Mathematics:

'A Story of Units

Parent Handbook

Grade 2 Module 7

Grade 2 • Module 7

Problem Solving with Length, Money, and Data

OVERVIEW

Module 7 presents an opportunity for students to practice addition and subtraction strategies within 100 and problem-solving skills as they learn to work with various types of units within the contexts of length, money, and data. Students represent categorical and measurement data using picture graphs, bar graphs, and line plots. They revisit measuring and estimating length from Module 2, though now using both metric and customary units.

Module 7 opens with students representing and interpreting categorical data. In Grade 1, students learned to organize and represent data with up to three categories. Now, in Grade 2, students build upon this understanding by drawing both picture and bar graphs. First, they record category counts in a table, solving problems based on the information in the table. Next, they draw picture graphs in which each picture represents one object. Finally, they represent the same data set in the form of a bar graph where one axis names the categories and the other shows a single-unit count scale. Students use the information to solve *put-together, take-apart,* and *compare* problems, making connections to finding sums and differences on a number line diagram. In the final lesson of Topic A, students display money data in the form of a bar graph, thus establishing a connection to word problems with coins in Topic B.

In Topic B, students work with the most popular units of all, bills and coins. Students apply their knowledge of coin values, place value strategies, and the properties of operations to solve addition and subtraction word problems to find the total value of a group of coins or bills. Next, they use coins to find multiple ways to represent the same quantity, sometimes using the fewest number of coins. Students then focus on the decomposition of a dollar, where they see that this unit behaves like all others they have seen before (e.g., 100 ones = 1 hundred, 100 cm = 1 m, etc.). Students learn how to make change from one dollar using counting on, simplifying strategies (e.g., number bonds), and the relationship between addition and subtraction. As students use coins or bills to solve addition and subtraction word problems within 100, they use drawings and equations to represent the unknown in various situations. The Application Problems throughout this module include solving two-step word problems involving two-digit money amounts (e.g., $28 + $47 or 28¢ + 47¢), as students use this new context to increase fluency with addition and subtraction within 100.

After the Mid-Module Assessment, Topic C reviews the measurement concepts and skills presented in Module 2, now with a focus on customary units. Students deepen their understanding of a *length unit* as they lay one-inch square tiles end-to-end to create simple inch rulers, just as they created centimeter rulers in Module 2. They see again that the smaller the unit, the more iterations are necessary to cover a given distance. Students measure the length of various objects with their new unit rulers, applying important concepts such as the understanding that the zero point on a ruler is the beginning of the total length and that *7* on a ruler means the distance covered by 7 length units.

In Topic D, students apply their measurement skills and knowledge of the ruler to measure a variety of objects using the appropriate measurement tools, such as inch rulers and yardsticks, just as they measured with centimeter rulers, meter sticks, and meter tape in Module 2. Students thereby add to their bank of benchmark lengths, such as an inch being the distance across a quarter. In doing so, students develop mental images of an inch, a foot, or a yard, which empowers them to estimate a given length.

In addition, in Topic D students measure objects twice using metric and customary length units, thereby developing an understanding of how the number of units needed depends upon the size of the unit chosen. As in Topic C, students recognize, for example, that the smaller the length unit, the more iterations are necessary to cover a given distance. Topic D concludes with students measuring to determine how much longer one object is than another. Students use addition and subtraction to compare two lengths, subtracting the length of the shorter object from the length of the longer object to determine the difference (e.g., 40 in − 35 in = 5 in, or 35 in + _____ = 40 in).

Whereas in Topic D students used rulers to compare lengths, in Topic E students use drawings (e.g., tape diagrams and number bonds) and equations with an unknown to represent addition and subtraction word problems. Once they have a solid conceptual understanding of length, students are ready to represent whole numbers as lengths on a number line and to apply their knowledge of the ruler to a number line diagram. In Topic E, they are asked to identify unknown numbers on a number line by using place value, reference points (e.g., 5, 10, 25, and 50), and the distance between points. Students are also asked to represent two-digit sums and differences using the number line as a measurement model for combining and comparing lengths.

