Title: Measurement Conversion

Brief Overview:

Students will explore the relationship between various units of measurement including inches to feet, feet to yards, and inches to yards. They will develop there understanding through the creation and use of a function table. They will then be able to calculate and determine equivalent units of measure and apply them to real world situations.

NCTM Content Standard

Measurement
- Carry out simple unit conversions within a system of measurement.
- Understand the need for measuring with standard units and become familiar with standard units in the customary system.

Algebra
- Represent and analyze patterns and functions, using words, tables, and graphs.

Grade/Level:

4th Grade.

Duration/Length:

4 Days, one of which is used for an assessment.

Student Outcomes:

Students will:
- Understand the need for measuring with standard units and become familiar with standard units in the customary systems.
- Students will be able to carry out simple unit conversions within the standard system of linear measurement.
- Create and use representations to organize, record, and communicate mathematical ideas.
- Represent and analyze patterns and functions, using words, tables, and graphs.

Materials and Resources:

Lesson 1
- Rulers (class set)
- Calculators (as needed)
- Teacher Resource Sheet 1 Index Card Match one set per group
- Teacher Resource Sheet 2: Balloon picture
- Teacher Resource Sheet 3: Example Function Table (overhead or chart paper)
- Student Resource Sheet 1: Blank Function Table one per pair.
- Teacher Resource Sheet 4: Blank Function Table Answer Key.
- Teacher Resource Sheet 5: Re-teach Example (for teacher use)
- Twelve Snails to One Lizard by Susan Hightower

Lesson2

- Rulers
- Calculator
- Yard sticks
- Student Resource Sheet 2: Comparison Warm-Up
- Teacher Resource Sheet 6: Comparison Warm-Up Answer Key
- Student Resource Sheet 3: Measure Up!
- Teacher Resource Sheet 7: Measure Up! Answer Key
- Student Resource Sheet 4: Units of Measure
- Teacher Resource Sheet 8: Units of Measure Answer Key

Lesson 3

- Rulers
- Calculators
- Yard sticks
- Teacher Resource Sheet 9: Estimation Warm-up
- Teacher Resource Sheet 10: Conversion Chart Answer Key
- Student Resource Sheet 5: Conversion Chart
- Student Resource Sheets # 6, 8, 10: Flower and Fences Word Problem
- Teacher Resource Sheets # 11, 12, 13: Flower and Fences Answer Key
- Student Resource Sheets # 7, 9, 11: Problem Solving
- Student Resource Sheet 12: Lumber Yard Problem
- Teacher Resource Sheet 14: Lumber Yard Problem Answer Key

Assessment:

- Student Resource Sheet 13: Summative Assessment
- Teacher Resource Sheet 15: Summative Assessment Answer Key

Development/Procedures:

Lesson 1

Pre-Assessment

- Read <u>Twelve Snails to One Lizard</u> by Susan Hightower. Using chart paper, discuss and record what the students know about units of measure.

Launch –

- Divide students into small groups.
- Distribute index cards with units of measure to each group. **(Teacher Resource Sheet 1)**
- Direct the students to match the cards in inches with the cards in feet. This will help determine what the students know about conversion of units in linear measurement.
  For example they should match the card that says 12 inches with the card that says 1 foot, etc.

Teacher Facilitation –

- Once the students have made as many matches as they can distribute rulers customarily. The students can use these rulers to either check their finished matches or if they are having problems, they can use the rulers to help finish matching the cards.

- Ask volunteers to share the strategies they use to match their cards. As students give their responses, be sure to ask the class if they agree or disagree. They can use a group response by holding their thumbs up or down to show whether or not they agree. Discuss the reasoning behind the way the cards were paired in each group. Possible questions to ask are…*"Did the rulers help you in any way?" "Why do you not agree with Billy?" "Why did you match 12 inches with 1 foot?" "How did you figure out how many inches were in four feet?" "Could there have been another answer?" "Is there another way to figure that out?"* Give students the opportunity to make changes to their cards during discussion.
- Discuss why we need different units of measure other than inches. *"What is the purpose of measuring in inches, feet, and yards?"* By asking this question you are trying to get the students to understand that we use these units of measure to figure out length, and that when we measure things are not all the same length so we need different units of measure.
- Pose the question, *"What happens if we want to measure something that is longer than one foot?"* Model using **(Teacher Resource Sheet 2)** to show an example of something that is larger than one foot. Say: *"Look at this picture of the hot air balloon... "I need to measure this, but it is longer than my ruler. What should I do?* Students may give a variety of responses such as, use two rulers. Measure with your ruler, make a mark with your pencil and move the ruler to pencil mark to measure the rest of it. Estimate. They may also notice that it is two rulers in length and double the inches.
- Ask for examples of things we would measure using each unit. Have students estimate the length of certain objects. For example, say to the student your math book is about 12 inches or one foot. *What objects can you think of that are about 1 foot long?* (Do the same for two feet and three feet)
- Model and complete a function table. This is something they may have learned in third grade and they need to be reminded of how it is used. **Use (Teacher Resource Sheet 3)** to model. Be sure to discuss the rule used to complete the table and any other possible rules you could have used. The rule is to multiply the numbers in the input column by 2 to get the answer in the output column.
- Ask, *"In what ways could we use a function table to help us change inches into feet?"* (Students may say you can use a function table to figure out the number of inches in a foot etc.)

