## Lesson 16 4•1

# Lesson 16

Objective: Solve two-step word problems using the standard subtraction algorithm fluently modeled with tape diagrams and assess the reasonableness of answers using rounding.

Related Topics: More Lesson Plans for the Common Core Math

## **Suggested Lesson Structure**

Fluency Practice	(12 minutes)
Application Problem	(5 minutes)
Concept Development	(30 minutes)
Student Debrief	(13 minutes)
Total Time	(60 minutes)

## Fluency Practice (12 minutes)

• Convert Meters and Centimeters to Centimeters <b>4.MD.1</b>	(8 minutes)
Compare Numbers 4.NBT.2	(4 minutes)

## Sprint: Convert Meters and Centimeters to Centimeters (8 minutes)

Materials: (S) Convert Meters and Centimeters to Centimeters Sprint

Note: Reviewing unit conversions that were learned in Grade 3 will help prepare the students to solve problems with meters and centimeters in Module 2, Topic A.

## **Compare Numbers (4 minutes)**

Materials: (S) Personal white boards

Note: Reviewing this fluency will help students work towards mastery of comparing numbers.

- T: (Project 342,006 \_\_\_\_\_ 94,983.) On your boards, compare the numbers writing the greater than, less than, or equal symbol.
- S: (Students write 342,006 > 94,893.)

Repeat for possible sequence: 7 thousands 5 hundreds 8 tens \_\_\_\_\_ 6 ten thousands 5 hundreds 8 ones, and 9 hundred thousands 8 thousands 9 hundreds 3 tens \_\_\_\_\_ 807,820.



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Date:

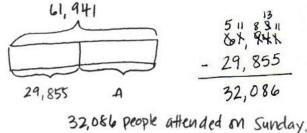
Solve two-step word problems using the standard subtraction algorithm fluently modeled with tape diagrams and assess the reasonableness of answers using rounding. 3/25/14





## **Application Problem (5 minutes)**

For the weekend basketball playoffs, a total of 61,941 tickets were sold. 29,855 tickets were sold for Saturday's games. The rest of the tickets were sold for Sunday's games. How many tickets were sold for Sunday's games?



Note: This Application Problem reviews content from the prior lesson of using the subtraction algorithm with multiple regroupings.

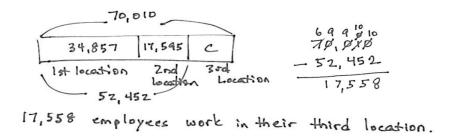
## **Concept Development (30 minutes)**

Materials: (S) Personal white boards

#### Problem 1

Solve a two-step word problem, modeled with a tape diagram, assessing reasonableness of answer using rounding.

A company has 3 locations with 70,010 employees all together. Their first location has 34,857 employees. Their second location has 17,595 employees. How many employees work in their third location?



T: Read with me. Take 2 minutes to draw and label a tape diagram.

Circulate and encourage the students: "Can you draw something?" "What can you draw?"

- T: (After 2 minutes.) Tell your partner the known and unknown information.
- S: We know the total number of employees and the employees at the first and second locations. We don't know how many employees are at the third location.



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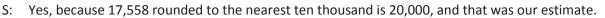




- T: Use your tape diagram to estimate the number of employees at the third location. Explain your reasoning to your partner.
- S: I rounded the number of employees.
   30,000 + 20,000 = 50,000 and I know that the total number of employees is about 70,000. That means that there would be about 20,000 employees at the third location.
- T: Now, find the precise answer. Work with your partner to do so.

Give students time to work.

- T: Label the missing part on your diagram and make a statement of the solution.
- S: There are 17,558 employees at the third location.
- T: Is your answer reasonable?



#### Problem 2

Solve two-step word problems, modeled with a tape diagram, assessing reasonableness of answer using rounding.

Owen's goal is to have 1 million people visit his new website within the first four months of it being launched. Below is a chart showing the number of visitors each month. How many more visitors does he need in Month 4 to reach his goal?