Topic F follows naturally, with students generating measurement data and representing it with a line plot. Students position data along a horizontal scale with whole number markings, drawn as a number line diagram. Since students are working with length, the scale on their line plots corresponds to the scale on their rulers. After generating measurement data, students create line plots from different data sets, and then they discuss and interpret the results.
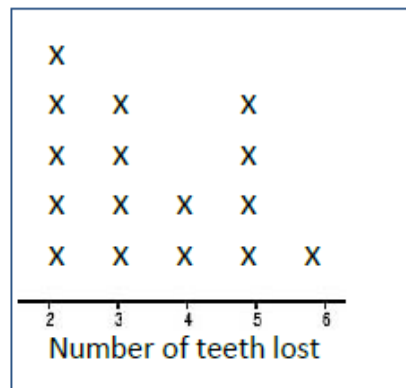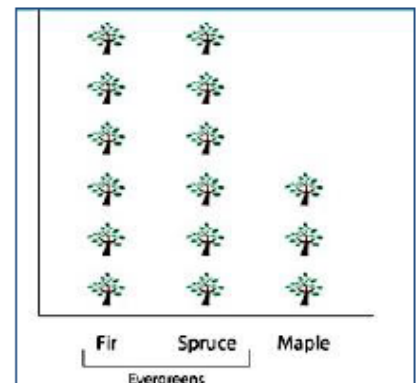
Terminology

New or Recently Introduced Terms

- Bar graph (diagram showing data using lines or rectangles of equal width)

- Category (group of people or things sharing a common characteristic, e.g., bananas are in the fruit category)

- Data (facts assembled for analysis or information)

- Degree (unit of temperature measure)

- Foot (ft., unit of length measure equal to 12 inches)

- Inch (in, unit of length measure)

- Legend (notation on a graph explaining what symbols represent)

- Line plot (graph representing data with an X above each instance of value on a number line)

- Picture graph (representation of data like a bar graph, using pictures instead of bars)

- Scale (system of ordered marks at fixed intervals used as a reference standard in measurement)

- Survey (collecting data by asking a question and recording responses)

- Symbol (picture that represents something real)

- Table (representation of data using rows and columns)

- Thermometer (temperature measuring tool)

- Yard (yd., unit of length measure equal to 36 inches or 3 feet)
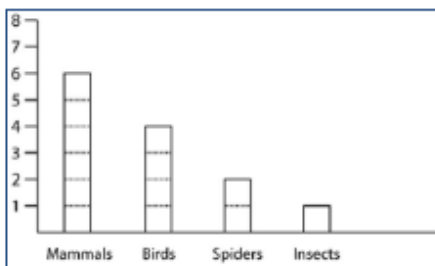
Bar Graph

Line Plot

Picture Graph

Scale

Terminology

Familiar Terms and Symbols

- Benchmark (e.g., round numbers like multiples of 10)

- Centimeter (cm, unit of length measure)

- Cents (e.g., 5¢)

- Coins (e.g., penny, nickel, dime, and quarter)

- Compare

- Compose

- Decompose

- Difference

- Dollars (e.g., $2)

- Endpoint

- Equation

- Estimation (an approximation of the value of a quantity or number)

- Hash mark (the marks on a ruler or other measurement tool)

- Height

- Length

- Length unit

- Meter (m, unit of length measure)

- Meter strip, meter stick

- Number bond

- Number line (a line marked at evenly spaced intervals)

- Overlap (extend over or cover partly)

- Ruler

- Tally mark

- Tape diagram

- Unit

- Value

Lesson 1

Objective: Sort and record data into a table using up to four categories; use category counts to solve word problems.

Use the Animal Classification table to answer the following questions about the types of animals Ms. Lee's second-grade class found in the local zoo.

Animal Classification			
Birds	Fish	Mammals	Reptiles
6	5	11	3

a. How many animals are birds, fish, or reptiles? __14__

b. How many more birds and mammals are there than fish and reptiles? __9__

$$17 - 8 = 9$$

c. How many animals were classified? __25__ $6 + 5 = 11$ $11 + 14 = 25$

$11 + 3 = 14$

d. How many more animals would need to be added to the chart to have 35 animals classified? __10__

e. If 5 more birds and 2 more reptiles were added to the table, how many fewer reptiles would there be than birds? __6__

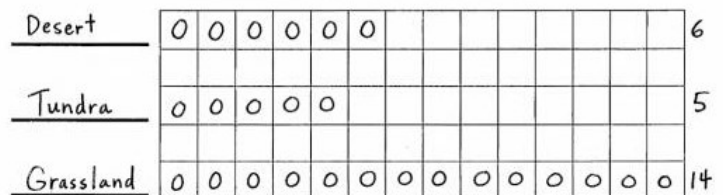$6 + 5 = 11$ $3 + 2 = 5$ $11 - 5 = 6$

Lesson 2

Objective: Draw and label a picture graph to represent data with up to four categories.

