Title: Missing Numbers Amusement Park

Missing Numbers

Brief Overview:

The students will solve missing number problems using a variety of real life situations encountered while visiting an amusement park, Dragon's Den. The students will have to do many activities including: Meet Me Over There, Guess the Weight game, and Tickets, Tickets, Tickets.

NCTM Content Standard

Algebra

- Represent and analyze mathematical situations and structures using algebraic symbols

Problem Solving

- Apply and adapt a variety of appropriate strategies to solve problems

Grade/Level:

Grades 2-3

Duration/Length:

Time frame: 3 days (60 minute lessons)

Student Outcomes:

Students will:

- Find the missing number (unknown) in a number sentence (equation) using operational symbols (addition, subtraction, multiplication, division)
- Find the missing number(s) (unknown) on one or both sides of a number sentence.
- Identify strategies to solve missing number problems.

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Materials and Resources:

- Overhead, Meet Me Over There, TR1
- Dragon's Den Amusement Park map, SR1
- Dragon's Den Amusement Park map one per student, SR1
- Balances
- Stuffed animals
- various gram weights
- Recording sheet, What Will It Weigh? (SR1)
- How Far Is It? (SR2)

- How Far Is It?, Answer key (TR6)
- Chart Paper
- Checklist Lesson 2 – What Will It Weigh (TR3)
- Do You Have Enough Tickets, Game Cards, (SR5)
- Recording table , Do You Have Enough Tickets, (SR7)
- Game directions, Do You Have Enough Tickets, (TR5)
- Student Tickets Lesson 3 (SR6)
- Yes/No Question (TR4)
- Yes or No cards, (SR4)
- Summative Assessment, (SR8)
- Summative Assessment Answer Key, (TR7)
- BCR, SR8
- BCR rubric, TR9
- BCR Answer Key, (TR8)
- envelopes
- Number generators - Dice
- Blank dice
- Possible read aloud:
    - Fair!
      Lewin, Ted.
    - Angelina at the Fair : story
      Holabird, Katharine

Development/Procedures:

Lesson 1 **Where Will We Go?**

Preassessment

- What strategies do the students have of solving problems with missing numbers? Present an overhead (TR1) with the following problem:

  Jason was at the Bustin' Bumpers. It took him 13 steps to walk to the funnel cake stand. Then he walked to the Dragon Lair roller coaster. He took a total of 17 steps. How many steps was it from the Funnel Cake Stand to the Dragon roller coaster?

- Ask the students to generate a list of strategies that could be used to solve the problem, but do not solve the problem. (Possible answers: subtraction algorithm, draw a picture, act it out, count on, guess and check.)

Launch

- Have a class discussion about what they like to do at an amusement park. Ask, "What kinds of rides do you like to go on?" "What kind of games do you play?" "What things do you buy?" "How do you find your way around?" "Have you ever used a map?"

- Give each student a map of the park, The Dragon's Den (SR1.) Allow students' time to read and explore the map on their own. Help them locate the Entrance.
- Talk about distances between locations. Point to the entrance and Balloon stand and tell the students that the distance/steps between them is 8 steps. Call on students to identify and point to other attraction spots that appear to be about 8 steps apart. Point to the Entrance again, and tell the students that the distance from the Entrance to Dragon's Lair is 12 steps. Call on a student to find Water Waves. Then have the students find another spot that is about the same distance from Water Waves to Bustin' Bumpers.

Teacher Facilitation

- Draw the map on (TR2) on a chart or the chalkboard. The distance from Entrance to Pizza Palace should be 10; from the Entrance to Balloons, 29 steps. Say, "This is part of a large map. (Adapted from Navigating through Algebra, in Prekindergarten – Grade 2, NCTM, "How Far")
- I don't know the distance from Pizza Palace to Balloons. I'll let a square stand for that number of steps. (Draw the square on the map.)
- I know that the total distance from the Entrance to Balloons is 29 steps."
  Is the distance from the Entrance to Pizza greater than or less than the distance from the Entrance to Balloons? (Point out the line segments to be compared.) (greater) How do you know?
  How can you figure out the number of the steps the square represents?
- Demonstrate how to write an addition sentence to show the relationship: 10+□=29
- Call on a student to read the addition sentence and relate the terms to the problem (e.g., If you add the number of steps from the Entrance to the Pizza Palace and from Pizza Palace to Balloon, the sum is 29.) Explain to students that the square is a variable. It stands for a number that is missing or not known. Talk about ways to find the value of the square.
- Now show the map of the amusement park. Repeat steps using different attractions. What attractions do you see on this map?
- Ask these questions;
  How many steps is it from the Entrance to Swings? (20)
  How many steps is it from the Entrance to the Merry Go-Round ? (8)
  How many steps is it from the Merry Go-round to the Swings ?(□)
  Is the distance from the Entrance to the Swings greater than or less than the distance from the Entrance to Merry go-Round? (point out the line segments to be compared.) (greater) How do you know?
  How can you figure out the number of the steps the square represents?
- Demonstrate how to write an addition sentence to show the relationship: 8 + □ =20
- Call on a student to read the addition sentence and relate the terms to the problem (e.g., If you add the number of steps from the Entrance to Merry Go-Round and from the Merry go-Round to the swings, the sum is 20.) Explain to

students that the square is a variable. It stands for a number that is missing or not known. Talk about ways to find the value of the square.

