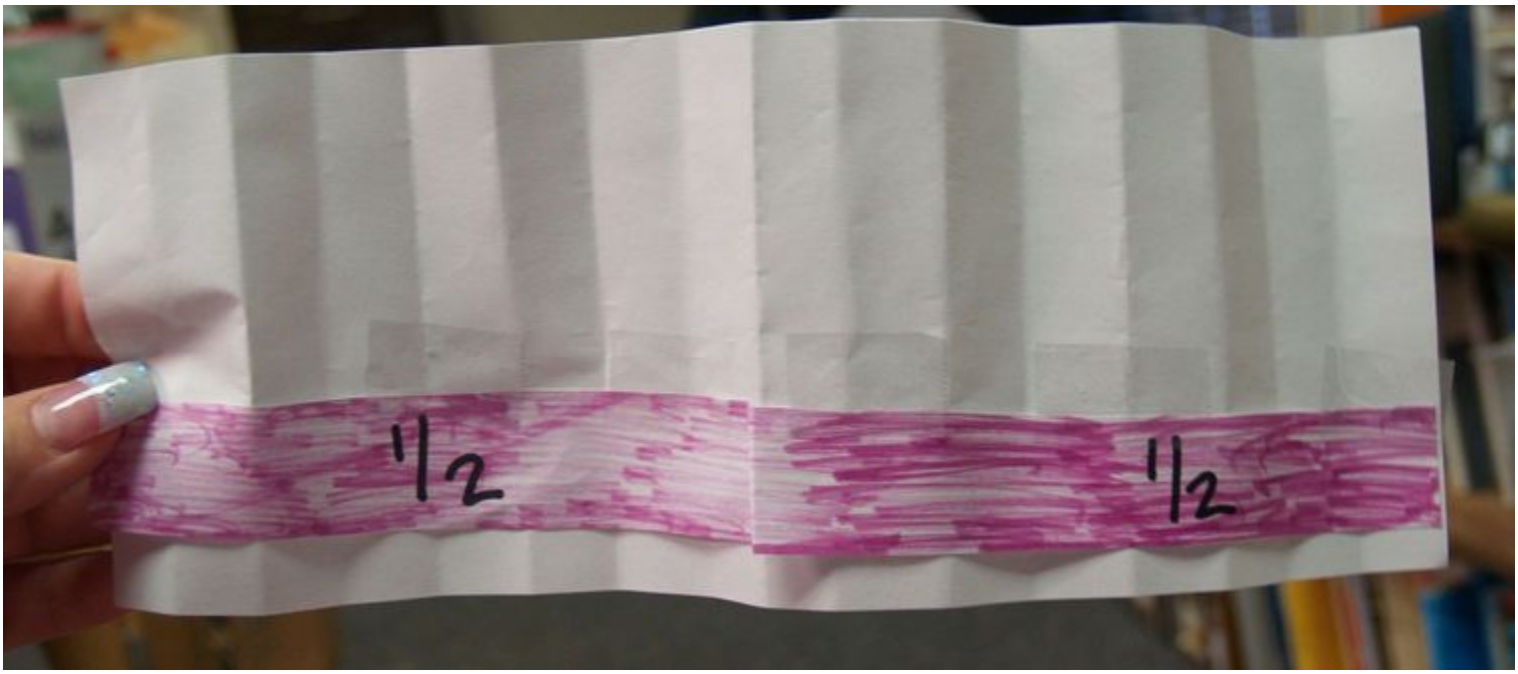
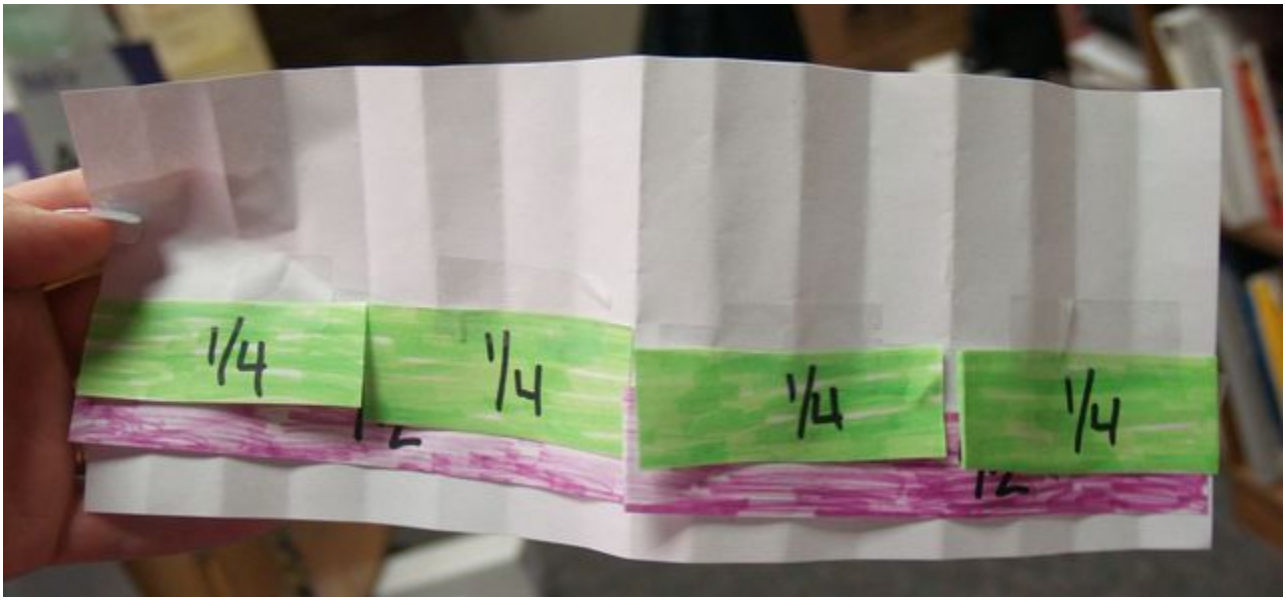
Step 11 = Now tape your cut out parts/sections/fractions starting with the largest ones to the smallest ones.



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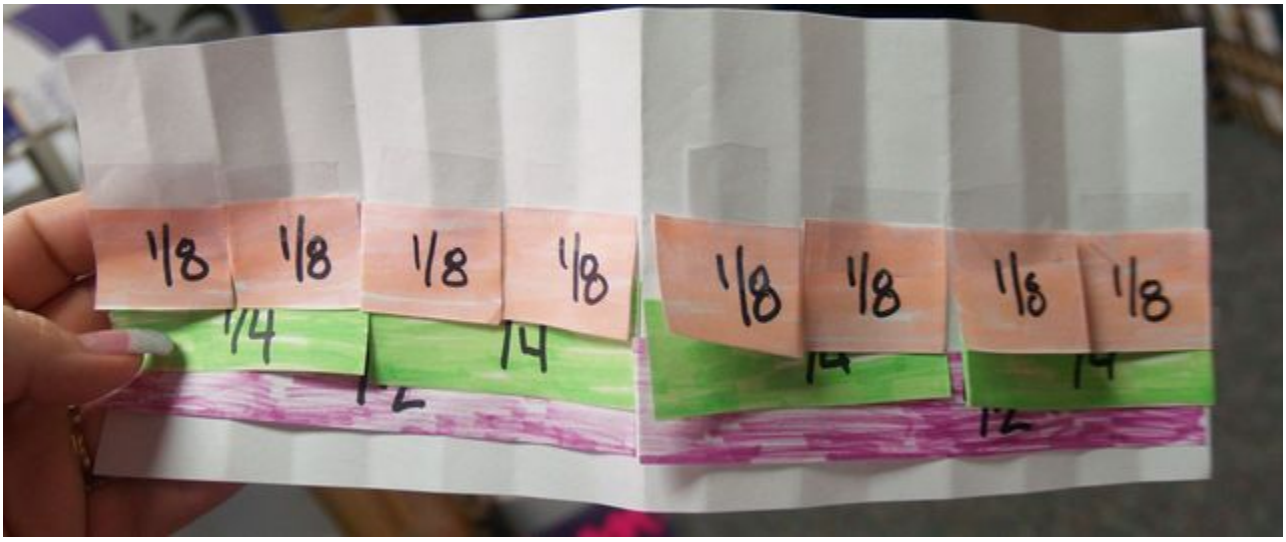