Use the table below to create a picture graph in the space provided.

Animal Habitats		
Desert	Tundra	Grassland
卌 I	卌	卌 卌 IIII

Title: __Animal Habitats__

Desert	O	O	O	O	O	O									6

Tundra	O	O	O	O	O										5

Grassland	O	O	O	O	O	O	O	O	O	O	O	O	O	O	14

Legend: __Each O = 1 animal habitat__

a. How many more animal habitats are in the grassland than in the desert? __8__

b. How many fewer animal habitats are in the tundra than in the grassland and desert combined? __15__

c. Write a comparison question that you can answer using the data from your picture graph.

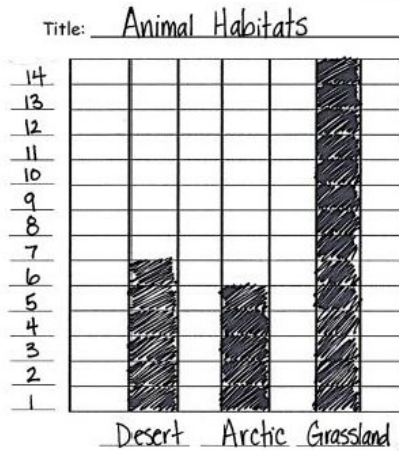Question: __How many more habitats are grassland than tundra?__

Answer: __9 because 5 + 9 = 14__

Lesson 3

Objective: Draw and label a bar graph to represent data; relate the count scale to the number line.

Complete the bar graph below using data provided in the table.

| Animal Habitats		
Desert	Arctic	Grassland
IIII I	IIII	IIII IIII IIII

Title: __Animal Habitats__

14
13
12
11
10
9
8
7
6
5
4
3
2
1

Desert Arctic Grassland

a. How many more animal habitats are in grassland and arctic combined than in the desert? __13__ $14+5=19$ $19-6=13$

b. If 3 more grassland animals and 4 more arctic animals are added to the graph, how many grassland and arctic animals would there be? __26__ $14+3=17$ $17+9=26$ $5+4=9$

c. If 3 animals were removed from each category, how many animals would there be? __16__ $3+2+11=16$

d. Write your own comparison question based on the data and answer it.
Question: __How many more grassland habitats than desert habitats?__

Answer: __$14-6=8$ There are 8 more grassland habitats than desert habitats.__

Lesson 4

Objective: Draw a bar graph to represent a given data set.

Complete the bar graph with labels and numbers using the number of farm animals on O'Brien's farm.

O'Brien's Farm Animals			
Goats	Pigs	Cows	Chickens
13	15	7	8

Title: __O'Brien's Farm Animals__

Goats Pigs Cows Chickens
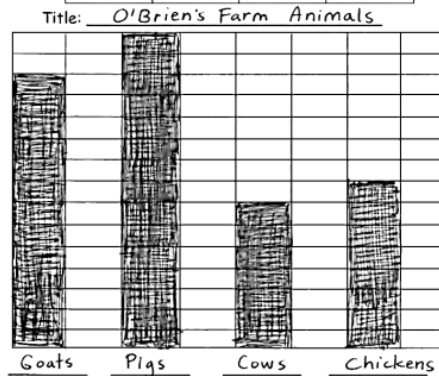
a. How many more pigs than chickens are on O'Brien's farm? __7__

b. How many fewer cows than goats are on O'Brien's farm? __6__

c. How many fewer chickens than goats and cows are on O'Brien's farm? __12__
   $13+7=20$ $20-8=12$

d. Write a comparison question that can be answered using the data on the bar graph.
   __How many more pigs than cows are on O'Brien's farm?__

Lesson 5

Objective: Solve word problems using data presented in a bar graph.

Complete a bar graph with labels and numbers using the number of dimes each student donated.