	Month					
		Month 1	Month 2	Month 3	Month 4	
	Visitors	228,211	301,856	299,542		
228,211 301,852	Contail Attack		228,2 301,89 299,5	11 ≈ 200 56 ≈ 300 42 ≈ <sup>+</sup> 300 800	,000 ,000 ,000	0 10 10 10 10 10 10 1,000,000 - 829,609 170,391
Owen n	ieeds 1	70,391 r	nore visi	tors to	reach his	

- T: With your partner draw a tape diagram. Tell your partner your strategy for solving this problem.
- S: We can find the sum of the number of visitors during the first 3 months. Then, we subtract that from 1 million to find how many more visitors are needed to reach his goal.
- T: Make an estimate for the number of visitors in Month 4. Explain your reasoning to your partner.



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**NOTES ON** 

**OF ACTION** 

**MULTIPLE MEANS** 

**AND EXPRESSION:** 

may not consider whether their answer

Students working below grade level

makes sense. Guide students to

choose the sensible operation and check their answers. Encourage

students to reread the problem after solving and to ask themselves, "Does

my answer make sense?" If not, ask,

"What else can I try?"

- S: I can round to the nearest hundred thousand and estimate. Owen will need about 200,000 visitors to reach his goal.
   → I rounded to the nearest ten thousand to get a closer estimate of 170,000 visitors.
- T: Find the total for the first 3 months. What is the precise sum?
- S: 829,609.
- T: Compare the actual and estimated solutions. Is your answer reasonable?
- S: Yes, because our estimate of 200,000 is near 170,391.
   → Rounded to the nearest hundred thousand 170,391 is 200,000. → 170,391 rounded to the nearest ten thousand is 170,000 which was also our estimate, so our solution is reasonable.



Challenge students working above grade level to expand their thinking and to figure out another way to solve the two-step problem. Is there another strategy that would work?

#### Problem 3

Solve a two-step word problem with a *compare with smaller unknown* base.

There were 12,345 people at a concert on Saturday night. On Sunday night, there were 1,795 fewer people at the concert than on Saturday night. How many people attended the concert on both nights?

Sat. 
$$[12,345]$$
  
Sun.  $[12,345]$   
Sun.  $[12,345]$   
 $P = 1,795 + 10,550$   
 $10,550 + 22,895$  people attended the concert on both  
nights.

- T: For 2 minutes with your partner draw a tape diagram. (Pause as they work. Circulate and encourage. One mode of delivery of instruction is to call two sets of partners to draw on the board while others work at their seats. Have the pairs then present their diagrams to the class.)
- T: (After drawing.) Now how can you calculate to solve the problem?
- S: We can find the number of people on Sunday night, and then add that number to the people on Saturday night.
- T: Make an estimate of the solution. Explain your reasoning to your partner.
- S: Rounding to the nearest thousand, the number of people on Saturday night was about 12,000. The number of people fewer on Sunday night can be rounded to 2,000, so the estimate for the number of people on Sunday is 10,000. 12,000 + 10,000 is 22,000.
- T: Find the exact number of people who attended the concert on both nights. What is the exact sum?
- S: 22,895.



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- T: Compare the actual and estimated solutions. Is your answer reasonable?
- S: Yes, because 22,895 is near our estimate of 22,000.
- T: Be sure to write a statement of your solution.

## Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.

## **Student Debrief (13 minutes)**

**Lesson Objective:** Solve two-step word problems using the standard subtraction algorithm fluently modeled with tape diagrams and assess the reasonableness of answers using rounding.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson. You may choose to use any combination of the questions below to lead the discussion.