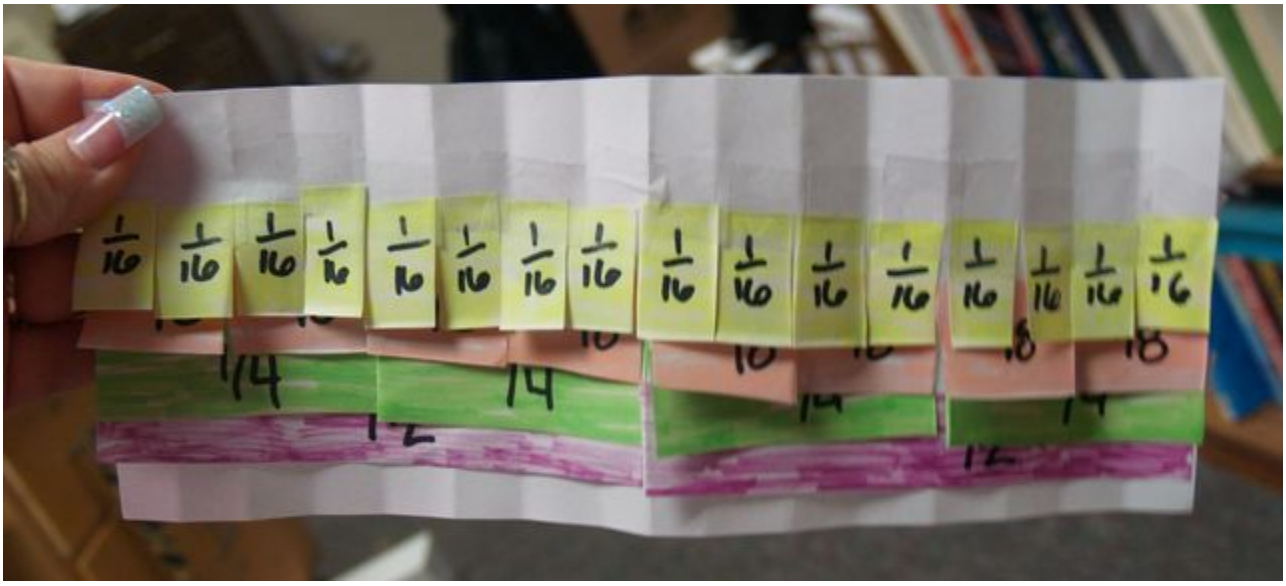


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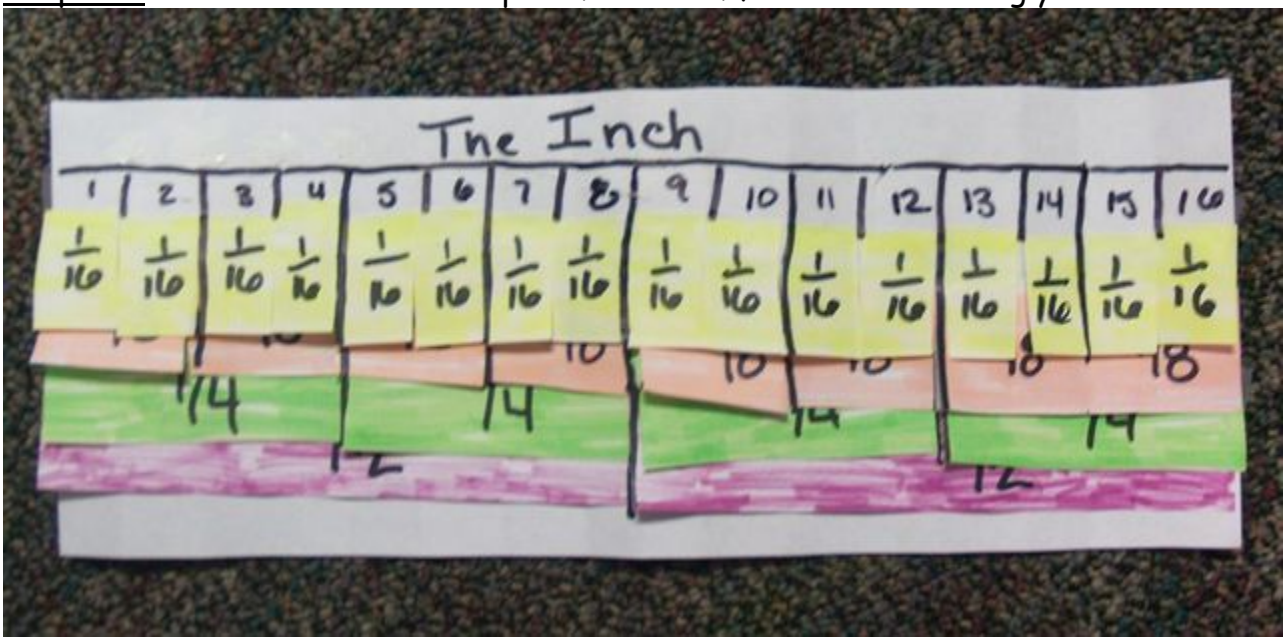
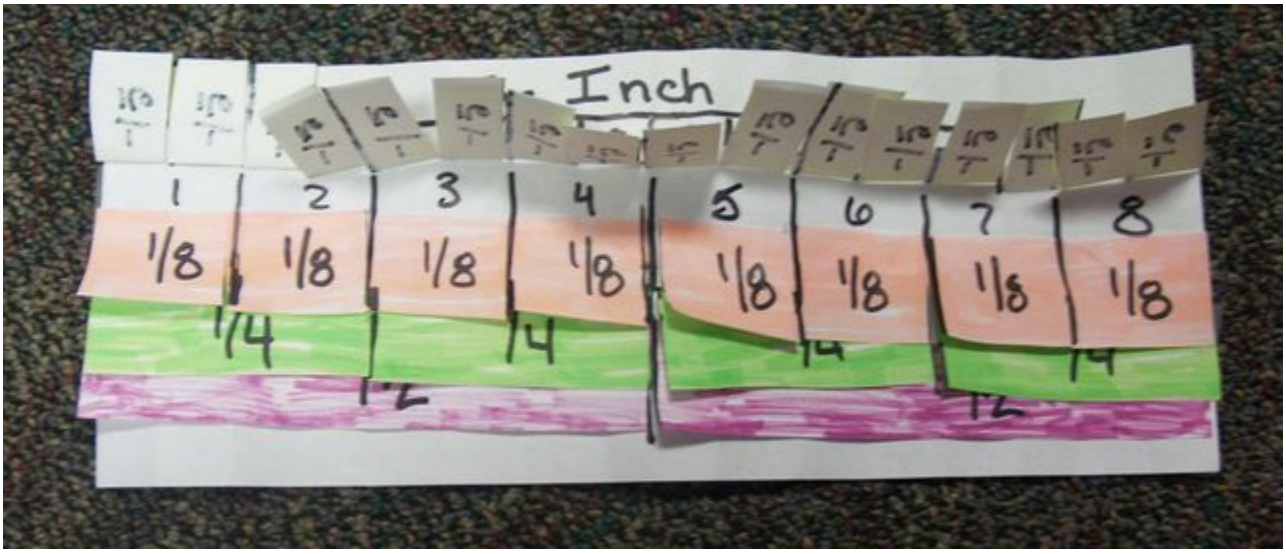
Step 12 = Now label the parts/sections/fractions accordingly