Number of Dimes

Madison	Robin	Benjamin	Miguel
12	10	15	13

Title: _Number of Dimes_
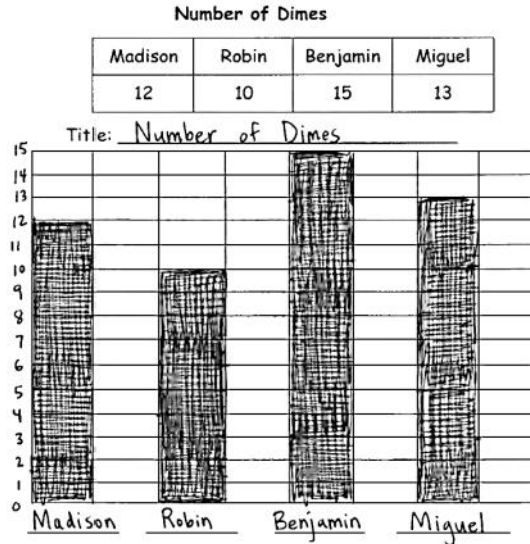
a. How many more dimes did Miguel donate than Robin? __3__

b. How many fewer dimes did Madison donate than Robin and Benjamin? __13__
   10+15=25   25-12=13

c. How many more dimes are needed for Miguel to donate the same as Benjamin and Madison? __14__   12+15 = 27   13 + ? = 27

d. How many dimes were donated? __50__
   12+10 =22   15+13 = 28   28 + 22 = 50
                                     2   20

Lesson 6

Objective: Recognize the value of coins and count up to find their total value.

34¢

52¢

* It is important to organize coins before counting

15. 95¢

Lesson 7

Objective: Solve word problems involving the total value of a group of coins.

Lisa has 2 dimes and 4 pennies in one pocket and 4 nickels and 1 quarter in the other pocket. How much money does she have in all?

$$24 + 45 = 69 ¢$$ Lisa has a total of 69 cents .

Emanuel had 53 cents. He gave 1 dime and 1 nickel to his brother. How much money does Emanuel have left?

$$
\begin{array}{r}
4\,5\overset{13}{\cancel{3}} \\
-\ 15 \\
\hline
38\ ¢
\end{array}
$$

Emanuel has 38 cents left.

Lesson 8

Objective: Solve word problems involving the total value of a group of bills.

Raja has $60. He gave 1 twenty-dollar bill and 3 five-dollar bills to his cousin. How much money does Raja have left?

$$
\begin{array}{r}
5\overset{10}{\cancel{6}}\cancel{0} \\
-\ 35 \\
\hline
\$25
\end{array}
$$

Raja has 25 dollars left.

Antonio had 4 ten-dollar bills, 5 five-dollar bills, and 16 one-dollar bills. He put $70 of that money in his bank account. How much money was not put in his bank account?

$$
\begin{array}{r}
\$81 \\
-\ 70 \\
\hline
\$11
\end{array}
$$

Antonio did not put 11 dollars into his bank account.

Lesson 9

Objective: Solve word problems involving different combinations of coins with the same total value.

1. 26 cents	Another way to make 26 cents:
2 dimes, 1 nickel, and 1 penny = 26 cents	1 quarter 1 penny
2. 35 cents	Another way to make 35 cents:
3 dimes and 1 nickel = 35 cents	1 quarter 10 pennies

Alex has 4 quarters. Nicole and Caleb have the same amount of money. Write two other coin combinations that Nicole and Caleb could have.

10 dimes	2 quarters 10 nickels

Lesson 10

Objective: Use the fewest number of coins to make a given value.

1. Kayla showed 30 cents two ways. Circle the way that uses the fewest coins.

A.   B.

What two coins from A were changed for one coin in B?

_____2 nickels into 1 dime_____

Kayla gave three ways to make 56¢. Circle the correct ways to make 56¢ and star the way that uses the fewest coins.

a. 2 quarters and 6 pennies

b. 5 dimes, 1 nickel, and 1 penny ✳

c. 4 dimes, 2 nickels, and 1 penny

Write a way to make 56¢ that uses the fewest possible amount of coins.

2 quarters 1 nickel 1 penny

Lesson 11

Objective: Use different strategies to make $1 or make change from $1.

Although you could solve these problems using the vertical method the arrow method is suggested because it so closely matches the way we count money.

