Title: Inching Along

Brief Overview:

This three-day lesson will help students measure to the nearest half, fourth, or eighth of an inch. Students will be introduced to, but not assessed on sixteenths. Students will learn to select the simplest form of the fraction in order to correctly identify fractional lengths.

NCTM Content Standard/National Science Education Standard:

Measurement: Length (customary)

Grade/Level:

Grade 4

Duration/Length:

Three days (60 minutes per day)
Additional 15 minutes for summative assessment

Student Outcomes:

Students will:

- Understand that an inch can be divided into smaller parts (fractions).
- Identify reasons why measuring to fractions of an inch is necessary.
- Identify the multiples of 2, 4, 8, and 16 on a grid numbered to 20.
- Identify the simplest form of a fraction up to sixteenths.
- Measure objects and pictures to the nearest half, fourth, or eight of an inch.

Materials and Resources:

Lesson 1

- One customary ruler for each student
- Student Resource Sheet # 1, one copy for each student
- Student Resource Sheet # 2, one copy for each student
- Inchworm and a Half by Elinor J. Pinczes
- One sheet of plain white 8 ½ x 11" paper for each student.
- Markers, crayons or colored pencils (yellow, red, blue, green) for each student.

Lesson 2

- Markers, crayons or colored pencils (four different colors) for each student.

- Student Resource Sheet # 3, one copy for each student
- Student Resource Sheet # 4, one copy for each student
- Student Resource Sheet # 5, one copy for each student

Lesson 3

- Transparency of Venn Diagram (Teacher Resource Sheet # 7)
- One customary ruler (to sixteenths of an inch) for each student.
- Student Resource Sheet # 6, one copy for each student
- Student Resource Sheet # 7, one copy for each student if needed
- Student Resource Sheet #, one copy for each student if needed

Summative Assessment

- Student Resource Sheet # 9, one copy for each student

Lesson 1: The Magic Inch

Development/Procedures:

Preassessment:

Hand each pair of students a copy of *A Prickly Problem* (Student Resource Sheet # 1). Answers can be found on Teacher Resource Sheet # 1. Direct students to measure the two pictures of the plant (using the inch side of the ruler) in order to measure the growth of the plant. Students should have difficulty measuring the difference, as it is less than an inch.

Launch:

Ask students what they noticed. Sample questions:

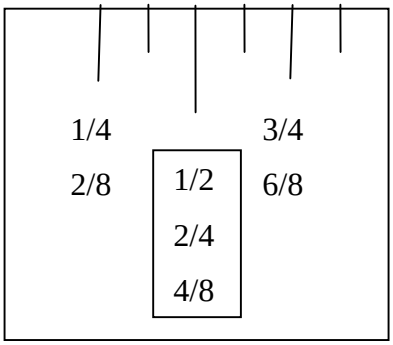
- Did the plant grow from week one to week two? (If students answer 'no' direct them to visually notice that the picture of the plant in week two is slightly taller than in week one.)
- How much did it grow? How can you tell?

Tell students that sometimes it is necessary to measure very carefully. Today we will do that by using something smaller than an inch.
Read Inchworm and a Half aloud. Ask students what the problem was (inchworm was too big to measure certain lengths) and how it was solved (fractional worms were able to measure these lengths).

Teacher Facilitation:

Teacher states the objective for the day. (Students will understand that an inch can be divided into smaller parts called fractions and identify the reasons why measuring to fractions of an inch is necessary.)

Distribute a plain sheet of paper to each student. Direct students to hold the paper horizontally and fold the paper in half like a book. Model opening the paper, drawing a yellow line half way down the fold, and labeling it 1/2. Instruct student to again fold the paper back in half and then in half again. Have students open the paper and draw a red line a quarter of the way down each fold (including the previous 1/2 line). Have the students label these lines 1/4, 2/4, and 3/4. Repeat the above procedure to draw and label the eighth lines, making them blue. Repeat again for the sixteenth lines, making them green. (See diagram below.)



Tell students they now have a "magic inch" that can be used to measure objects around the room. Demonstrate using the "magic inch." by measuring lines on the chalkboard. Be sure to emphasize what to do when the line (or object) ends between two lines on the ruler.

Allow students five minutes to explore using their "magic inch."

Student Application:

Assign small groups of students specific measurements. Assign the following measurements: 1/2, 2/4, 3/8, 3/4, and 6/8. Instruct students to walk around the room and find as many objects as they can that match their magic measurement using their 'magic inch'. Each student should create their own list; however they may work with others in their group to get ideas as needed.

Once students have created their lists, give them time to discuss their findings with their group. Ask each group to share what they found.

Guide students in a discussion about why different groups have different lists and why we had to use different assigned measurements. What would have happened if we had all looked for things that were one "magic inch?" (Possible answer cues include: There would be a lot of things we wouldn't be able to measure. We needed to be more specific.)

Instruct students to keep their "magic inches" and their lists of measured objects. They are needed for lesson two.

Embedded Assessment:

Distribute Student Resource Sheet # 2. Give students time to respond. Allow several students to share their ideas. Sample answers can be found on Teacher Resource Sheet # 2.

Reteaching/Extension:

Pull students who need additional instruction into a small group. Have students try to measure using only the full "magic inch." Discuss why this doesn't always work and have students suggest measurements that would work better for certain objects.

Lesson 2: Choosing the Best Name

Have students use their "magic inch" to find objects of different lengths (other than their previously assigned measurement.)