- How did your estimate help you determine that your exact answer was correct in Problem 1?
- Why was the estimate so much smaller than the exact answer in Problem 1?
- In Problem 2, how close was your actual answer to your estimate?
- In Problem 3, to which place did you round? Why?
- How did your tape diagram help you solve Problem 5?

ame _	Jack		Date	
	ns: Estimate first and then s wer is reasonable.	olve each problem. Mo	del the problem with a tape of	diagram. Explain if
			Tuesday, they sold 18,023 p sold 62,409 pounds of potate	
	About how many pounds of value to the nearest thousar		ell on Wednesday? Estimate	by rounding each
Ma	onday 25,196 $\approx$ :	25,000	I	
	lésday 18,023≈ otal 62,409≈	62,000	5,000 18,000 P 25,000 67,000 8,000 - 43,000 43,000 19,000	The farm sold about 19,000 POUnds of Potatoes On Wednesday.
b. F	Find the precise number of p	oounds of potatoes sold	on Wednesday.	
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		7 + 18,023	57,409 - 43,219 - 19,190	
	25,196 18,023 P	25,196 + 18,023 +3,219	19,190	
		d 19,190 pound	s of potatoes on l	vedue cday.
s	sentence to explain your rea	isoning.	stimate from (a) to your ans	
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Lesson 16

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Solve two-step word problems using the standard subtraction algorithm fluently modeled with tape diagrams and assess the reasonableness of answers using rounding. 3/25/14



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- How do you determine what place value to round to when finding an estimate?
- What is the benefit of checking the reasonableness of your answer?
- Describe the difference between rounding and estimating.

#### Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

	nore pages in the second week than in the first week.
How many pages had they read by the end of the s you know using estimation.	econd week? Is your answer reasonable? Explain how
	5,452
3,452 2 3,000	
4,090 = 4,000	
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LU BOD	3,452 4,090
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+7,000	The class read 10,994 pages by the
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by the end of the second week.	My answer is reasonable because
	My estimate was 10,000 which is very
	close to 10,994.
	CLOSE TO COLLETT.
A cargo plane weighed 500,000 pounds. After the pounds. Then 16,478 more pounds were taken off.	first load was taken off, the airplane weighed 437,981
pounds. Then 16,478 more pounds were taken off. removed from the plane? Is your answer reasonab	first load was taken off, the airplane weighed 437,981 . What was the total number of pounds of cargo .le? Explain.
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pounds. Then 16,478 more pounds were taken off removed from the plane? Is your answer reasonab 500,000 P $437,981437,981 \approx 4443,000$	first load was taken off, the airplane weighed 437,991 . What was the total number of pounds of cargo le? Explain. $\frac{v_{1}^{2}}{\sqrt{2}}\frac{\lambda}{\sqrt{2}}\frac{\lambda}{\sqrt{2}}\frac{w}{\sqrt{2}}$ $-\frac{4}{\sqrt{2}}7,961}$ $\frac{1}{\sqrt{2},019}$ , $P = 62,019$ $\frac{62}{\sqrt{2}},019$ $+\frac{1}{\sqrt{2}}\frac{w}{\sqrt{2}}$
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pounds. Then 16,478 more pounds were taken off removed from the plane? Is your answer reasonab 500,000 P $431,981437,981 \approx 445,006\frac{8}{200},000-440,000$	$ \begin{array}{c} & \text{first load was taken off, the airplane weighed 437,991} \\ & \text{What was the total number of pounds of cargo le? Explain.} \\ & \frac{1}{\sqrt{28}} \frac{1}{\sqrt{8}} \frac{1}{\sqrt{69}} \frac{1}{\sqrt{28}} \frac{1}{\sqrt{69}} \frac{1}{\sqrt{22}} $
pounds. Then 16,478 more pounds were taken off removed from the plane? Is your answer reasonab 500,000 P $437,981437,981 \approx 440,000\frac{8}{8}gp_{0},000$	first load was taken off, the airplane weighed 437.981 . What was the total number of pounds of cargo le? Explain. $\frac{1}{2}\frac{3}{2}\frac$
pounds. Then 16,478 more pounds were taken off removed from the plane? Is your answer reasonab 500,000 P $431,981437,981 \approx 445,006\frac{8}{200},000-440,000$	first load was taken off, the airplane weighed 437.981 What was the total number of pounds of cargo le? Explain. $\frac{2}{5}\frac{3}{5}\frac{3}{5}\frac{3}{5}\frac{3}{5}\frac{1}{5}$ $=\frac{4}{52.7}, \frac{481}{52.7}$ $=\frac{1}{52.7}, \frac{1}{51}$ $=\frac{1}{52.7}, \frac{1}{51}$ $=\frac{1}{7}\frac{1}{5}, \frac{1}{1}\frac{1}{5}$ $=\frac{1}{7}\frac{1}{5}, \frac{1}{1}\frac{1}{5}$ $=\frac{1}{7}\frac{1}{5}, \frac{1}{1}\frac{1}{5}$ $=\frac{1}{7}\frac{1}{5}, \frac{1}{1}\frac{1}{5}$ $=\frac{1}{7}\frac{1}{5}, \frac{1}{1}\frac{1}{5}$ $=\frac{1}{7}\frac{1}{5}, \frac{1}{1}\frac{1}{5}$ $=\frac{1}{7}\frac{1}{5$
pounds. Then 16,478 more pounds were taken off removed from the plane? Is your answer reasonab 500,000 $P$ $\frac{1}{431,981}$ $\frac{1}{8}$ $\frac{1}{9}$ $\frac{1}{300}$ $\frac{1}{1000$	first load was taken off, the airplane weighed 437.981 What was the total number of pounds of cargo le? Explain. $\frac{2}{5}\frac{3}{6}\frac{3}{7}\frac{3}{6}\frac{3}{10}\frac{10}{10}$ $\frac{-4.37, 9.81}{-6.2, 0.19}$ $\frac{6.2, 0.19}{-6.2, 0.19}$ $\frac{4.2, 0.19}{-7.6, 14.97}$ 7.6, 14.97 7.6, 14.97
pounds. Then 16,478 more pounds were taken off removed from the plane? Is your answer reasonab 500,000 $P$ $\frac{1}{431,981}$ $\frac{1}{8}$ $\frac{1}{9}$ $\frac{1}{300}$ $\frac{1}{1000$	first load was taken off, the airplane weighed 437.981 What was the total number of pounds of cargo le? Explain. $\frac{2}{5}\frac{3}{6}\frac{3}{7}\frac{3}{6}\frac{3}{10}\frac{10}{10}$ $\frac{-4.37, 9.81}{-6.2, 0.19}$ $\frac{6.2, 0.19}{-6.2, 0.19}$ $\frac{4.2, 0.19}{-7.6, 14.97}$ 7.6, 14.97 7.6, 14.97
pounds. Then 16,478 more pounds were taken off removed from the plane? Is your answer reasonab 500,000 P $431,981437,981 \approx 449,000\frac{8}{2}90,000-440,000\frac{1}{6,000}$	first load was taken off, the airplane weighed 437.981 What was the total number of pounds of cargo le? Explain. $\frac{2}{5}\frac{3}{5}\frac{3}{5}\frac{3}{5}\frac{3}{5}\frac{1}{5}$ $=\frac{4}{52.7}, \frac{481}{52.7}$ $=\frac{1}{52.7}, \frac{1}{51}$ $=\frac{1}{52.7}, \frac{1}{51}$ $=\frac{1}{7}\frac{1}{5}, \frac{1}{1}\frac{1}{5}$ $=\frac{1}{7}\frac{1}{5}, \frac{1}{1}\frac{1}{5}$ $=\frac{1}{7}\frac{1}{5}, \frac{1}{1}\frac{1}{5}$ $=\frac{1}{7}\frac{1}{5}, \frac{1}{1}\frac{1}{5}$ $=\frac{1}{7}\frac{1}{5}, \frac{1}{1}\frac{1}{5}$ $=\frac{1}{7}\frac{1}{5}, \frac{1}{1}\frac{1}{5}$ $=\frac{1}{7}\frac{1}{5$

Lesson 16



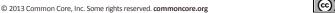
Lesson 16:

Date:

Solve two-step word problems using the standard subtraction algorithm fluently modeled with tape diagrams and assess the reasonableness of answers using rounding. 3/25/14