$29¢ + 71 = 100$

$$71 \xrightarrow{+9} 80 \xrightarrow{+20} 100$$

$100¢ - 43¢ = 57¢$

$$43 \xrightarrow{+7} 50 \xrightarrow{+50} 100$$

$1
57¢   43¢

Lesson 12

Objective: Solve word problems involving different ways to make change from $1.

Daniel had exactly $1 in change. He lost 6 dimes and 3 pennies. What coins might he have left?

| | 63¢ |

$1

37¢

He could have 1 quarter, 1 dime, and 2 pennies.

Dane saved 26 cents on Friday and 35 cents on Monday. How much more money will he need to save to have saved $1?

$$\begin{array}{r} 35 \\ +26 \\ \hline 61 \end{array}$$

$1
61   39

Lesson 13

Objective: Solve two-step word problems involving dollars or cents with totals within $100 or $1.

Christopher has 3 ten dollar bills, 3 five dollar bills, and 12 one dollar bills. Jenny has $19 more than Christopher. How much money does Jenny have?

Christopher $57

Jenny $57 $19

?

57
+19
$76

Mary found 98 cents in her piggy bank. She counted 1 quarter, 8 pennies, 3 dimes, and some nickels. How many nickels did she count?

63¢   98 ¢

98
- 63
35

7 nickels
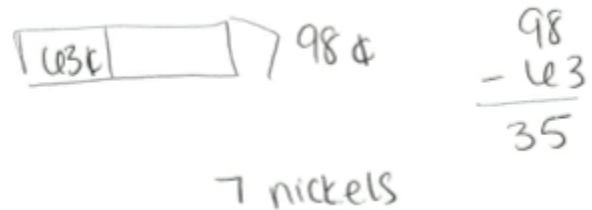
Lesson 14

Objective: Connect measurement with physical units by using iteration with an inch tile to measure.

Mark and Melissa both measured the same marker with an inch tile but came up with different lengths. Circle the student work that is correct and explain why you chose that work.
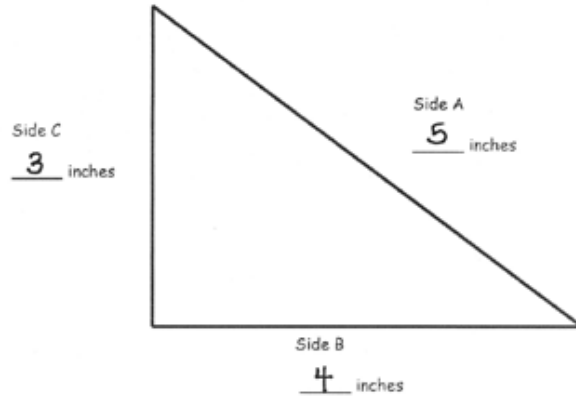
Melissa's Work

6   in

Mark's Work

7   in
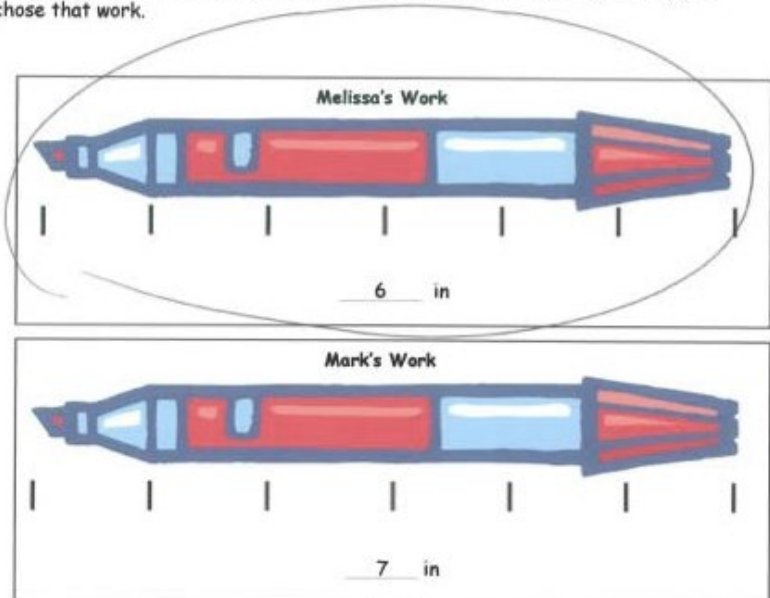
Explanation:
Melissa is right because she counted the inches and Mark counted the dash marks.