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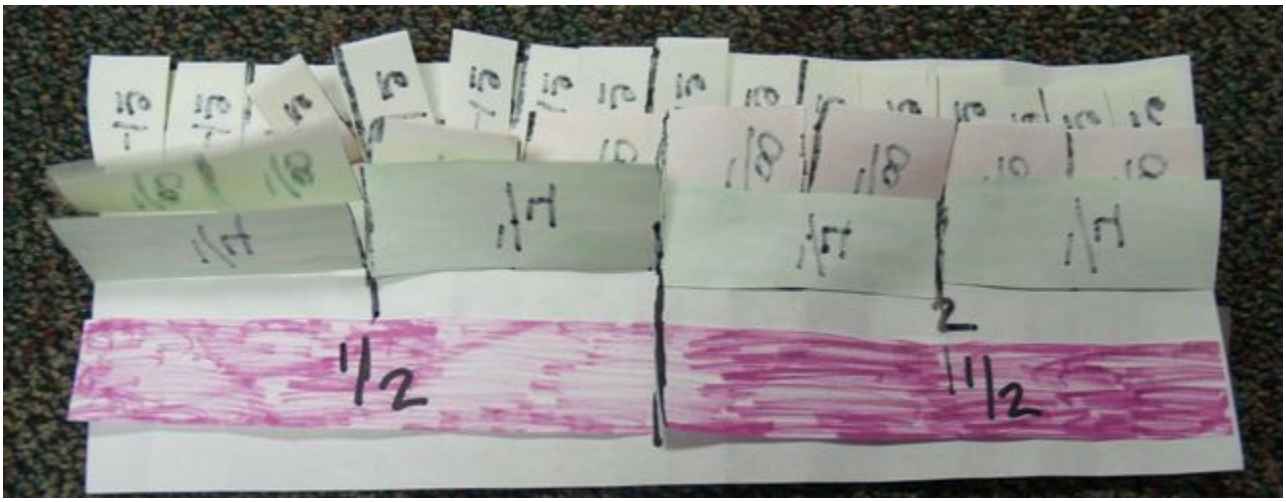


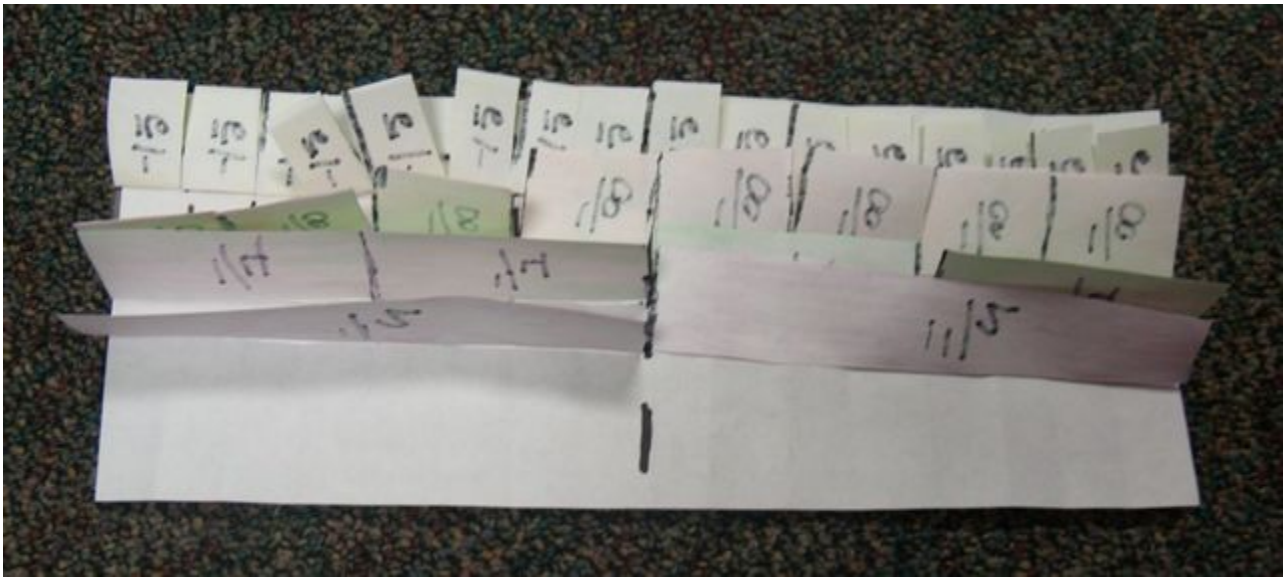


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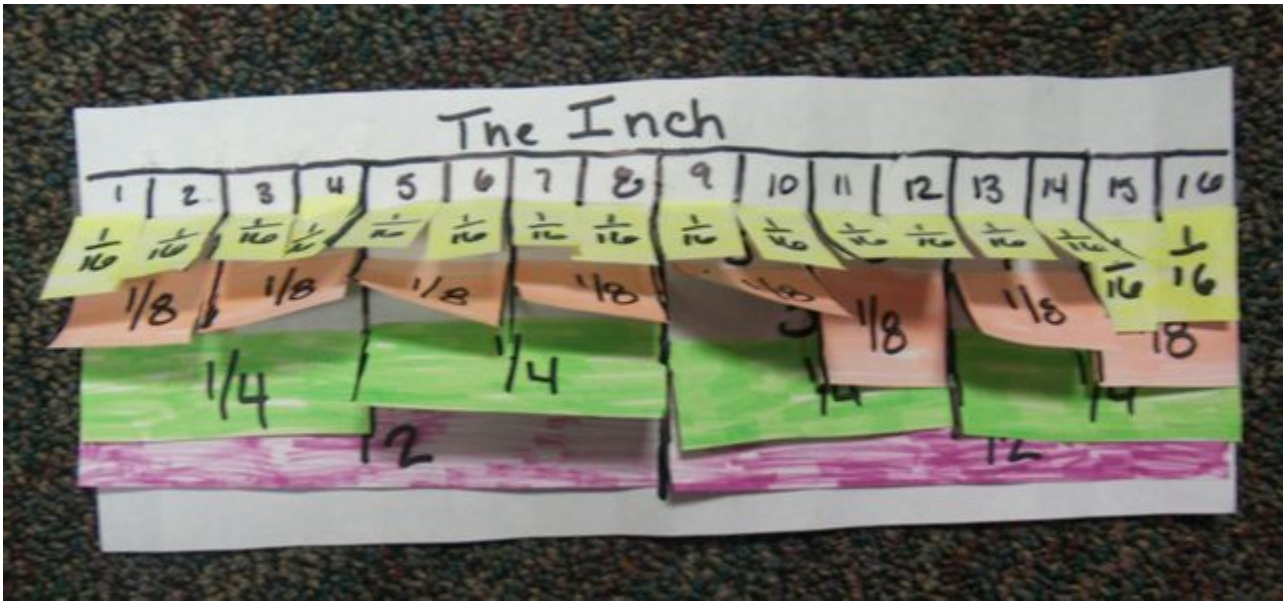


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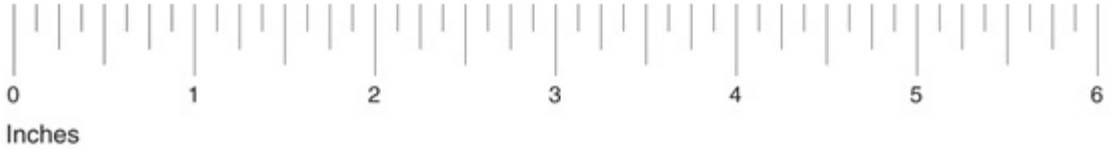
# Reading The Ruler Pre-test

## Centimeters

## Inches




## Word Bank

| Word Bank: each word will be used at least once, maybe twice. | |
|---|---|
| 3/8” | 5/8” |
| 1” | 1 7/8” |
| 2” | 2 1/16” |
| 2 1/8 | 2 ½” |
| 3 ¼ ” | 3 ½ ” |
| 3 3/4” | 4 1/2” |
| 4 7/8” | 5 1/4” |
| 3 5/8” | 3 15/16” |

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NAME:_____ DATE:_____
TEACHER:_____ CLASS:_____

# READING THE RULER PRE-TEST:

**INSTRUCTIONS:** Each question is worth 2 points. Take your time and do your BEST.
If you score 80% or better you will not have to practice and re-take this test.