Student Application –
- Distribute the function table, and direct students to work with their group or partner to complete the function table showing the connection between the numbers of inches to the number of feet **(Student Resource Sheet 1 and Teacher Resource Sheet 4)**
- Challenge students to find the rule for the function table. The rule is to divide by 12. For example 12 inches ÷ 12 = 1 foot. 24 inches ÷ 12 = 2 feet
- Students may use calculators to help them complete the table if needed. This way you can tell that they understand the process while not getting hung up on the arithmetic.
- Be sure to leave up the function table in a visible spot for future reference.

Embedded Assessment –
- Walk around and observe the students' progress, while asking their reasoning behind their answers.
- Clear up any misunderstandings within the groups. Discuss the rule they used to complete their table. Guide them to realize that the table operates by using groups of twelve whether they add or multiply.

Reteaching/Extension –

- Students who understand the concept can take it a step further by creating riddles for one another to solve using units of measure. For example: *I am 26 inches from foot to knee, and 40 inches from knee to head. How tall am I in feet and inches?*
- Gather the students who are having difficulty and give them a calculator and access to rulers. Have the students create a model of a function table on the floor using the rulers to represent feet and using their calculators to convert feet into inches. They can record answers on a blank function table. This should help students see the relationship between the two units of measure and the process used to get those numbers. **(Teacher Resource Sheet 5)**

Lesson 2

Preassessment –
- As a warm-up, have the students compare inches to feet using the <, >, or = signs. **(Student Resource Sheet 2 and Teacher Resource Sheet 6)** This can be done either as a whole class on the blackboard, or individually using paper and pencil.

Launch –
- Give the students the problem titled Measure up! **(Student Resource Sheet 3 and Teacher Resource Sheet 7)** Help the students brainstorm possible ways to solve this problem.
- Distribute materials such as rulers and yard sticks to the students.

Teacher Facilitation –
- Tell the students to look at their yardsticks. Have a discussion describing what information they can get from the yardsticks.
- Facilitate a discussion asking what they notice about the yardstick leading them to realize the connection between inches, feet, and yards. *Could the yardstick help us solve this problem? How?* Ask, *"Could we use the function table to help us solve the problem?"*
- Remember they are not to solve the problem at this point, you are only discussing it.
- Lead a discussion about the parts of your body that can be used as units of measure so they always have a reference in case they are without actual measurement tools. Ex:

1 inch	1 foot	1 yard

- Discuss the function table that was completed the day before and ask how it can be used to convert feet to yards.
- Ask your students, *"What happens if I need to measure something that is longer than one yard?"*
- Have a discussion about conversions that are not exact. For example if I have 7 feet about how many yards would that equal? The students would have to figure out that they would have 2 yards that equals 6 feet leaving them with 1 foot left over. Practice a few with your students by thinking aloud.
  If I have 13 feet how many yards does that equal? I know that 3 feet = 1 yard, and 6 feet = 2 yards, 9 feet = 3 yards, 12ft. = 4 yards. So, 13 feet is one more foot than 4 yards so my answer is **4yds 1 ft.**

Student Application –
- Give the students **(Student Resource Sheet 4 and Teacher Resource Sheet 8)** Units of Measure, and have them practice converting feet to yards and inches.
- Solve the Measure Up word problem. If there is time you can have students create conversion problems for their partner to solve.

Ex. 3 yards = _____ feet   5 feet = _____ yards _____ feet

Embedded Assessment –
- You can review the problems and solutions created and solved by the students. You can either assess them informally by walking around or formally by collecting the finished problems.