Preassessment:

Ask a student from yesterday's 1/2 group to start reading their list of measured objects. Instruct the students from the other groups to raise their hand if they hear something on their list. The teacher should record any matches on the board including the two measurements.
Sample:

Notebook 1/2, 2/4

Launch:

Ask the students why objects could be two different measurements. Take suggestions from students for discussion. Use an example from the preassessment to show visually that the two measurements are really the same measurement with different names.

Teacher Facilitation/ Student Application:

Teacher states the objective for the day. (Students will identify the multiples of 2, 4, 8, and 16 on a grid numbered to 20 and identify the simplest form of a fraction up to sixteenths.)

Distribute the *20's Chart* (Student Resource Sheet # 3) to each student. Students should take out their four colored writing utensils.

Review the definition of multiples.

Students should select a color and skip count by 2's, placing a colored dot in each box that is a multiple of two. Repeat the above procedure for multiples of 4,8, and 16 using a different color for each.

Ask students to look at their "magic inch" from yesterday. Tell students that if they have a multiple of the numerator in the denominator then it's not the best name or the simplest for the fraction. There is one exception to this rule: multiples of one does not count because every number is a multiple of one. Guide students through several examples.

Example:

Look at 2/4. Notice that 4 is a multiple of 2. We can call it another name, a simpler name. What is a better name? (1/2)

Distribute *A Better Name* (Student Resource Sheet # 4) to each student. Have students complete the sheet independently. Afterwards, go over the answers orally. Answers can be found on Teacher Resource Sheet # 3.

Embedded Assessment:

Students complete the BCR (Student Resource Sheet # 5.) Sample answers can be found on Teacher Resource Sheet # 4. Rubrics for scoring can be found on Teacher Resource Sheet #s 5 and 6.

Reteaching/Extension:

For students needing additional instruction, guide them to understand fractions by using fraction strips. Have students create equivalent fractions such as 1/2, 2/4, 4/8. Have students compare equivalent fractions and choose the one with the smallest number of pieces. This will then be the simplest form.

Lesson 3: Using "Real" Rulers

As an extension, give students several other examples of fractions and have them find other equivalent fractions using their 20's chart.

Preasssment:

Ask the students to think about everything they know about measuring in inches. After students have had a minute to think, ask them to share their ideas with someone else. After they have had time to talk, ask them to share their best ideas with the group. Teacher can chart the responses.

Launch:

Give each student a ruler. Have them compare and contrast their real rulers to their "magic inches."

Teacher Facilitation:

Teacher states the objective for the day. (Students will measure objects and pictures to the nearest half, fourth, or eight of an inch.)

Display the Venn Diagram transparency (Teacher Resource Sheet # 7.) Have students share their ideas from the launch. Record their ideas in the appropriate sections of the diagram.

Guide students in finding specific fractions, first on the "magic inch" then on the actual ruler. Have them point to each identified fraction on both mediums.

Student Application:

Assign specific classroom items for the students to measure. Examples: math textbook, pencil, notebook, etc. Monitor to make sure that students are measuring accurately.

Give students 5 minutes to explore. Allow them to walk around the room and measure items of their choice. They should make a list of the items and the measurements.

Embedded Assessment:

Students complete *Use Your Ruler!* (Student Worksheet 6.) Answers can be found on Teacher Resource Sheet # 8.

Reteaching/Extension:

For students needing additional instruction, distribute 1/4 inch graph paper. Have them trace an object onto the paper. Color enough squares to the end of the object, changing colors every four squares (1 inch.) Help the students see the 1/4 and 1/2 marks.

As an extension, give each child *Mystery Picture* (Student Resource Sheet # 8.) Answers can be found on Teacher Resource Sheet # 9.

Additional Resource:

www.funbrain.com Measure It!

Summative Assessment:

Students will complete an assessment activity sheet including selected responses (SR's) and a brief constructed response (BCR) (Student Resource Sheet #s 9.) Answers can be found on Teacher Resource Sheet #s 10. See also the BCR rubrics on Teacher Resource Sheet #s 4 and 5.

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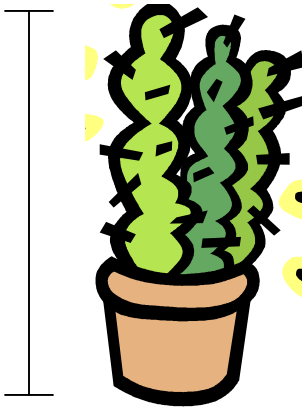
Name_____Date_____

A Prickly Problem

Ms. Johnson bought a new cactus for her class. The class decided to measure the growth of the cactus over time by measuring it each week. Each Monday, Ms. Johnson took a picture of the cactus. By the second week, the class realized they had a problem.

Below you will see the picture from the first two weeks the class had the plant. Measure the two pictures to find the growth of the cactus. Use the inch side of your ruler. Record your measurements on the lines below the pictures.

Week 1



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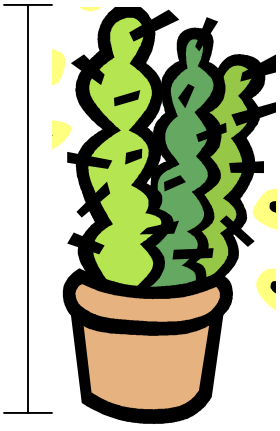
Week 2



_____

What problem do you think Ms. Johnson's students had?