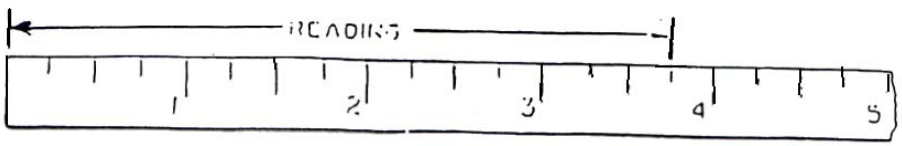
**USING THE PRE-TEST RULER PROVIDED, WHAT IS THE LENGTH OF THE LINE GIVEN IN INCHES?**

1. _____ 1. _____"

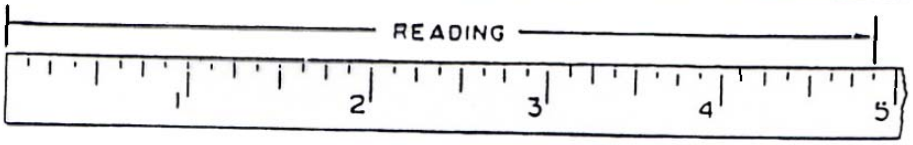
2. _____ 2. _____"

3. _____ 3. _____"

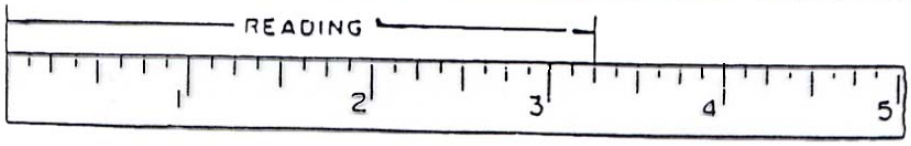
**DO NOT use a real ruler! Give the length between the letter(s) using the rulers below.**

4. 

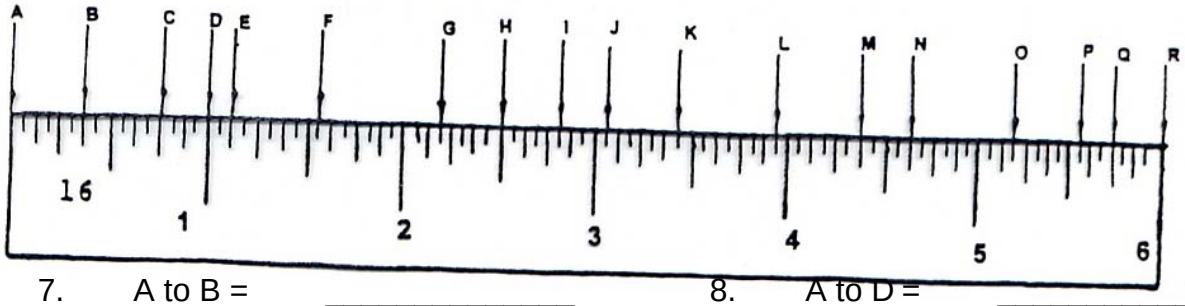
4. _____

5. 

5. _____

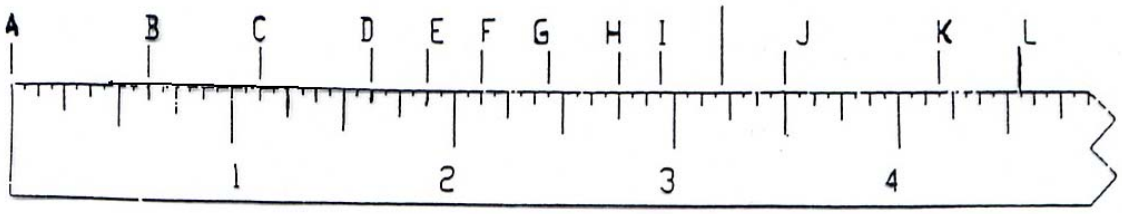
6. 

6. _____




7. A to B = _____ 8. A to D = _____

9. J to O = _____ 10. L to R = _____




11. A to B = _____ 12. A to E = _____ 13. A to J = _____

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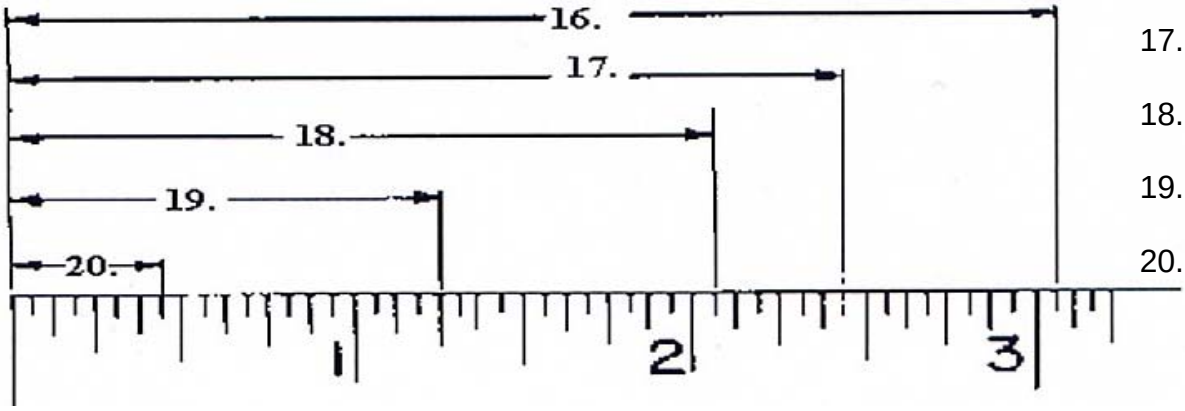
**Use the following measurement word bank to answer questions on this page, they maybe used once or NOT at all.**

| | | | | |
|---|---|---|---|---|
| 7/32” | 7/16” | 7/8” | 1 ¼” | 2 1/16” |
| 2 7/16” | 3 1/16” | 6 13/16” | 1’-0” | 12” |
| ‘ | “ | | | |
| 0.5cm | 0.65cm | 2.4cm | 2.45cm | 2.8cm |
| 3.9cm | 5.25cm | 5.5cm | 6.6cm | 8.7cm |
| 8.9cm | 10.7cm | 12cm | 12.2cm | 13.2cm |

**What is the symbol for the following?**

14. Foot = _____ 15. Inch = _____




16. _____
17. _____
18. _____
19. _____
20. _____

USING THE PRE-TEST RULER PROVIDED, WHAT IS THE LENGTH OF THE LINE GIVEN IN CENTIMETERS (CM)?

21. _____ 21. _____cm

22. _____ 22. _____cm

23. _____ 23. _____cm

24. _____ 24. _____cm

25. _____cm

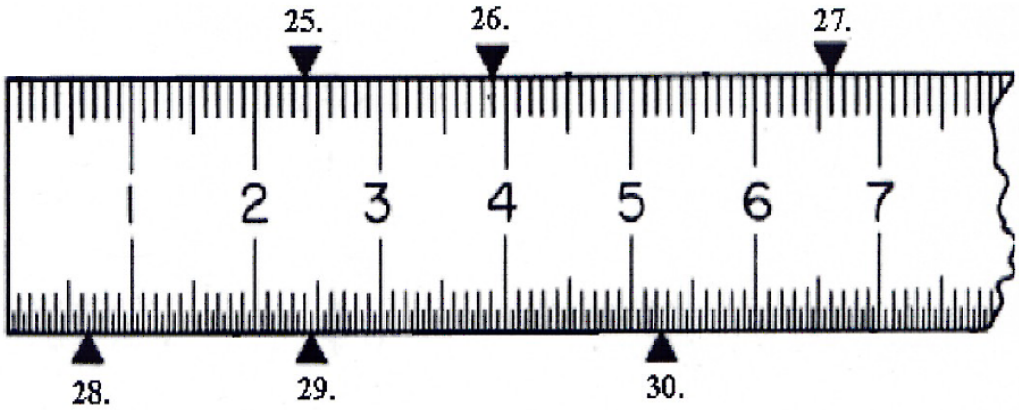
26. _____cm

27. _____cm

28. _____cm

29. _____cm

30. _____cm

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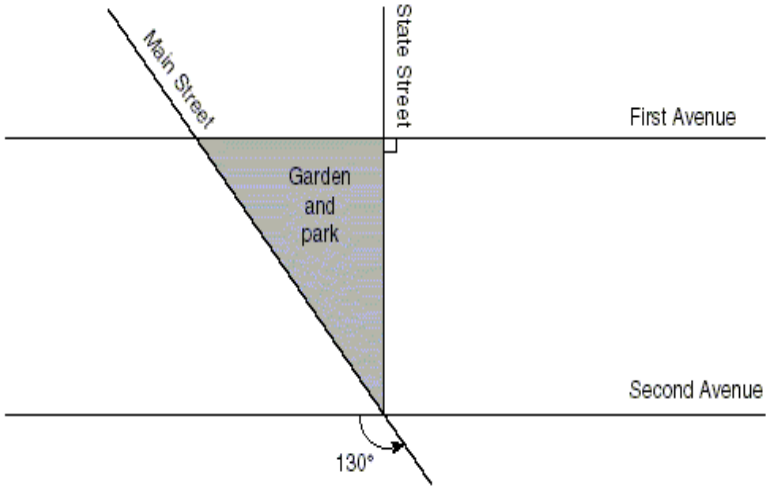
**You may use a calculator on this part. (Worth 8 points each)**