1.E.44





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Α	Write in centimeters.			÷	# Correct
1	2 m =	cm	23	1 m 2 cm =	cm
2	3 m =	cm	24	1 m 3 cm =	cm
3	4 m =	cm	25	1 m 4 cm =	cm
4	9 m =	cm	26	1 m 7 cm =	cm
5	1 m =	cm	27	2 m 7 cm =	cm
6	7 m =	cm	28	3 m 7 cm =	cm
7	5 m =	cm	29	8 m 7 cm =	cm
8	8 m =	cm	30	8 m 4 cm =	cm
9	6 m =	cm	31	4 m 9 cm =	cm
10	1 m 20 cm =	cm	32	6 m 8 cm =	cm
11	1 m 30 cm =	cm	33	9 m 3 cm =	cm
12	1 m 40 cm =	cm	34	2 m 60 cm =	cm
13	1 m 90 cm =	cm	35	3 m 75 cm =	cm
14	1 m 95 cm =	cm	36	6 m 33 cm =	cm
15	1 m 85 cm =	cm	37	8 m 9 cm =	cm
16	1 m 84 cm =	cm	38	4 m 70 cm =	cm
17	1 m 73 cm =	cm	39	7 m 35 cm =	cm
18	1 m 62 cm =	cm	40	4 m 17 cm =	cm
19	2 m 62 cm =	cm	41	6 m 4 cm =	cm
20	7 m 62 cm =	cm	42	10 m 4 cm =	cm
21	5 m 27 cm =	cm	43	10 m 40 cm =	cm
22	3 m 87 cm =	CM © Bill D		11 m 84 cm =	cm

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Lesson 16:

Date:

Solve two-step word problems using the standard subtraction algorithm fluently modeled with tape diagrams and assess the reasonableness of answers using rounding. 3/25/14



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В	Write in centimeters.	rite in centimeters.		
1	1 m =	cm 23	1 m 1 cm =	cm
2	2 m =	cm 24	1 m 2 cm =	cm
3	3 m =	cm 25	1 m 3 cm =	cm
4	7 m =	cm 26	1 m 9 cm =	cm
5	5 m =	cm 27	2 m 9 cm =	cm
6	9 m =	cm 28	3 m 9 cm =	cm
7	4 m =	cm 29	7 m 9 cm =	cm
8	8 m =	cm 30	7 m 4 cm =	cm
9	6 m =	cm 31	4 m 8 cm =	cm
10	1 m 10 cm =	cm 32	6 m 3 cm =	cm
11	1 m 20 cm =	cm 33	9 m 5 cm =	cm
12	1 m 30 cm =	cm 34	2 m 50 cm =	cm
13	1 m 70 cm =	cm 35	3 m 85 cm =	cm
14	1 m 75 cm =	cm 36	6 m 31 cm =	cm
15	1 m 65 cm =	cm 37	6 m 7 cm =	cm
16	1 m 64 cm =	cm 38	4 m 60 cm =	cm
17	1 m 53 cm =	cm 39	7 m 25 cm =	cm
18	1 m 42 cm =	cm 40	4 m 13 cm =	cm
19	2 m 42 cm =	cm 41	6 m 2 cm =	cm
20	8 m 42 cm =	cm 42	10 m 3 cm =	cm
21	5 m 29 cm =	cm 43	10 m 30 cm =	cm
22	3 m 89 cm =	© Bill Davids	11 m 48 cm =	cm

© Bill Davidson



Lesson 16:

Date:

Solve two-step word problems using the standard subtraction algorithm fluently modeled with tape diagrams and assess the reasonableness of answers using rounding. 3/25/14



1.E.46



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Name

Date \_\_\_\_\_

Directions: Estimate first and then solve each problem. Model the problem with a tape diagram. Explain if your answer is reasonable.

- 1. On Monday, a farm sold 25,196 pounds of potatoes. On Tuesday, they sold 18,023 pounds. On Wednesday, they sold some more potatoes. In all, they sold 62,409 pounds of potatoes in the 3 days.
  - a. About how many pounds of potatoes did the farm sell on Wednesday? Estimate by rounding each value to the nearest thousand and then compute.

b. Find the precise number of pounds of potatoes sold on Wednesday.

c. Is your precise answer reasonable? Compare your estimate from (a) to your answer from (b). Write a sentence to explain your reasoning.