_____

_____

Teacher Resource Sheet #1

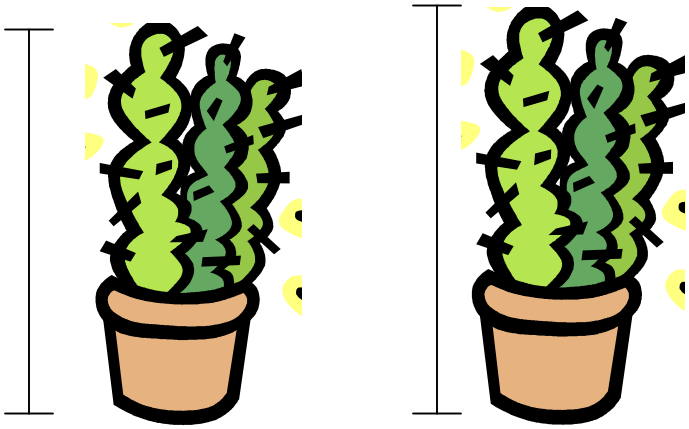
Name_____ Date_____

A Prickly Problem

Ms. Johnson bought a new cactus for her class. The class decided to measure the growth of the cactus over time by measuring it each week. Each Monday, Ms. Johnson took a picture of the cactus. By the second week, the class realized they had a problem.

Below you will see the picture from the first two weeks the class had the plant. Measure the two pictures to find the growth of the cactus. Use the inch side of your ruler. Record your measurements on the lines below the pictures.

Week 1 Week 2



Students should encounter problems measuring. The difference between the two pictures is very small. Accept reasonable responses between 2 and 3 inches.

_____ _____

What problem do you think Ms. Johnson's students had?

Possible answer cues: the difference is too small to measure in inches (without fractional parts)

Name _____ Date _____

Oh No! The Measure It Company has decided to stop making rulers with fractions. Please convince them that this is necessary in order for people to measure items more accurately. Use information from today's lesson to explain to the company why sometimes it is necessary to measure things in units smaller than an inch.

_____

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Name _____ Date _____

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_____

_____

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Name _____ Date _____

Oh No! The Measure It Company has decided to stop making rulers with fractions. Please convince them that this is necessary in order for people to measure items more accurately. Use information from today's lesson to explain to the company why sometimes it is necessary to measure things in units smaller than an inch.

Possible answers include: many items will measure the same length if more specific values are not available; small differences are not measurable if fractions of an inch are not available

Name _____ Date _____

Oh No! The Measure It Company has decided to stop making rulers with fractions. Please convince them that this is necessary in order for people to measure items more accurately. Use information from today's lesson to explain to the company why sometimes it is necessary to measure things in units smaller than an inch.

_____

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_____

Name_____ Date_____

20's Chart

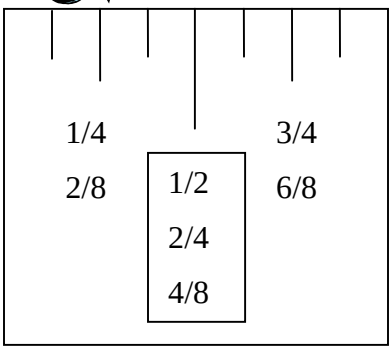
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Name _____ Date_____

A Better Name

Use the "magic" inch below each picture. Circle the best name for each measurement.

1.



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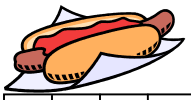

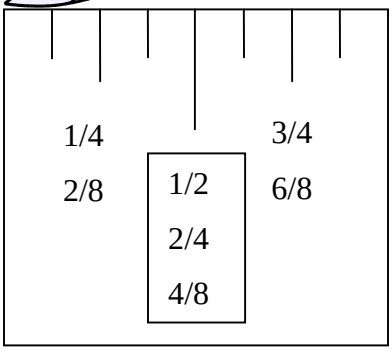

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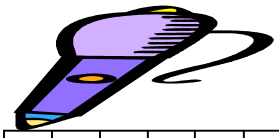

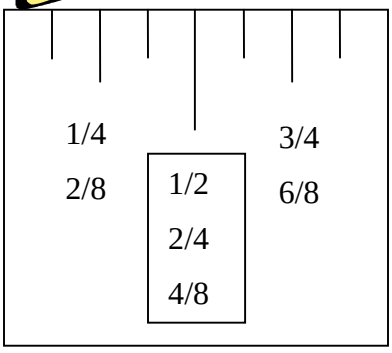

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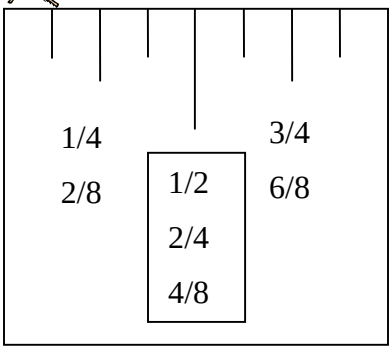
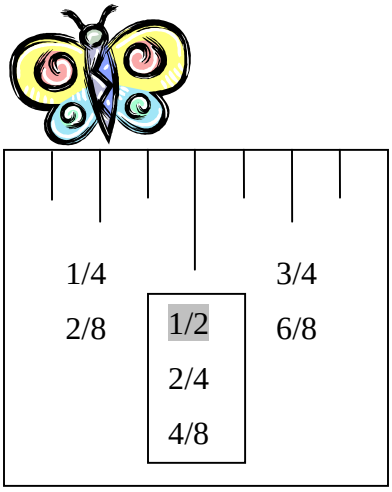


Name _____ Date_____

A Better Name

Use the “magic” inch below each picture. Circle the best name for each measurement.