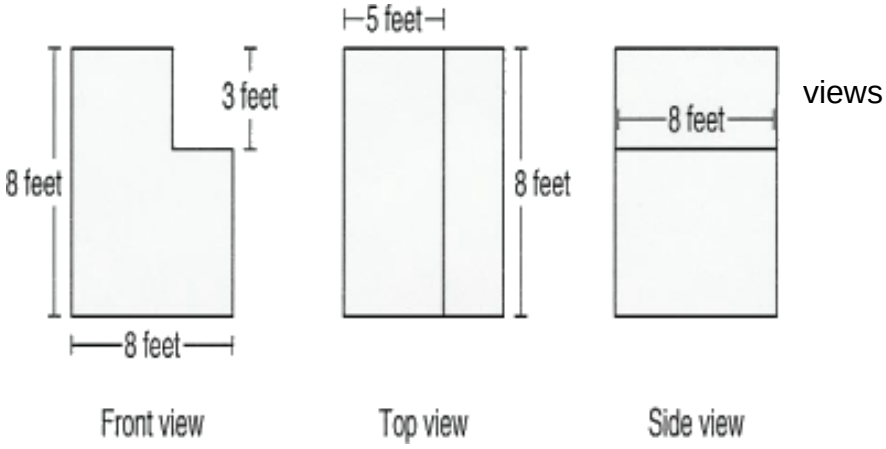
31. On the map below, First Avenue and Second Avenue are parallel. A city planner proposes to locate a small garden and park on the triangular island formed by the intersections of the four streets shown.




What are the three angles of the garden?

a. $90^0$, $65^0$, $25^0$
b. $90^0$, $50^0$, $40^0$
c. $90^0$, $60^0$, $30^0$
d. $130^0$, $40^0$, $10^0$

32. What is the volume of the 3-dimensional object with the dimensions shown in the 3 views to the right?




a. 120
b. 440
c. 512
d. 960

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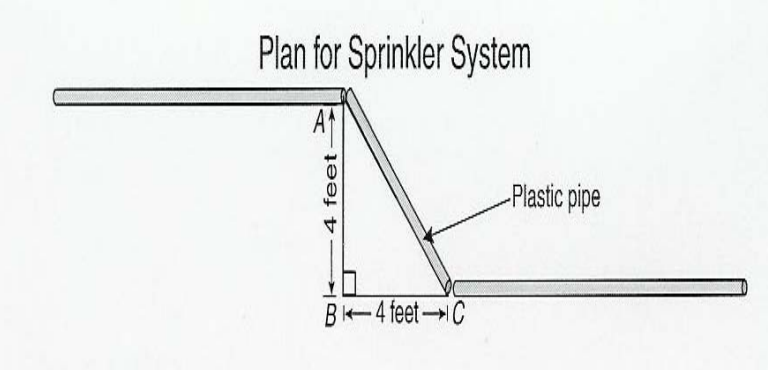
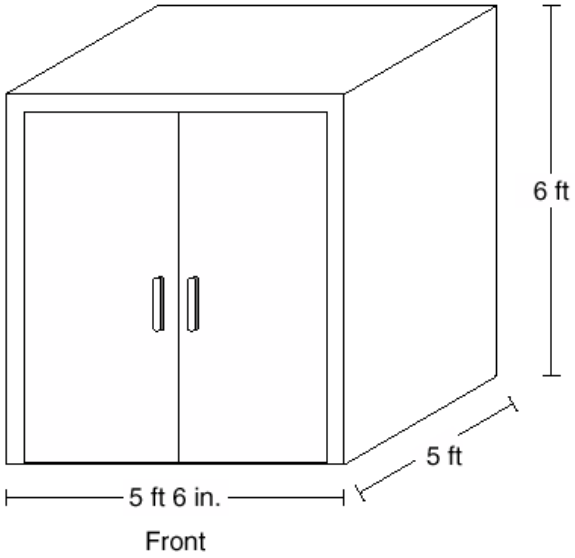
33. The drawing to the right shows part of the plan for a new underground lawn-sprinkler system.




Which is closest to the length of the section of plastic pipe from point A to point C?

a. 4.7 ft
b. 5.7 ft
c. 6.7 ft
d. 7.7 ft

34. Henry built a wooden storage shed in the shape of a rectangular prism for his tools. The figure below shows the dimensions of the storage shed.




If Henry plans to paint only the top, front, left and right sides of his shed, which is closest to the surface area that will be painted?

a. 121 $ft^2$
b. 181 $ft^2$
c. 154 $ft^2$
d. 91 $ft^2$

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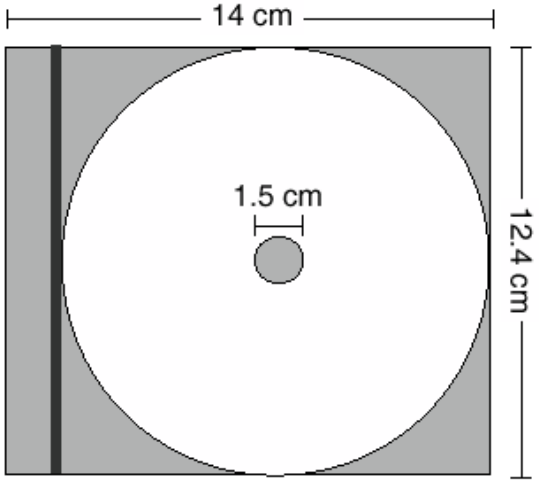
35. The figure below shows a CD in its rectangular storage case.




Which is closest to the area of the storage case NOT occupied by the CD?

a. 55 $cm^2$
b. 46 $cm^2$
c. 51 $cm^2$
d. 60 $cm^2$

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Name: _____Date: _____

Teacher: _____Class:_____

## Ruler Test – 10 Questions

**Multiple Choice**

*Identify the letter of the choice that best completes the statement or answers the question.*

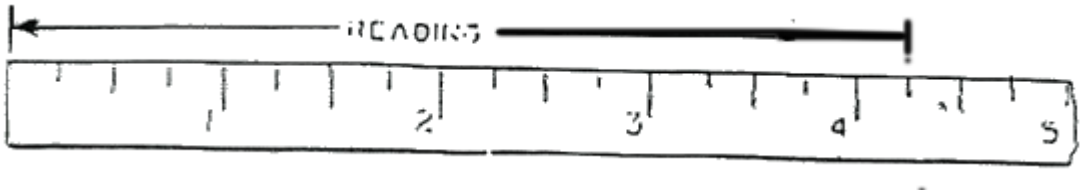
____ 1. The SYMBOL for Foot is:

a. In
b. “
c. Ft
d. ‘

____ 2. The SYMBOL for Inch is:

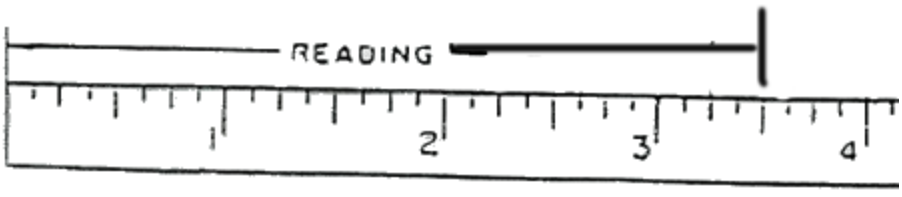
a. In
b. ‘
c. “
d. Ft

____ 3. What is this measurement?




a. 3 1/2”
b. 4 1/2”
c. 4 1/4 “
d. 2 1/2”