Lesson 15

Objective: Apply concepts to create inch rulers; measure lengths using inch rulers.

Measure and label the length of each side of the triangle using your ruler.

Side C ___3___ inches

Side A ___5___ inches

Side B ___4___ inches

a. Which side is the shortest? Side A Side B (Side C)

b. What is the length of Side A? ___5___ inches

c. What is the length of Sides C and B together? ___7___ inches

d. What is the difference between the shortest and longest sides? ___2___ inches

Solve.

a. ___12___ inches = 1 foot

b. 5 inches + ___7___ inches = 1 foot

c. ___8___ inches + 4 inches = 1 foot

Lesson 16

Objective: Measure various objects using inch rulers and yardsticks.

Circle the unit you would use to measure each item.

football field	inch/foot/(yard)
cell phone	(inch)/foot/yard

Name 3 things in your classroom. Decide which unit you would use to measure that item. Record it in the chart in a full statement.

| Item	Unit
a.	I would use __yards__ to measure the length of __chalkboard__.

Lesson 17

Objective: Develop estimation strategies by applying prior knowledge of length and using mental benchmarks.

Item	Mental Benchmark	Estimation	Actual Length
d. Length of a desk	arm	2 feet	2 feet
e. Length of a reading book	pencil	10 inches	8 inches
f. Length of a crayon	pencil	8 inches	7 inches
g. Length of the room	yard stick	4 yards	5 yards

Lesson 18

Objective: Measure an item twice using different length units and compare; relate measurement to unit size.

1. _____

   13 cm   5 in
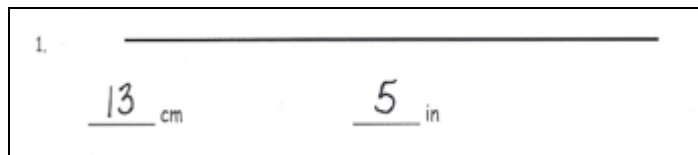
Thomas and Chris both measured the crayon below but came up with different answers. Explain why both answers are correct.

Thomas: 8 cm
Chris: 3 in

Explanation: one measured in centimeters and one measured in inches so they are both correct

Lesson 19

Objective: Measure to compare the differences in length using inches, feet, and yards.

Tammy and Martha both built fences around their properties. Tammy's fence is 54 yards long. Martha's fence is 29 yards longer than Tammy's.

Tammy's Fence
54 yards

Martha's Fence
_83_ yards
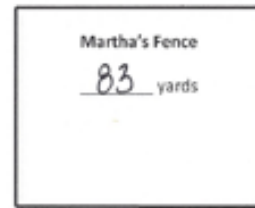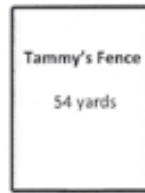
a. How long is Martha's fence? __83__ yards

$$54 \xrightarrow{+30} 84 \xrightarrow{-1} 83$$

T [54 yd.]
M [54 yd] [29 yd]
longer

b. What is the total length of both fences? __137__ yards

$$83 \xrightarrow{+20} 103 \xrightarrow{+30} 133 \xrightarrow{+4} 137$$

T [54] M [83]
? 137

Line C _____

Line D _____

Line C measured about __3__ inches.   Line D measured about __6__ inches.

Line C is about __3__ inches **shorter** than Line D.

Lesson 20

Objective: Solve two-digit addition and subtraction word problems involving length by using tape diagrams and writing equations to represent the problem.

Frankie has a 64-inch piece of rope and another piece that is 18 inches shorter than the first. What is the total length of both ropes?