Reteaching/Extension –
- Those who need an extension can measure parts of their body, within reason, such as a finger and have to determine how many fingers are in a yard.
- Those who need extra support can review the concept of feet to yards by using rulers and a yard stick to determine how many rulers = one yard stick, etc.
- Those needing extra help can also have the option of being given paper strips equaling a yard and measuring and cutting it to find the number of feet within the yard.

Lesson 3

Pre-Assessment –
- In a hat provide strips of paper with the name of various objects or distances that can be found in your classroom. As you walk around the room have students draw a paper out and estimate the length in yards and feet. **(Teacher Resource Sheet 9 Estimation Warm-Up)**

Launch –
- Discuss with your students how they arrived at their answers. Possible answers may include using their body, rulers, yardsticks, or the function table. *Depending on the student responses possible questions to ask may include…"What resources did you use to come up with your answer? "How did you use the function table to help you? "How were you able to solve the problem without using rulers or yard sticks?"*
- Ask, "What do you think the relationship is between inches, feet and yards?" Prompt them to notice that a certain number of inches equal a certain number of feet as well as yards. These numbers are constant and are all around us.

Teacher Facilitation –
- The previous estimation activity should lead to a discussion about the relationship between inches, feet and yards. You can then discuss how to convert inches to feet and to yards using a conversion table. You may want to display a yardstick and ask the students to estimate how many 12 inch or 1-foot rulers they think can fit into one yard stick. Once they realize that there are three feet in one yard, the next question should be how many inches are in one yard?
- You should provide each group of students with rulers, calculators, and a yardstick and a blank copy of the conversion table. **(Student Resource Sheet 5)** You can have students complete their blank table while you model how to fill in part of your own so that they can use it in the future as a resource. **(Teacher Resource Sheet 10 Conversion Chart)**

- Model starting with what they already have discovered.
  - *We know that there are three feet in one yard so I can fill that in on my chart.*
  - *Then say, we have discovered that there are 36 inches in one yard. I know this because there are 12 inches in one foot and 12 inches x three feet will give me 36 inches.*
- Depending on your class you may want to complete the first two or three together before they work on their own.
- As you fill in the table together, ask if they notice any patterns emerging in the table such as the feet going up by 3 and the yards increasing by 1 etc. Have them complete the rest of the table in their group.
- The teacher conversion chart is already filled in for your convenience. You can either use a blank one, or use the one already filled in and cover the numbers with sticky notes and pull them away as you convert each number.

Inches	Feet	Yards
36	3	1
62	6	2
108	9	3
144	12	4
180	15	5
216	18	6

Student Application –
- Give the students the flowers and fences problem solving worksheet (Student Resource Sheet 6 and Teacher Resource Sheet 11). There are three different problems for you to choose from in order to differentiate among your learners. Give each group of students a different problem to work on. Have the students work individually to solve the problem at first. Have them follow the problem solving strategies that are on the student resource sheet. Be sure to review the strategies before having the students work on the problem. After about 6 minutes have the groups share the strategies they used to solve the problem. After about 8 minutes have the groups pass their problem to the next group so they can try to solve the problem. Repeat the process until everyone has had a chance to solve each of the problems. This gives all the students an opportunity to solve problems of varying degrees. **(Student Resource Sheets # 6-11 and Teacher Resource Sheets #11-13)**
- Give support to the groups as needed. This will lead to a discussion about conversion of feet to yards and yards to inches. Discuss how the groups solved the problem and the strategies they used. This can be done for everyone regardless of the problem they were given.

Embedded Assessment –
- You can assess the students informally by circulating around the room and asking questions such as, *"How did you get that answer?" "Did someone in your group solve it a different way?" What resources did you use?" "If you did not have the conversion chart what else could you have done?"*
- You can assess your students formally by collecting the word problems.

Reteaching/Extension –

- Those who need an extension activity can create their own word problems for one another to solve. The problems could include converting inches to feet or feet to yards or inches to yards.
- Those who need extra support can be given **(Student Resource Sheet 12 and Teacher Resource Sheet 14)**. Give them yardsticks and rulers to help them figure out how many inches they will need to solve the problem.

Summative Assessment:

The summative assessment will measure the student's ability to solve real-world problems by converting inches to feet, feet to yards, and inches to yards. They will demonstrate their understanding of the topic by justifying their reasoning. The students will also be responsible for completing basic conversion problems. **(Student Resource Sheet 13 and Teacher Resource Sheet 15)** Answers can be found on Teacher Resource Sheet 7.