____ 4. What is this measurement?




a. 2 4/8”
b. 4 1/2”
c. 3 1/2”
d. 3 4/8”

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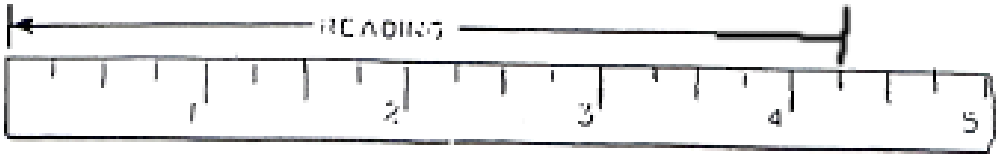
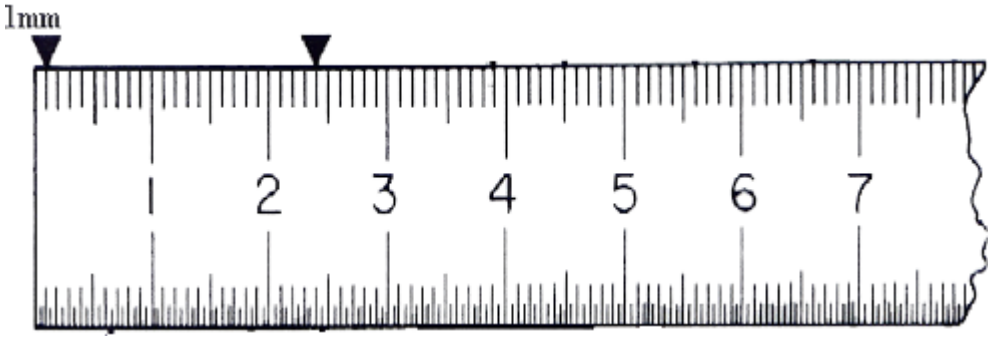
____ 5. What is this measurement?



a. 4 1/2”
b. 4 7/8”
c. 5”
d. 4 1/4”

____ 6. What is this measurement in mm?




a. 2.4cm
b. 24mm
c. 2.3mm
d. 3.3mm

____ 7. What is this measurement?

a. 1/2”
b. 1”
c. 7/16”
d. 7/8”

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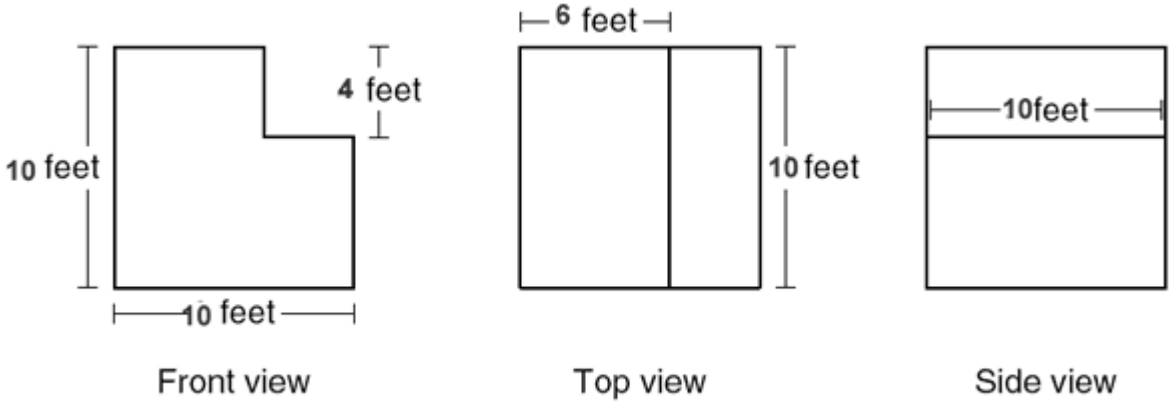
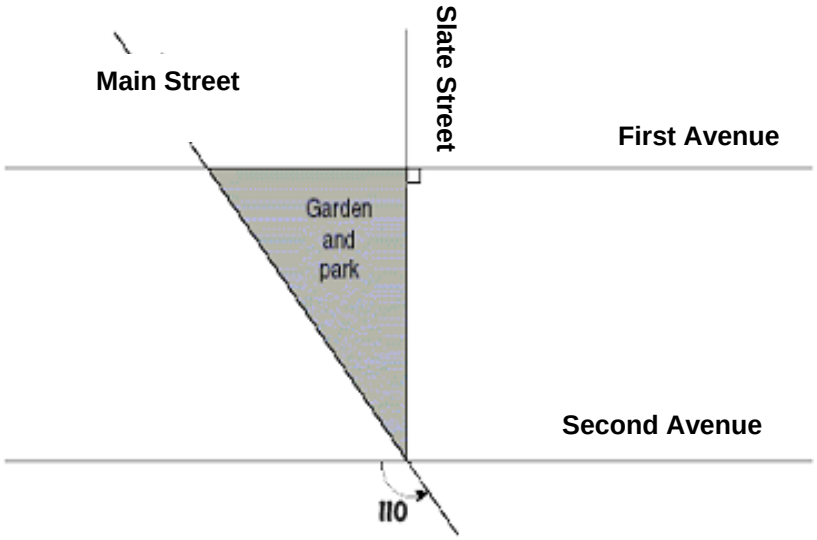
____ 8. What is the volume of a 3-dimensional object with the dimensions shown in the 3 views below?




a. 840 cu ft
b. 1000 cu ft
c. 512 cu ft
d. 440 cu ft

____ 9. On the map below, First Avenue and Second Avenue are parallel. A city planner proposes to locate a small garden and park on the triangular island formed by the intersections of the four streets shown.




What are the three angles of the garden?

a. $90^0$, $50^0$, $40^0$
b. $70^0$, $70^0$, $40^0$
c. $90^0$, $70^0$, $20^0$
d. $90^0$, $30^0$, $30^0$

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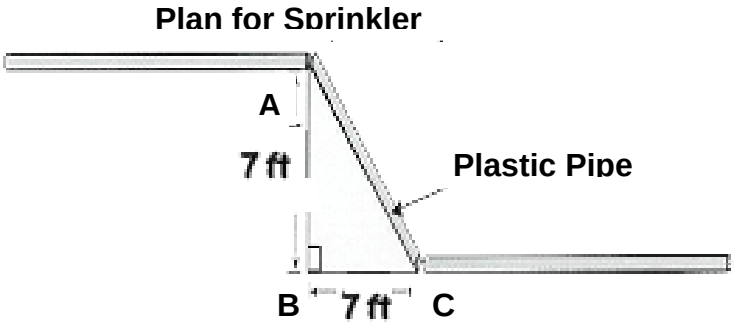
____ 10. The drawing shows part of the plan for a new underground lawn-sprinkler system.