1.



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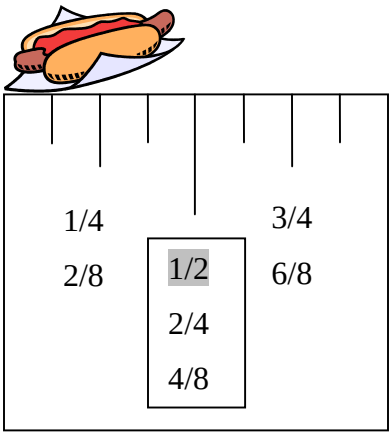

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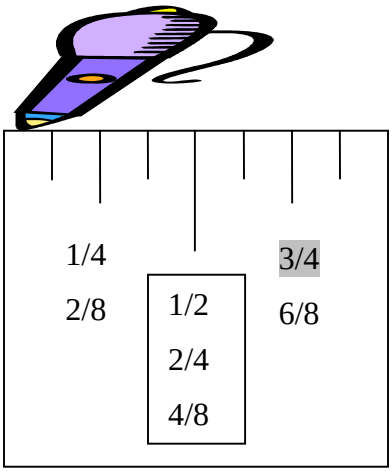

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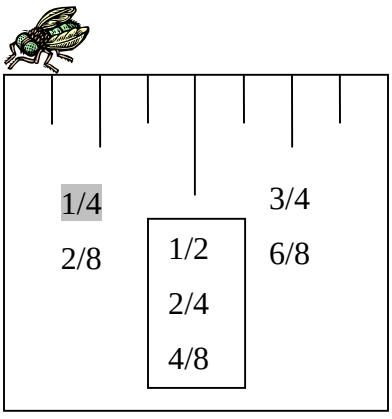


Brief Constructed Response

Xavier and Janice each measured the width of their teacher's thumbnail. Xavier said it was 2/4 of an inch wide. Janice said it was 1/2 of an inch wide. Their teacher said they were both correct, but one answer was better than the other.

Step A
Which answer was better?

_____

Step B
Use what you know about measurement and multiples to explain why your answer is correct. Use words and/or numbers in your explanation.

_____

_____

_____

_____

_____

Brief Constructed Response

Xavier and Janice each measured the width of their teacher's thumbnail. Xavier said it was 2/4 of an inch wide. Janice said it was 1/2 of an inch wide. Their teacher said they were both correct, but one answer was better than the other.

Step A
Which answer was better?

Janice's answer was better. OR 1/2

Step B
Use what you know about measurement and multiples to explain why your answer is correct. Use words and/or numbers in your explanation.

Answers will vary. Answer cues include: in 2/4 there is a multiple of the numerator in the denominator; 1/2 is the simplest form.

Mathematics BCR Rubric

2 The response demonstrates a complete understanding and analysis of a problem.

- Application of a reasonable strategy in the context of the problem is indicated.
- Explanation[1] of and/or justification[2] for the mathematical process(es) used to solve a problem is clear, developed, and logical.
- Connections and/or extensions made within mathematics or outside of mathematics are clear.
- Supportive information and/or numbers are provided as appropriate. [3]

1 The response demonstrates a minimal understanding and analysis of a problem.

- Partial application of a strategy in the context of the problem is indicated.
- Explanation[1] of and/or justification[2] for the mathematical process(es) used to solve a problem is partially developed, logically flawed, or missing.
- Connections and/or extensions made within mathematics or outside of mathematics are partial or overly general, or flawed.
- Supportive information and/or numbers may or may not be provided as appropriate. [3]

0 The response is completely incorrect, irrelevant to the problem, or missing. [4]

Notes:

[1] **Explanation** refers to students' ability to communicate **how** they arrived at the solution for an item using the language of mathematics.