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Teacher Resource Sheet 1

Matching Index Cards

1 foot	**12 inches**	**2 feet**	**24 inches**

3 feet	36 inches	4 feet	48 inches
5 feet	60 inches	6 feet	72 inches
7 feet	84 inches	8 feet	96 inches

Teacher Resource Sheet 2

You will need to cut out the two pieces and glue them together prior to the demonstration.
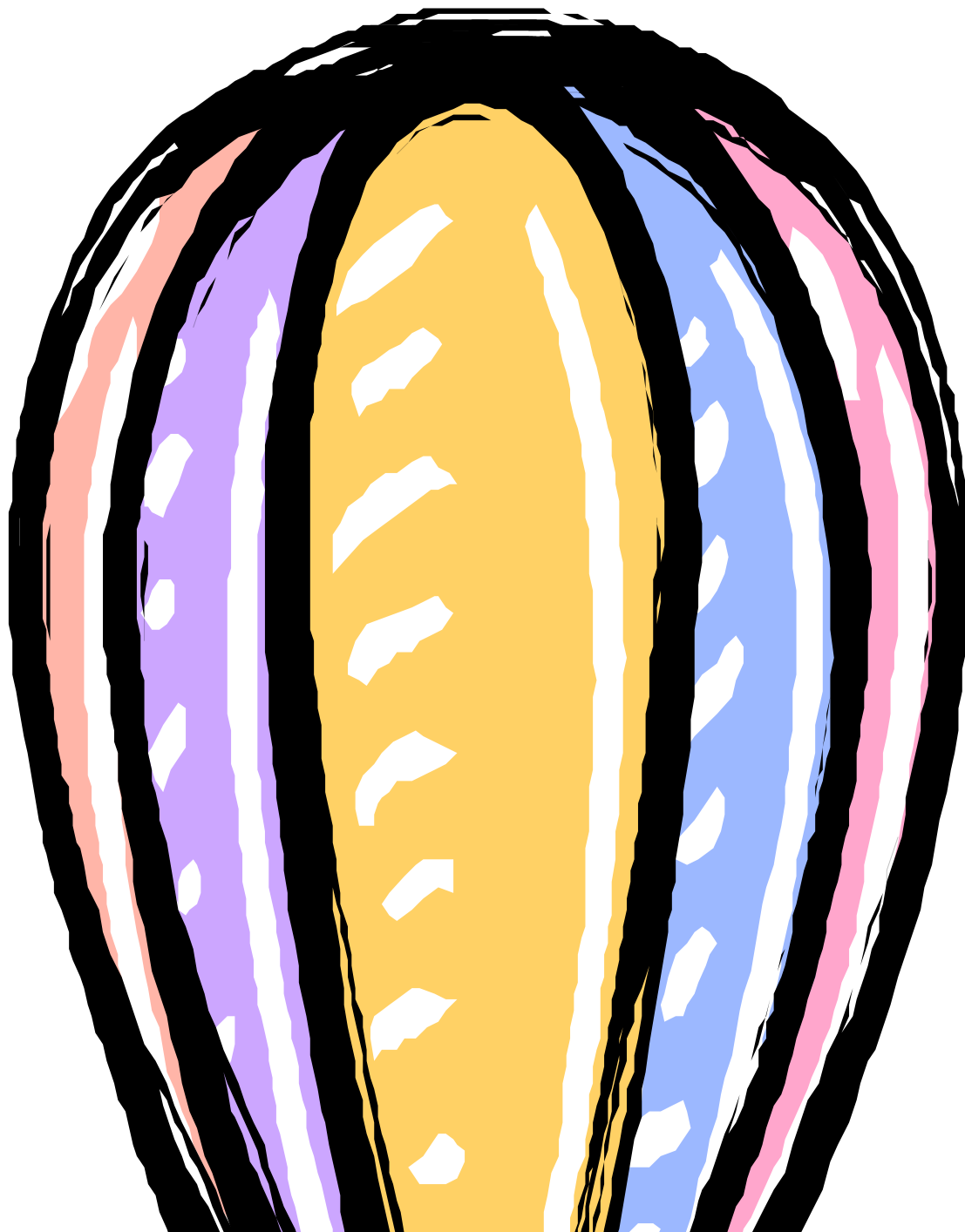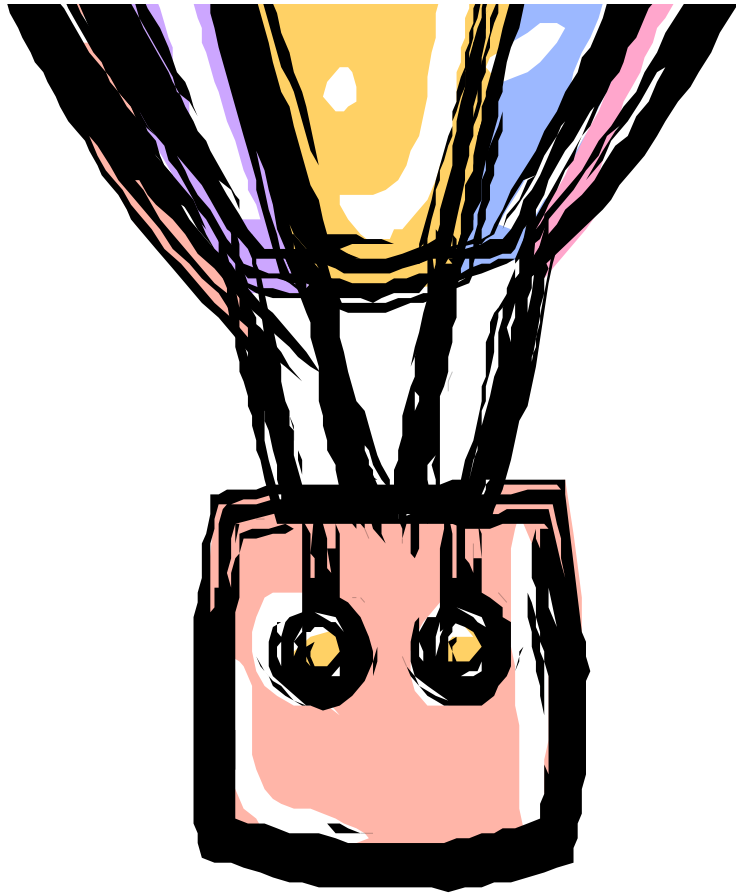
Name _____