64in

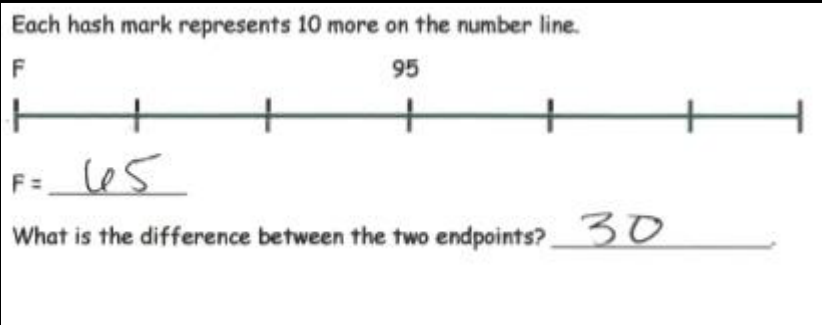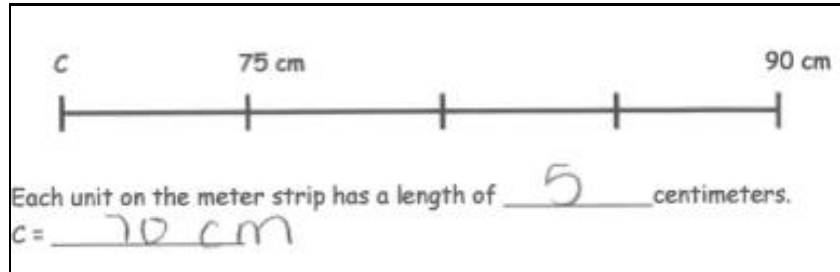18in
?

$$64-18$$
$$66-20 = 46$$

64 in   46 in
?
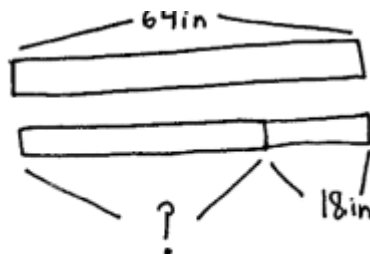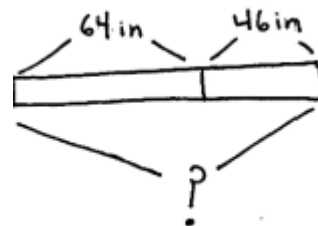
Both ropes are 110 inches. $46 + 64 = 110$ inches

4   60

Lesson 21

Objective: Identify unknown numbers on a number line diagram by using the distance between numbers and reference points.

C   75 cm   90 cm

Each unit on the meter strip has a length of ___5___ centimeters.

C = __70 cm__

Each hash mark represents 10 more on the number line.

F   95

F = __65__

What is the difference between the two endpoints? __30__ .

Lesson 22

Objective: Represent two-digit sums and differences involving length by using the ruler as a number line.

Vincent's meter strip got cut off at 68 centimeters. To measure the length of his screwdriver, he writes "81 cm – 68 cm." Alicia says it's easier to move the screwdriver over 2 centimeters. What is Alicia's subtraction sentence? Explain why she's correct.

Vincent's Idea ├┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┤
68 cm   81 cm

Alicia's Idea ├┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┼┤
68 cm   81 cm
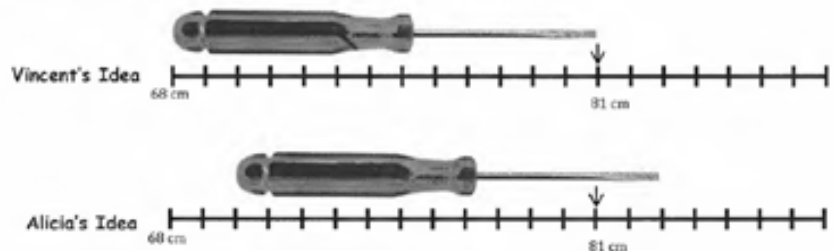
83 - 70 = 13   Alicia is correct because when you're subtracting you can make friendly numbers if you add the same amount to both numbers. The answer will be the same.

Ingrid measured her garden snake's skin to be 28 inches long using a yardstick, but didn't start her measurement at zero. What might be the two endpoints of her snakeskin on her meter stick? Write a subtraction sentence to match your idea.

28 in

10   38
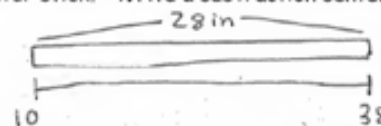
38 - 28 = 10
or
38 - 10 = 28

Lesson 23

Objective: Collect and record measurement data in a table; answer questions and summarize the data set.

1. Measure the lines below in inches. Record the data using tally marks on the table provided.

Line A _____ 6 in

Line B _____ 3 in

Line C _____ 5 in

Line D _____ 4 in

Line E _____ 2 in

Line F _____ 1 in

Line G _____ 5 in

Line Length	Number of Lines
Shorter than 5 inches	IIII
Longer than 5 inches	I
Equal to 5 inches	II

a. How many more lines are shorter than 5 inches than equal to 5 inches?
   __2 lines__

b. What is the difference between the number of lines that are shorter than 5 inches and those that are longer than 5 inches? __3 lines__

c. Ask and answer a comparison question that could be answered using the data above.
   Question: ___How many more lines are equal to 5 inches___
   than longer than 5 inches?