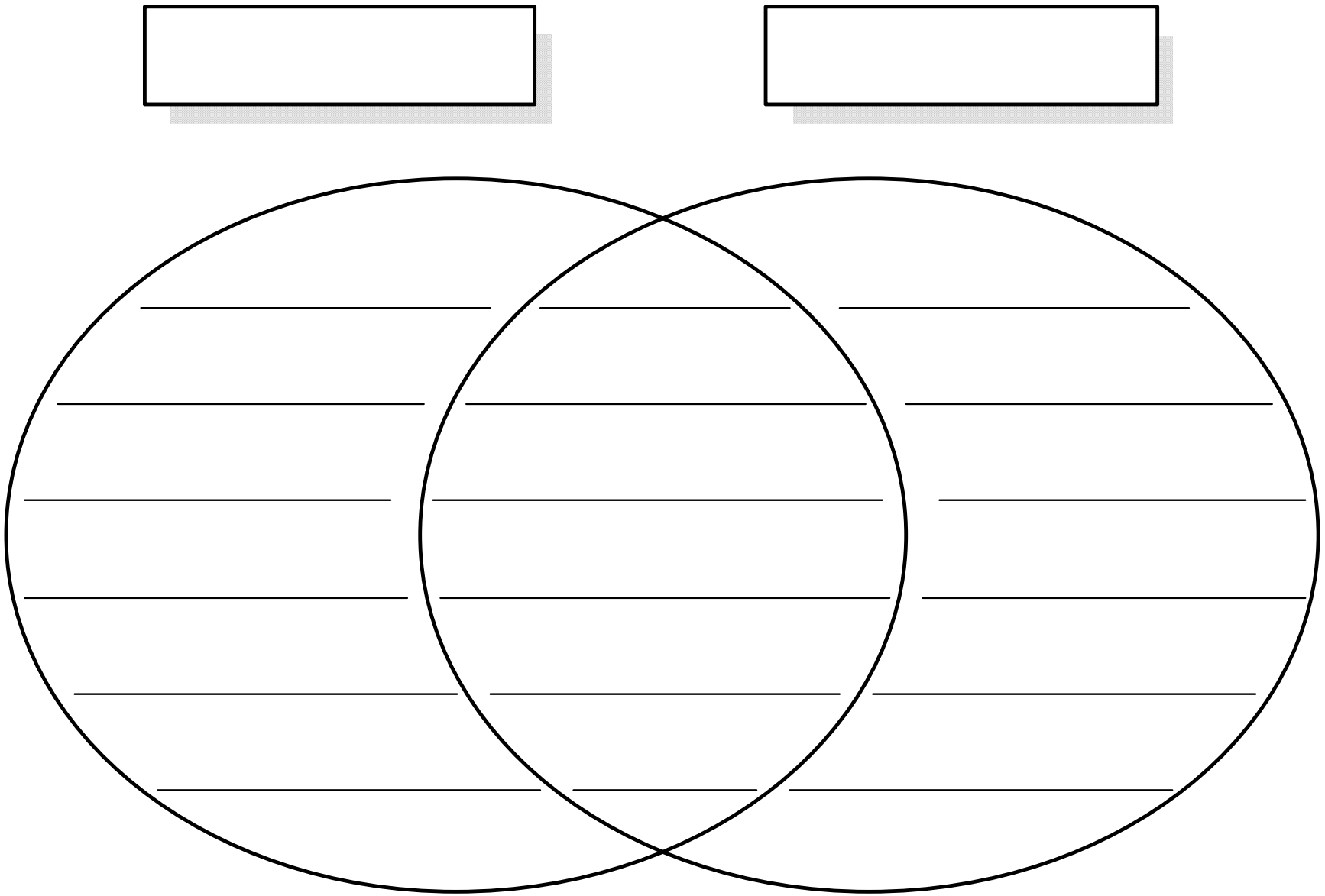
[2] **Justification** refers to students' ability to support the reasoning used to solve a problem, or to demonstrate **why** the solution is correct using mathematical concepts and principles.

[3] Students need to complete rubric criteria for ***explanation, justification, connections*** and/or ***extensions*** as cued for in a given problem.

[4] Merely an exact copy or paraphrase of the problem will receive a score of "0".

MSA Brief Constructed Response "Kid Speak" Mathematics Rubric
Grades 1 through 8

Score	
2	**My answer shows I completely understood the problem and how to solve it:** • **I used a very good, complete strategy to correctly solve the problem.** • **I used my best math vocabulary to clearly explain what I did to solve the problem. My explanation was complete, well-organized and logical.** • **I applied what I know about math to correctly solve the problem.** • **I used numbers, words, symbols or pictures (or a combination of them) to show how I solved the problem.**
1	**My answer shows I understood most of the problem and how to solve it:** • **I used a strategy to find a solution that was partly correct.** • **I used some math vocabulary and most of my reasons were correct to explain how I solved the problem. My explanation needed to be more complete, well-organized or logical.** • **I partly applied what I know about math to solve the problem.** • **I tried to use numbers, words, symbols or pictures (or a combination of them) to show how I got my answer, but these may not have been completely correct.**
0	**My answer shows I didn't understand the problem and how to solve it:** • **I wasn't able to use a good strategy to solve the problem.** • **My strategy wasn't related to what was asked.** • **I didn't apply what I know about math to solve the problem.** • **I left the answer blank.**



Name _____

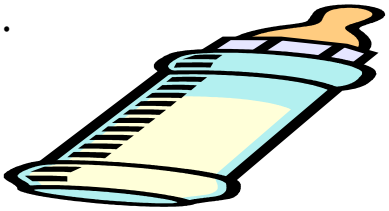
Date_____

Use Your Ruler!

Use your customary ruler to measure the following pictures of objects to the nearest 16^{th} of an inch. Give the most accurate measurement you can.

1.

2.



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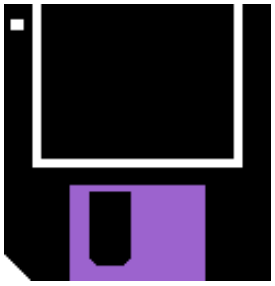

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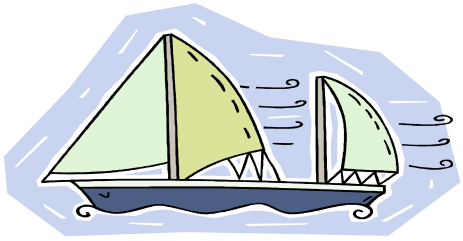

5.

6.

Name _____ Date_____

Use Your Ruler!