Rule: Multiply by 2

Input	Output
3	6
4	8
6	
	14
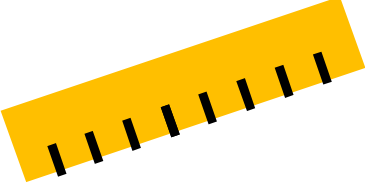
Name _____

Inches to Feet Function Table

Rule:	
Inches (Input)	Feet (Output)
12	1
	2
36	
	4
60	

This can be done on the floor or chart paper or blackboard using real rulers or paper copies.

Rule:	
Input	**Output**
	12 inches
	24 inches
	36 inches
	48 inches

Name _____   Date _____

Measurement Comparison

Use >, <, or = to compare.

1. 12 inches ( ) 1 foot

2. 36 inches ( ) 2 feet

3. 48 inches ( ) 6 feet

4. 60 inches ( ) 3 feet

5. 4 feet ( ) 36 inches

6. 5 feet ( ) 72 inches

Measure up!

You have decided to build a fence in your yard so your new puppy won't escape. The fence needs to be 15 yards long. Unfortunately the wood for the fence is only measured using feet. How many feet of fencing will you need to build your fence? Explain how you know your answer is correct.

_____
_____
_____
_____
_____
_____
_____
_____

Name _____   Date _____

Units of Measure

Complete the conversions.