Lesson 16:

Date:

Solve two-step word problems using the standard subtraction algorithm fluently modeled with tape diagrams and assess the reasonableness of answers using rounding. 3/25/14



- 2. A gas station had two pumps. Pump A dispensed 241,752 gallons. Pump B dispensed 113,916 more gallons than Pump A.
  - a. About how many gallons did both pumps dispense? Estimate by rounding each value to the nearest hundred thousand and then compute.
  - b. Exactly how many gallons did both pumps dispense?
  - c. Assess the reasonableness of your answer in (b). Use your estimate from (a) to explain.
- 3. Martin's car had 86,456 miles on it. Of that distance, Martin's wife drove 24,901 miles, and his son drove 7,997 miles. Martin drove the rest.
  - a. About how many miles did Martin drive? Round each value to estimate.
  - b. Exactly how many miles did Martin drive?
  - c. Assess the reasonableness of your answer in (b). Use your estimate from (a) to explain.



Lesson 16:

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Solve two-step word problems using the standard subtraction algorithm fluently modeled with tape diagrams and assess the reasonableness of answers using rounding. 3/25/14



1.E.48

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 A class read 3,452 pages the first week and 4,090 more pages in the second week than in the first week. How many pages had they read by the end of the second week? Is your answer reasonable? Explain how you know using estimation.

5. A cargo plane weighed 500,000 pounds. After the first load was taken off, the airplane weighed 437,981 pounds. Then 16,478 more pounds were taken off. What was the total number of pounds of cargo removed from the plane? Is your answer reasonable? Explain.



Lesson 16:

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Solve two-step word problems using the standard subtraction algorithm fluently modeled with tape diagrams and assess the reasonableness of answers using rounding. 3/25/14



1.E.49



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Date \_\_\_\_\_

Directions: Model each problem with a tape diagram. Estimate and then solve each problem. Explain if your answer is reasonable.

- 1. Quarterback Brett Favre passed for 71,838 yards between the years 1991 and 2011. His all-time high was 4,413 passing yards in one year. In his second highest year, he threw 4,212 passing yards.
  - a. About how many passing yards did he throw in the remaining years? Estimate by rounding each value to the nearest thousand and then compute.

b. Exactly how many passing yards did he throw in the remaining years?

c. Assess the reasonableness of your answer in (b). Use your estimate from (a) to explain.



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Solve two-step word problems using the standard subtraction algorithm fluently modeled with tape diagrams and assess the reasonableness of answers using rounding. 3/25/14



Name

Date \_\_\_\_\_

Directions: Model each problem with a tape diagram. Estimate and then solve each problem. Explain if your answer is reasonable.

- 1. Zachary's final project for a college course took a semester to write and had 95,234 words. Zachary wrote 35,295 words the first month and 19,240 words the second month. How many words did he write during the remaining part of the semester?
  - a. Round each value to the nearest ten thousand to estimate how many words Zachary wrote during the remaining part of the semester.

b. Find the exact number of words written during the remaining part of the semester.

c. Use your answer from (a) to explain why your answer in (b) is reasonable.



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Solve two-step word problems using the standard subtraction algorithm fluently modeled with tape diagrams and assess the reasonableness of answers using rounding. 3/25/14



- 2. During the first quarter of the year, 351,875 people purchased a particular app for their smartphones. During the second quarter of the year, 101,949 fewer people downloaded the app than during the first quarter. How many downloads occurred during the two quarters of the year?
  - a. Round each number to the nearest hundred thousand to estimate how many downloads occurred during the first two quarters of the year.

b. Determine exactly how many downloads occurred during the first two quarters of the year.

c. Determine if your answer is reasonable. Explain.

3. A local store was having a two-week Back to School sale. They started the sale with 36,390 notebooks. During the first week of the sale, 7,424 notebooks were sold. During the second week of the sale, 8,967 notebooks were sold. How many notebooks were left at the end of the two weeks? Is your answer reasonable? Explain how you know using rounding.



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Solve two-step word problems using the standard subtraction algorithm fluently modeled with tape diagrams and assess the reasonableness of answers using rounding. 3/25/14