Which is closest to the length of the section of plastic pipe from point A to point C?

a. 7.9 ft
b. 6.9 ft
c. 9.9 ft
d. 5.7 ft

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**Ruler Test**
**Answer Section**

## MULTIPLE CHOICE

| | | | | |
|---|---|---|---|---|
| 1. | ANS: | d. | PTS: | 1 |
| 2. | ANS: | c. | PTS: | 1 |
| 3. | ANS: | c. | PTS: | 1 |
| 4. | ANS: | c. | PTS: | 1 |
| 5. | ANS: | d. | PTS: | 1 |
| 6. | ANS: | b. | PTS: | 1 |
| 7. | ANS: | c. | PTS: | 1 |
| 8. | ANS: | a. | PTS: | 1 |
| 9. | ANS: | c. | PTS: | 1 |
| 10. | ANS: | c. | PTS: | 1 |

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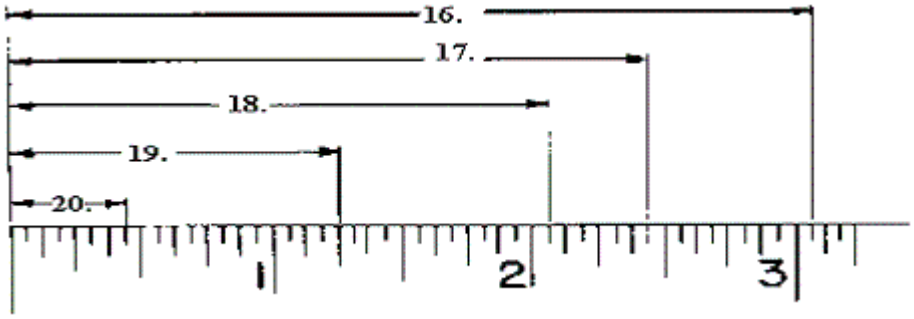
Name: _____Date: _____

Teacher: _____Class:_____

## Ruler Test – 20 Questions

**Matching**

*Identify the letter (a. thru m.) that has the correct measurement for questions in 1-5 below.*




1. #16. above = _____
2. #17. above = _____
3. #18. above = _____
4. #19. above = _____
5. #20. above = _____

a. 8 13/32
b. 1 ¼
c. 6 13/16
d. 3 1/16
e. 7/32
f. 6 9/32
g. 6 11/32
h. 2 1/16
i. 2 7/16
j. 7 21/32
k. 7 23/32
l. 6 26/32
m. 7/16

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**Multiple Choice**
*Identify the letter of the choice that best completes the statement or answers the question.*

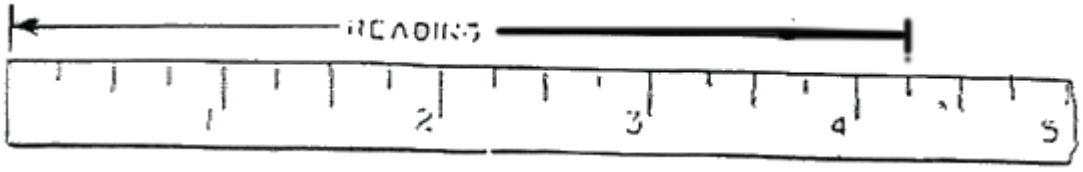
____ 6. The SYMBOL for Foot is:

a. In
b. “
c. Ft
d. ‘

____ 7. The SYMBOL for Inch is:

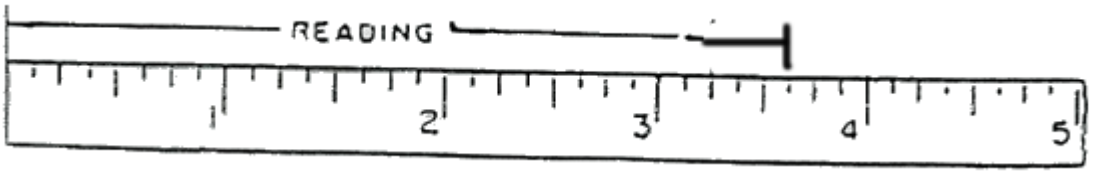
a. In
b. ‘
c. “
d. Ft

____ 8. What is this measurement?




a. 3 1/2”
b. 4 1/2”
c. 4 1/4 “
d. 2 1/2”

____ 9. What is this measurement?




a. 3 5/8”
b. 2 3/8”
c. 3 4/8”
d. 2 7/8”

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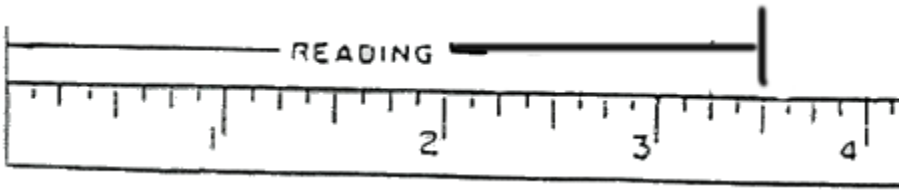
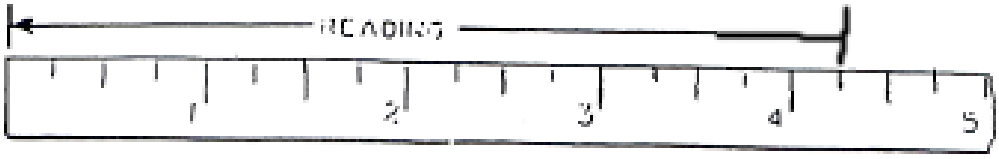
____ 10. What is this measurement?



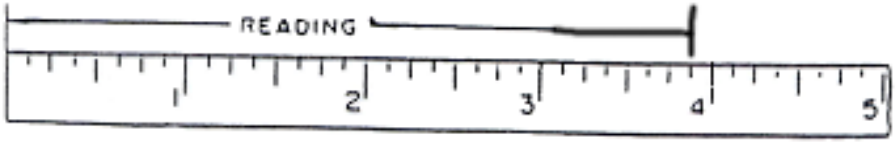

a. 2 4/8”
b. 4 1/2”
c. 3 1/2”
d. 3 4/8”

____ 11. What is this measurement?



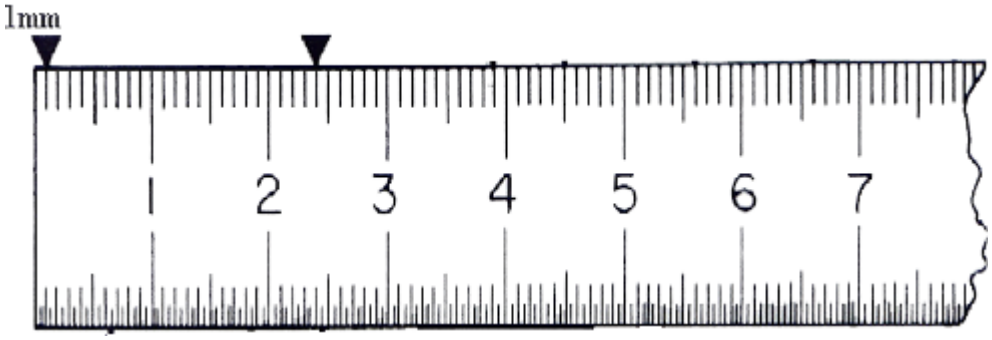

a. 4 1/2”
b. 4 7/8”
c. 5”
d. 4 1/4”

____ 12. What is this measurement?




a. 3 7/8”
b. 3 1/4”
c. 3 1/2”
d. 4 7/8”

____ 13. What is this measurement in mm?




a. 2.4cm
b. 24mm
c. 2.3mm
d. 3.3mm

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____ 14. What is this measurement?

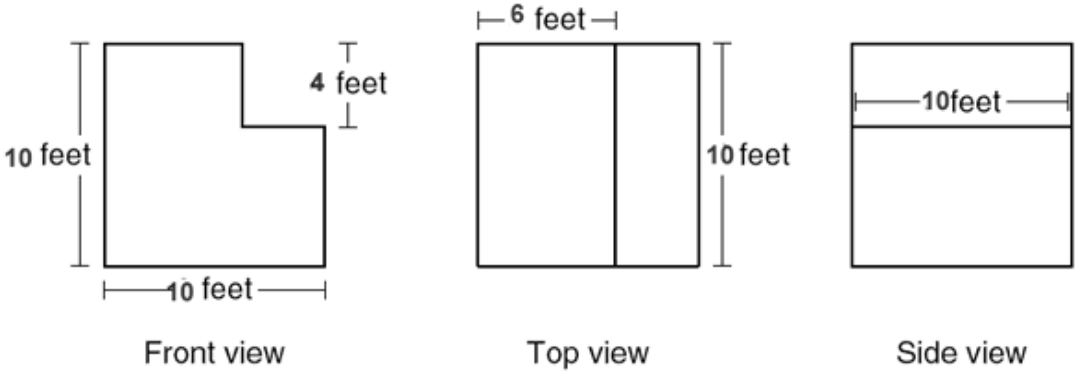
a. 1/2”
b. 1”
c. 7/16”
d. 7/8”