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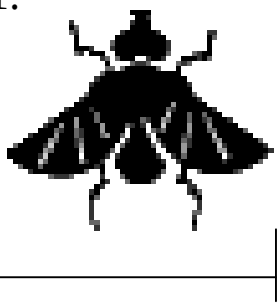
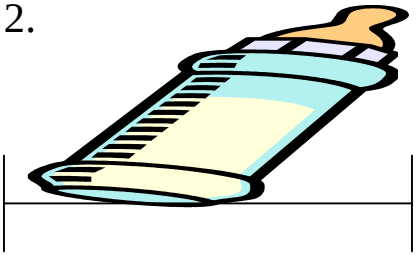
1.



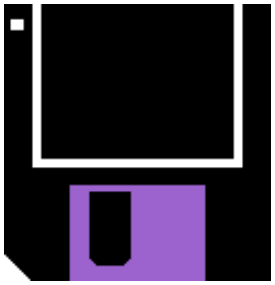
1 1/2 inches

2.



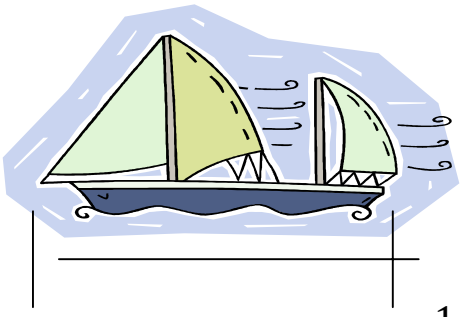
2 1/8 inches

3.



1 3/8 inches

4.



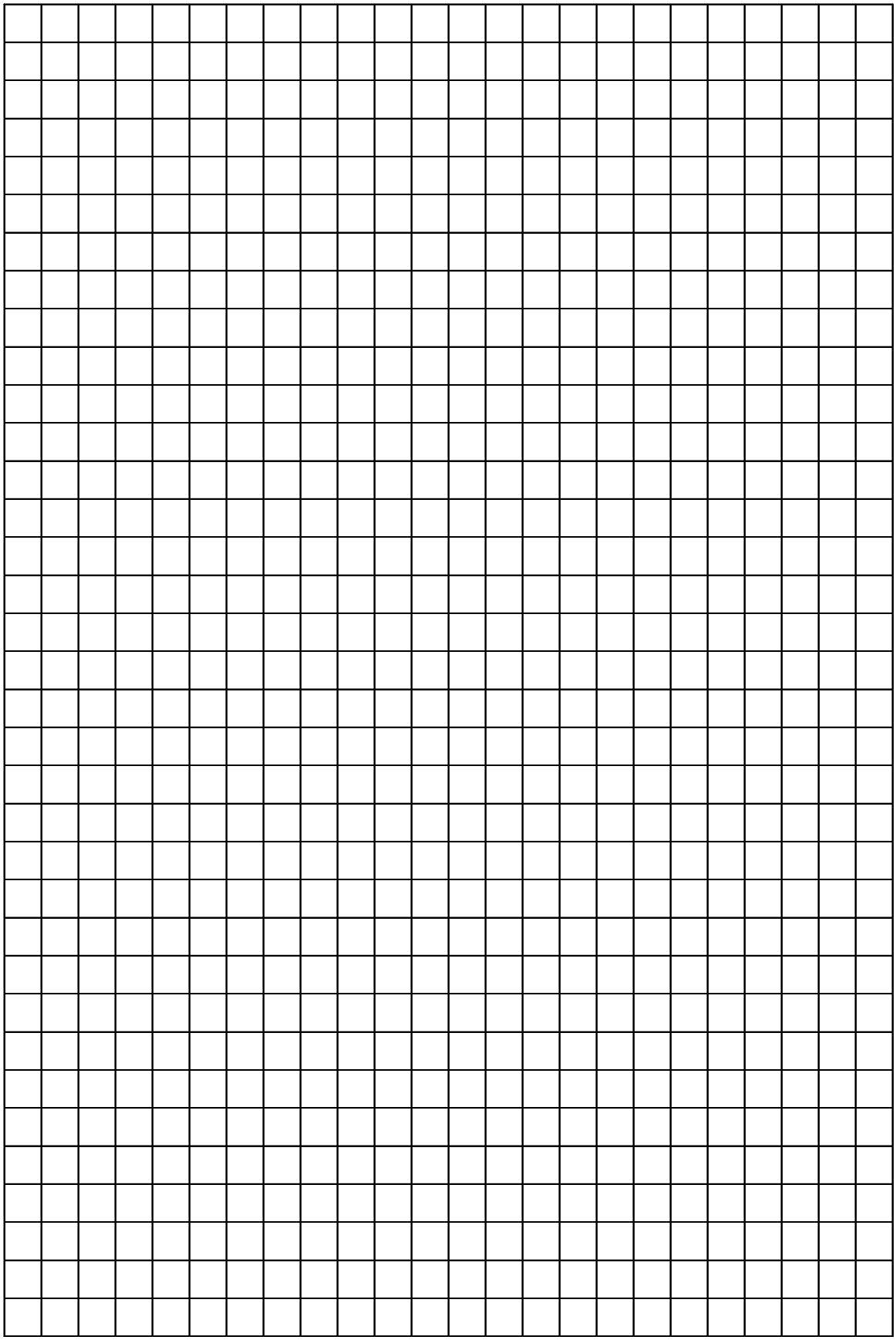
1 7/8 inches

5.

1 ½ inches

6.