1. 21 in = _____ft _____in

2. 35 in = _____ft _____ in

3. 48 in = _____ft _____ in

4. 41 in = _____ft _____ in

5. 9 ft = _____ yds

6. 7 yds = _____ ft

7. 25 ft = _____yds _____ft

8. 16 ft = _____yds _____ft

9. 18 yds = _____ ft

10. 21 yds = _____yds _____ft
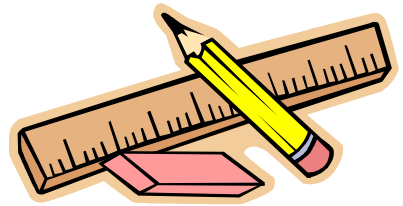
The blank spaces are so you can add your own. Be sure they are measuring the length of each object.
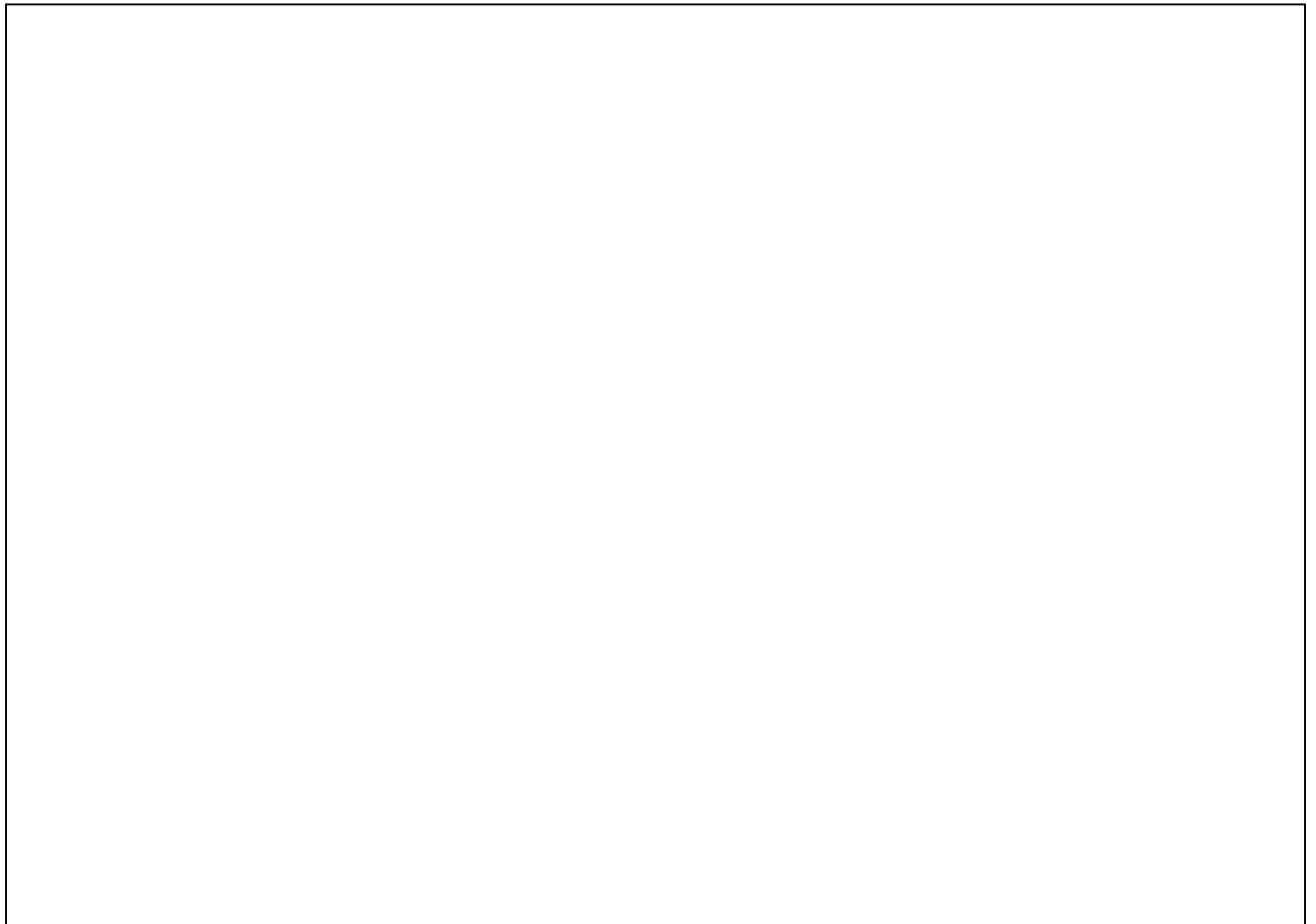
student desk	pencil	math book	your shoe
dollar bill	chalkboard	classroom door	projector screen
chair sea	computer monitor	window	bookshelf
hallway	teacher's desk	From the door to your desk	

Conversion Chart

Inches	Feet	Yards

Conversion Chart

Inches	Feet	Yards
36	3	1
62	6	2
108	9	3
144	12	4
180	15	5
216	18	6

You have decided to plant flowers along the fence in your backyard. Your fence measures 15 yards in length. Each bundle of flowers measures 6 inches in length. You would like to have 3 inches of space between each bundle of flowers. How many flowers can you fit along your fence?