Lesson 24

Objective: Draw a line plot to represent the measurement data; relate the measurement scale to the number line.

| Length of Ribbon Scraps (centimeters)	Number of Ribbon Scraps
14	1
16	3
18	8
20	7
22	5

Length of Ribbon Scraps
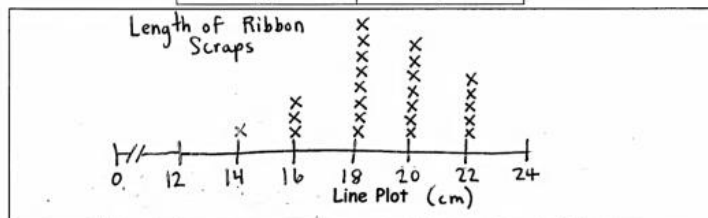
Line Plot (cm)

a. Describe the pattern you see in the line plot.
   Most ribbon scraps are 18 cm or 20 cm long.

b. How many ribbons are 18 centimeters or longer? __20__

c. How many ribbons are 16 centimeters or shorter? __4__

d. Create your own comparison question related to the data.
   How many more ribbons are 18 inches than 16 inches? 5 ribbon scraps

Lesson 25

Objective: Draw a line plot to represent a given data set; answer questions and draw conclusions based on measurement data.

The chart shows the length of paper second-grade students used in their art projects.

Length of Paper	Number of Students
3 ft	2
4 ft	11
5 ft	9
6 ft	6

Second Grade Art Paper   Line Plot
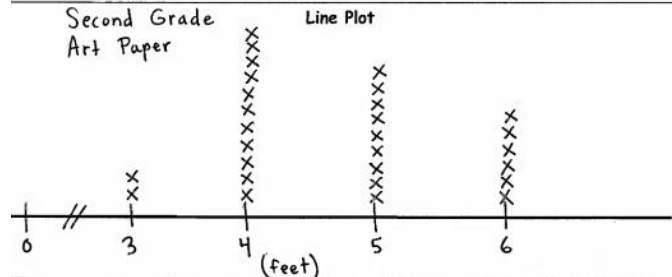
a. How many art projects were made? __28__

b. What paper length occurred most often? __4 feet__

c. If 8 more students used 5 ft of paper and 6 more students used 6 ft of paper, how would it change how the line plot looks?
Then 5ft would be the highest used and 6 ft would be the second highest.

d. Draw a conclusion about the data in the line plot.
Students like to use longer paper for art projects better than short paper.

Lesson 26

Objective: Draw a line plot to represent a given data set; answer questions and draw conclusions based on measurement data.

Use the data in the table provided to create a line plot and answer the questions.

2. The table below describes the length of pencils in Mrs. Richie's classroom in centimeters.

Length (centimeters)	Number of Pencils
12	1
13	4
14	9
15	10
16	10

Lengths of Mrs. Richie's Pencils

cm
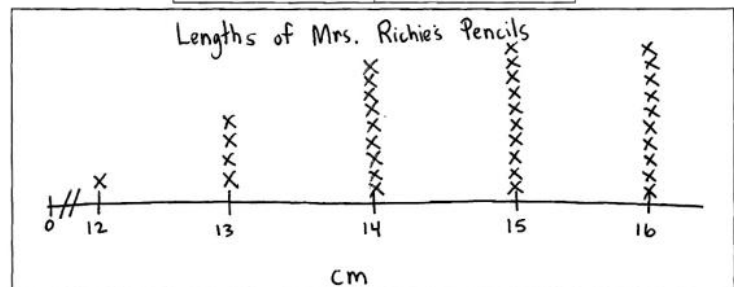
a. How many pencils were measured? __34__   1+4+9=14   10+10=20
     14+20=34

b. Draw a conclusion as to why most pencils were 15 and 16 cm:
I think Mrs. Richie has a lot of new pencils.

c. For this data, a line plot / table (circle one) is easier to read because...
The numbers are all in a row and the are easy to compare by looking at the x's.