1 7/8 inches

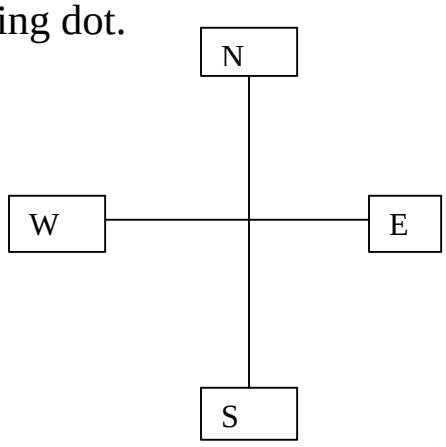


Name _____ Date _____

Magic Picture

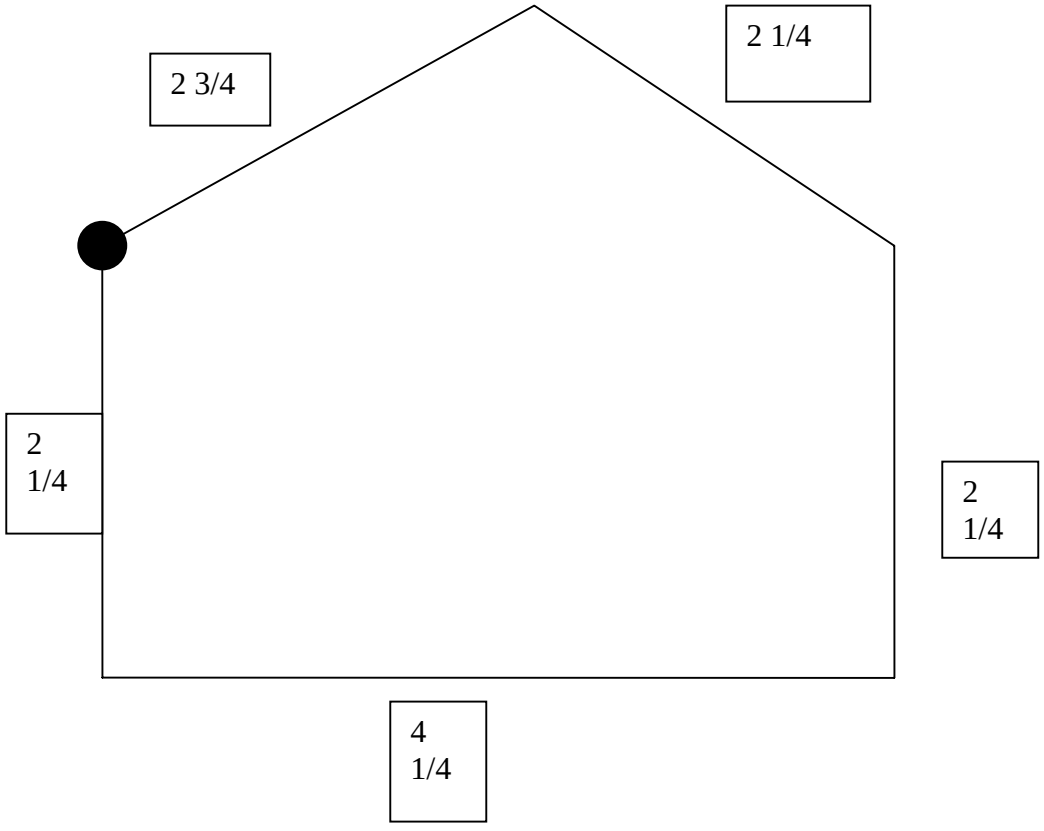
Directions: Start at the dot and follow the measurement directions in order to find a "mystery" picture.

1. Start at the dot and draw a straight line going south that measures 2 1/4".
2. At the end of line #1, draw a straight line going east that measures 4 1/4".
3. At the end of line # 2, draw a straight line going north that measures 2 1/4".
4. At the end of line #3, draw a line going northwest that measures 2 1/4".
5. At the end of line #4, draw a line going southwest that measures 2 3/4". This line's end should connect to the starting dot.



Magic Picture

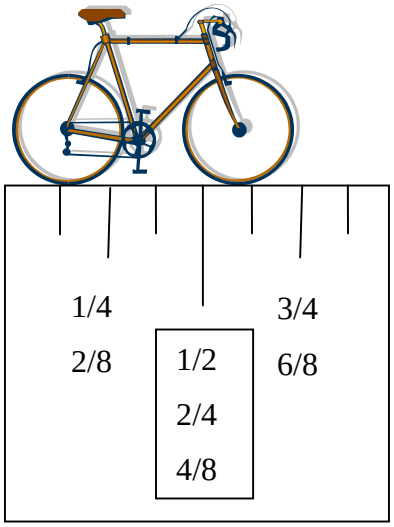
Directions: Start at the dot and follow the measurement directions in order to find a “mystery” picture.



Name_____ Date_____

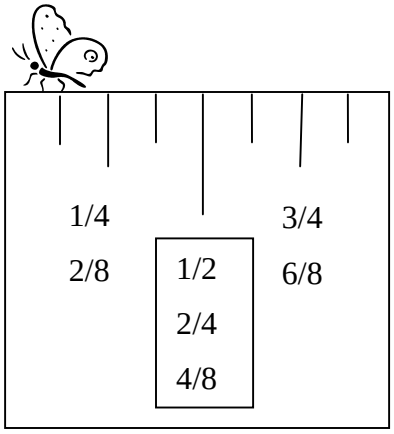
Use the "magic" inch below each picture. Circle the letter for the best answer.