Answer: _____

Problem Solving

Understand the Problem

What do I already know? _____

_____

What do I need to know? _____

_____

Planning/Strategy

What strategy am I going to use to solve this problem? _____

_____

Solve It (Remember to Show your Work)

_____

Look Back

Does my answer make sense? Why? _____

_____

_____

_____

You have decided to plant flowers along the fence in your backyard. Your fence measures 15 yards in length. Each bundle of flowers measures 6 inches in length. How many flowers can you fit along your fence?

Answer: _____

Problem Solving

Understand the Problem

What do I already know? _____

_____

What do I need to know? _____

_____

Planning/Strategy

What strategy am I going to use to solve this problem? _____

_____

Solve It (Remember to Show your Work)

_____
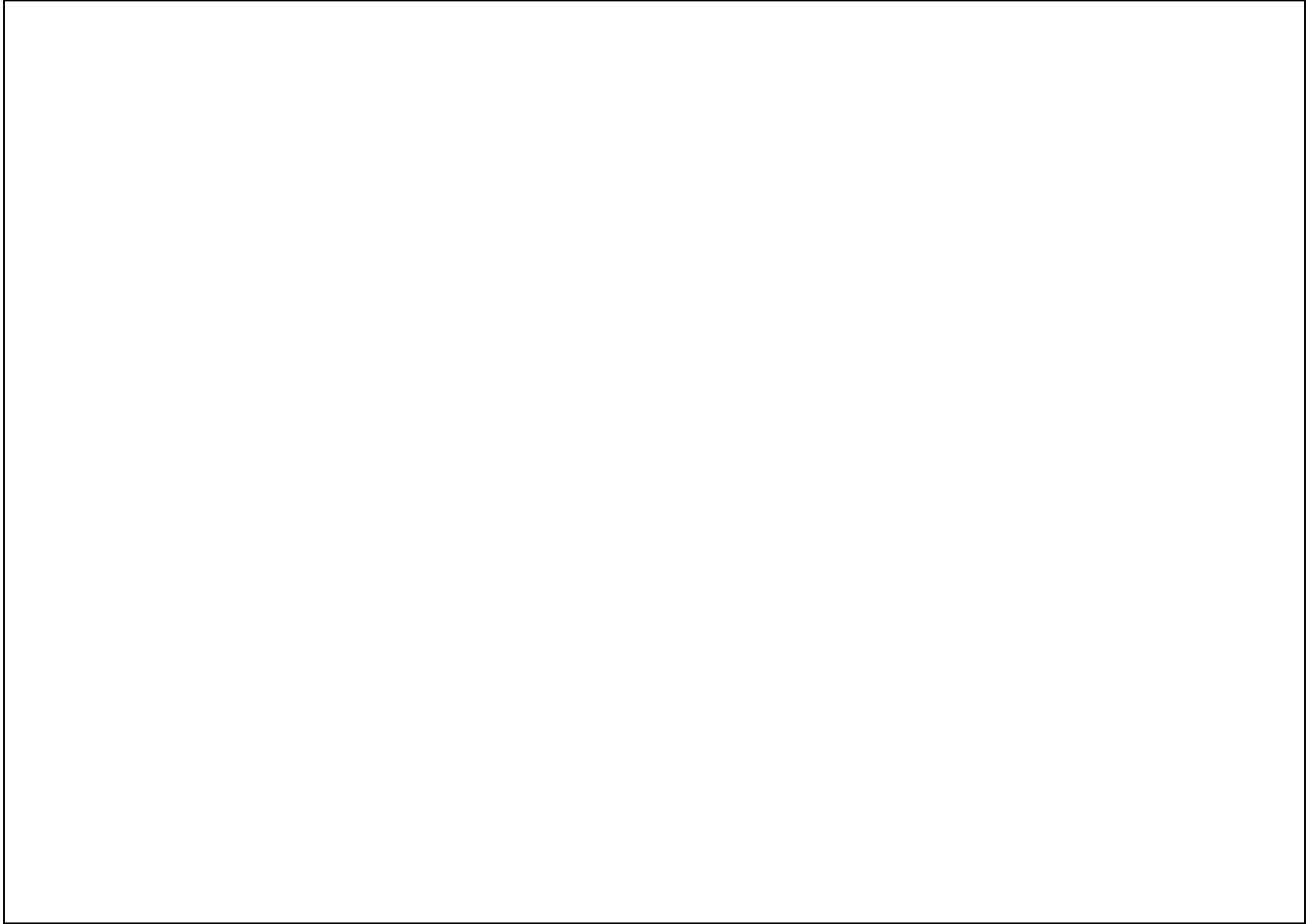| |
| |
| |
| |
| |
|_____|

Look Back

Does my answer make sense? _____

_____

_____

_____

You have decided to plant flowers along the fence in your backyard. Your fence measures 15 yards in length. Each bundle of flowers measures 6 inches in length.   How many flowers can you fit along your fence? If each bundle costs $2.00, how much money would you need to spend?