____ 15. What is this measurement in mm?

a. 5.6
b. 60.5
c. 24.5
d. 6.5

____ 16. What is the volume of a 3-dimensional object with the dimensions shown in the 3 views below?

a. 840 cu ft
b. 1000 cu ft
c. 512 cu ft
d. 440 cu ft

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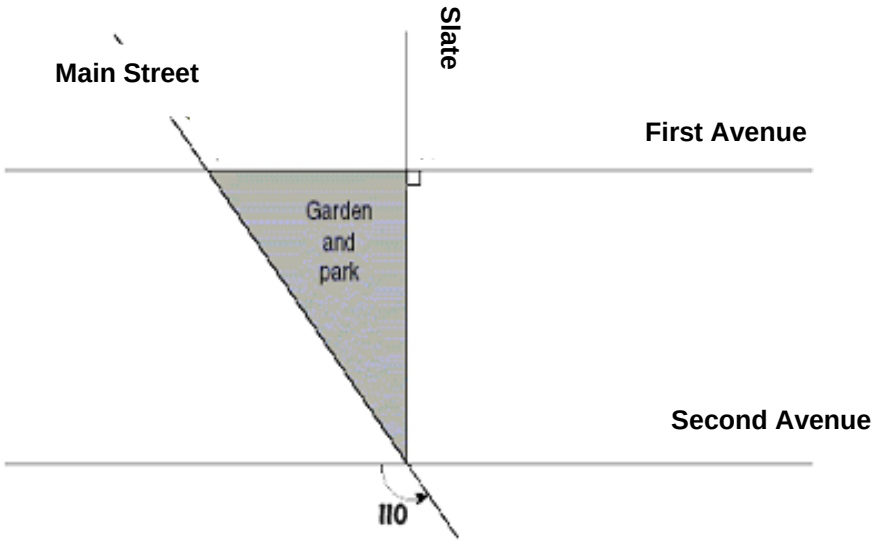
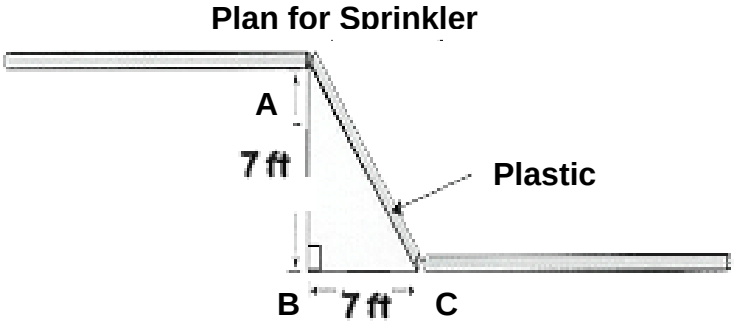
____ 17. On the map below, First Avenue and Second Avenue are parallel. A city planner proposes to locate a small garden and park on the triangular island formed by the intersections of the four streets shown.




What are the three angles of the garden?

a. $90^0$, $50^0$, $40^0$
b. $70^0$, $70^0$, $40^0$
c. $90^0$, $70^0$, $20^0$
d. $90^0$, $30^0$, $30^0$

____ 18. The drawing shows part of the plan for a new underground lawn-sprinkler system.




Which is closest to the length of the section of plastic pipe from point A to point C?

a. 7.9 ft
b. 6.9 ft
c. 9.9 ft
d. 5.7 ft

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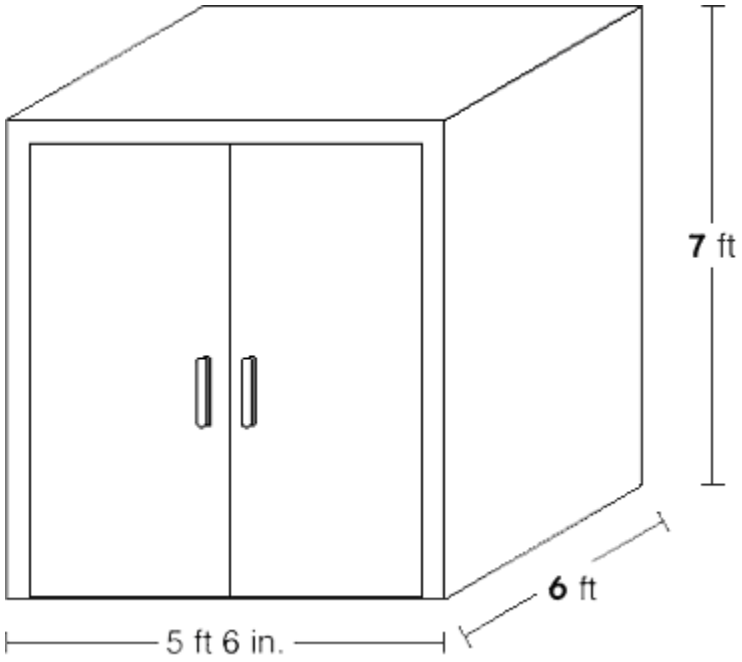
____ 19. Henry built a wooden storage shed in the shape of a rectangular prism for his tools. The figure below shows the dimensions of the storage shed.




(19. Continued next page)

If Henry plans to paint only the top, front, left and right sides of his shed, which is closest to the surface area that will be painted?

a. 181 $ft^2$
b. 156 $ft^2$
c. 121 $ft^2$
d. 154 $ft^2$

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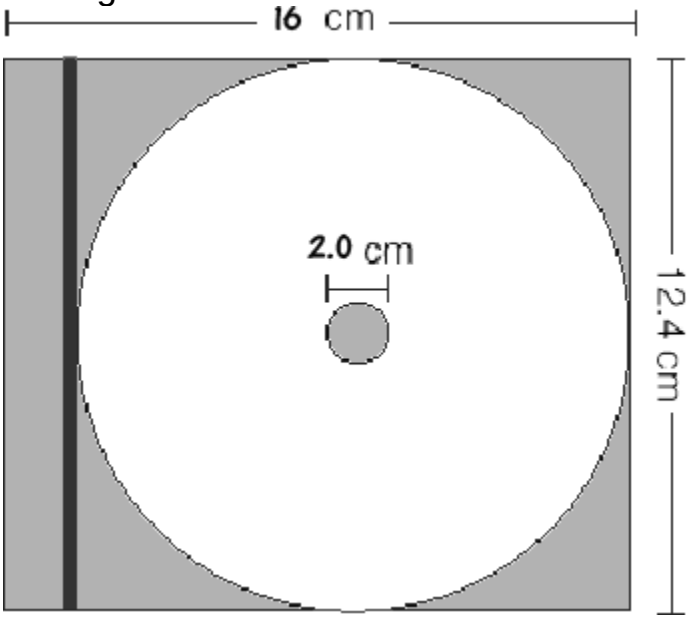
____ 20. The figure below shows a CD in its rectangular storage case.




Which is closest to the area of the storage case NOT occupied by the CD?

a. 55 $cm^2$
b. 81 $cm^2$
c. 51 $cm^2$
d. 77 $cm^2$

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**Ruler Test**
**Answer Section**

## MATCHING

| | | | |
|---|---|---|---|
| 1. | ANS: | d. | PTS: 1 |
| 2. | ANS: | i. | PTS: 1 |
| 3. | ANS: | h. | PTS: 1 |
| 4. | ANS: | b. | PTS: 1 |
| 5. | ANS: | m. | PTS: 1 |

## MULTIPLE CHOICE

| | | | |
|---|---|---|---|
| 6. | ANS: | d. | PTS: 1 |
| 7. | ANS: | c. | PTS: 1 |
| 8. | ANS: | c. | PTS: 1 |
| 9. | ANS: | a. | PTS: 1 |
| 10. | ANS: | c. | PTS: 1 |
| 11. | ANS: | d. | PTS: 1 |
| 12. | ANS: | a. | PTS: 1 |
| 13. | ANS: | b. | PTS: 1 |
| 14. | ANS: | c. | PTS: 1 |
| 15. | ANS: | d. | PTS: 1 |
| 16. | ANS: | a. | PTS: 1 |
| 17. | ANS: | c. | PTS: 1 |
| 18. | ANS: | c. | PTS: 1 |
| 19. | ANS: | b. | PTS: 1 |
| 20. | ANS: | a. | PTS: 1 |

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