1.



A. 1/2 B. 6/8
C. 3/4 D. 4/8

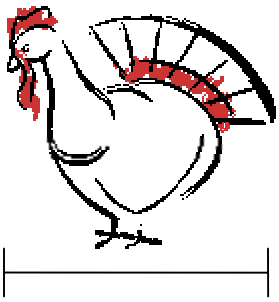
2.



A. 2/8 B. 4/8
C. 1/2 D. 1/4

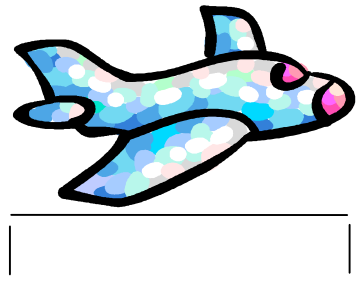
Use your ruler to measure the following pictures of objects. Give the most accurate measurement you can.

3.



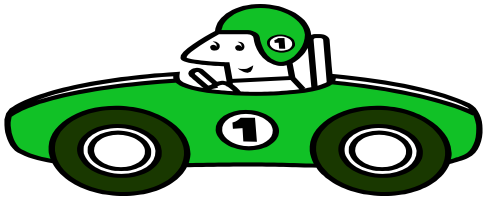
A. 1 3/8 B. 1 4/8
C. 1 1/2 D. 1 1/4

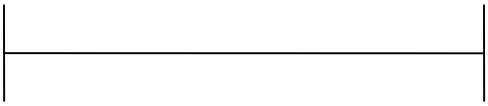
4.



A. 1 6/8 B. 1 7/8
C. 1 3/4 D. 1 4/8

Brief Constructed Response





Step A

Measure the above toy car to the nearest fraction of an inch.

_____

Step B

Use what you know about measurement to explain why your answer is correct. Use words and/or numbers in your explanation.

_____

_____

_____

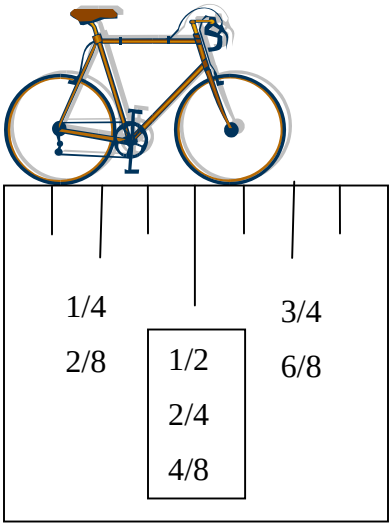
_____

_____

Name_____ Date_____

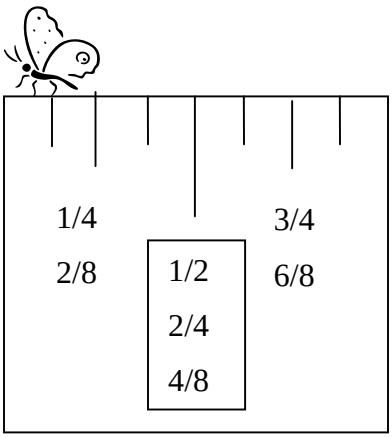
Use the "magic" inch below each picture. Circle the letter for the best answer.

2.



B. 1/2 B. 6/8
D. 3/4 D. 4/8

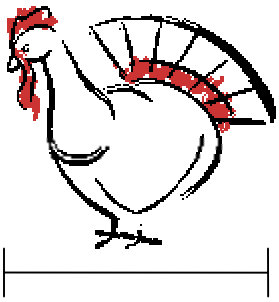
2.



B. 2/8 B. 4/8
C. 1/2 D. 1/4

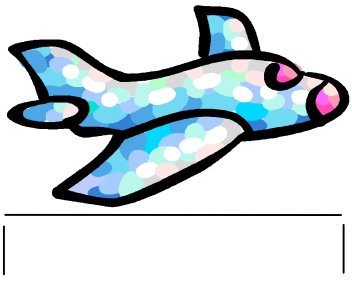
Use your ruler to measure the following pictures of objects. Give the most accurate measurement you can.

3.



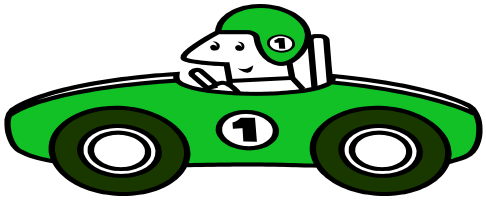
A. 1 3/8 B. 1 4/8
C. 1 1/2 D. 1 1/4

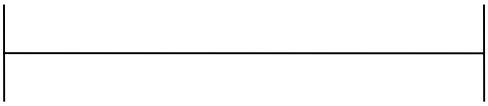
4.



A. 1 6/8 B. 1 7/8
C. 1 3/4 D. 1 4/8

Brief Constructed Response





Step A

Measure the above toy car to the nearest fraction of an inch.

2 1/2 inches

Step B

Use what you know about measurement to explain why your answer is correct. Use words and/or numbers in your explanation.

possible answer cues include: the car is bigger than two inches (it goes past the 2 mark on the ruler), 2/4 is not correct because 4 is a multiple of 2 (therefore not simplest form)