Answer: _____

Problem Solving

Understand the Problem

What do I already know? _____

_____

What do I need to know? _____

_____

Planning/Strategy

What strategy am I going to use to solve this problem? _____

_____

Solve It (Remember to Show your Work)

Look Back

Does my answer make sense? Why? _____

_____

_____
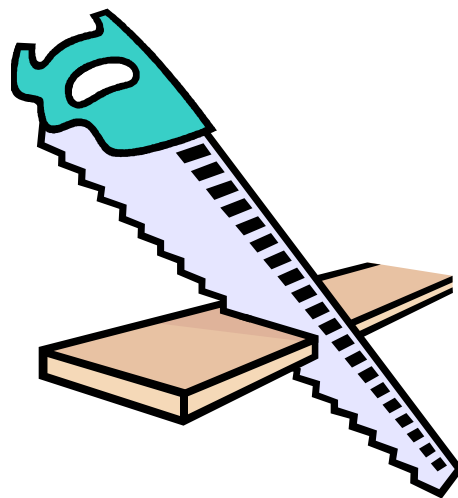
_____

Name _____   Date _____

      You are going to a lumberyard to get wood for your tree house. You need 3 yards of wood. When you get to the lumberyard, you find out they only sell the wood in inches. How many inches of wood do you need to buy?

_____inches of wood

Summative Assessment

Name: _____ Date: _____

Assessment

Complete the conversion chart.

Inches	Feet	Yards
36	3	
	6	2
108		3
144	12	
	15	5
216	18	

Complete the conversions.

1. 36 in = _____ yds

2. 18 ft = _____ yds

3. 48 in = _____ ft

4. 31ft = _____ yds _____ ft

5. 60 in = _____ yds _____ ft

1. You and a friend are making a poster. You need two yards of string to put around the edge of the poster. You have a piece of string that is 60 inches long.

A. Do you have enough string to go around the edge of the poster?

     Yes   No

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

_____

_____

_____

_____

_____

_____

2. You have three yards of ribbon to make bows. You use two and a half

   yards of the ribbon.

A. How much ribbon do you have left?

_____

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

_____

_____

_____

_____

_____

_____

Answers

Inches	Feet	Yards
36	3	1
72	6	2
108	9	3
144	12	4
180	15	5
216	18	6

1. 36 in =   1   yds

2. 18 ft =   6   yds

3. 48 in =   4   ft

4. 31ft =   10   yds   1   ft

5. 60 in =   1   yd   2   ft

BCR Rubric

Part A: This part receives a score of a **1** or **0**. The answer is either completely correct or incorrect.

Part B: Use the following rubric to determine this score.

Score	
2	- Application of a reasonable strategy is indicated - Explanation of and/or justification for the mathematical processes used to solve the problem is clear, developed, and logical - Connections and/or extensions are made within mathematics or outside mathematics are clear - Supportive information and/or numbers are provided as appropriate
1	- Partial application of a strategy is indicated - Explanation of and/or justification for the mathematical processes used to solve the 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
0	The response is completely incorrect, irrelevant to the problem, or missing

Possible Student answers could include:

Question 1

Part A: no

Score
2: Since my string is only 60 inches long, I didn't have enough. I need 72 inches because one yard is 36 inches and 36 + 36 = 72. I only have 60 inches, which is less than 72 inches so that's not enough to go around my poster.

1: 36 +36 = 72 and that doesn't equal 60 inches, so I didn't have enough to go around my poster.

0: I didn't have enough string, I needed more.

Question 2

Part A: half a yard or 18 inches or 1 and ½ feet

Score
2: I know my answer is correct because 9 feet of ribbon equals 3 yards. If I use 2 yards of ribbon, I have used 6 feet and still have 3 feet left. I know that I used another half of a yard so I am left with 1 ½ feet

1: I know my answer is correct because I had 3 -2 = 1 and 1(-) ½ = is ½. I took away 2 ½ from 3 and got ½ left.

0: I know my answer is correct because I subtracted.