Student Application

- Now the students will work individually to assess their understanding of the concept. Give the student's worksheet "How Far Is It?"(SR2) They will solve equations with a missing number. The teacher should give individual attention to anyone who needs further assistance. Class can discuss different strategies used in solving equations.

Embedded Assessment

- Teacher should be looking for an understanding and the student's ability to create an equation that represents the problem and then solve. This can be done through observation during group and individual work, discussion, and whole class responses. Also the "How Far Is It?" will be collected to identify how well the students grasped the concept.

Reteaching

- Work in small groups to solve the following problem.
- Have each student look at the Dragon's Den Amusement Park Map. Present the following problem: You can walk anywhere in the park, but you can only walk 20 steps. How many places can you walk? Who can come up with the most locations? Who can get as close to 20 as possible?
- Students should record possible answers as number sentences.

Extension –

- Have each student look at the Dragon's Den Amusement Park Map. Present the following problem: You can walk anywhere in the park, but you can only walk 50 steps. How many places can you walk? Who can come up with the most locations? Who can get as close to 50 as possible?
- Students should record possible answers as number sentences.

Lesson 2 **Guess the Weight**

Preassessment

- Review the strategies that were used in the previous lesson.
- Show the map of the Amusement park. Yesterday the students made up questions about walking to different activities in the park. Present the class with 1 or 2 of these problems. Solve together as a class.
- Example: Nick walked to the following places at the Amusement Park:
    - The Entrance to the *Pizza Palace* (10 steps).
    - Then to the *Scaly Express* (8 steps).
    - Next he walked to the *Water Waves* (5 steps).
    - *Water Waves* to *What Will It Weigh?* (8 steps)
    - *What Will It Weigh*? to the *Balloons* (18 steps)

Launch

- Today, we are going to visit one of the games at the Dragon's Den Amusement park: *What Will It Weigh*? Your job at this game will be to discover the weight of the stuffed animal.
- The teacher will present the class with a balance. The teacher will explain the parts of the balance and how it is like an equation.

Teacher Facilitation

- Place a small bear on the right side of the balance.
- Ask how we can find out the weight of the bear. We can use the gram weights to weigh the bear. If the balance is even, then we will have found the weight of the bear.
- Demonstrate this process to the class.
- Use this information to solve problems. We know the weight of the bear and now we want to know the weight of the bear and other animals.
- At all times you will have the bear on the right side of the balance and the weights on the left side.
- We know that they are equal. Now I want to know the weight of another animal, a bunny.
- How can we solve for this unknown weight? Which side of the balance should it go on? (The left side)
- Add the bunny to the left side of the balance.
- What happened to the balance? The balance is now uneven.
- Add more gram weights to the right side of the balance.
- The total weight, 12 grams.
- I still do not know the weight of the second animal. I need to solve for the unknown. Do I know how much the bunny weighs? Yes, Why?
- Explain. The bunny weighs the amount of grams that were added to the balance.
- Now show how this represented an algorithm. We know that the bear is 5 grams, the second animal is unknown, and the total is 12.
- The equation will be: 5 + Bunny = 12.
- Therefore, 5+? =12. 5+7=12.
- Bunny equals 7.

Student Application

- Now the students will work in groups of 4 to solve for unknown weights of stuffed animals.
- They will use the known variable of the bear to help them.
- Each group will need stuffed animals of various weights, a bear of a common weight, gram weights, and a worksheet to record their information. (Adapted from Navigating through Algebra, in Pre-kindergarten – Grade 2, NCTM, "Balancing Act")
- They will model each problem using the material and record the problems and answers on the record sheet. (What Will It Weigh? SR3)

Embedded Assessment

- Walk around the classroom and observe the students as they are completing the activity. (Teacher Checklist TR3)
- Record on the Teacher Checklist what you see the students doing. How can they solve the problems? What successes or difficulties are the students encountering?

Extension

- The teacher will present to the whole class the following web site: http://illuminations.nctm.org/mathlets/expbalance/index.html
    - This web site uses a balance to show equal equations with unknown variables.

Reteaching

- http://illuminations.nctm.org/mathlets/num_balance/index.html
    - This web site uses a balance to show equal equations by creating number sentences on either side of the balance.

Lesson 3 Tickets, Tickets, Tickets

Preassessment

- Use teacher resource sheet (TR4 - as an overhead) Pass out YES/NO cards (SR4) for the students to respond to the question. Ask students to answer if this equation is correct by using their yes/no cards. Call on a student to explain why they chose their answer. Discuss the solution

Launch

- Using the map of the amusement park, The Dragon's Den, have students choose an attraction that they would like to visit first. Read chart, *Do You Have Tickets?,*(SR5)which shows the amount of tickets needed for each ride or attraction.
- Have student share with a classmate their plan for spending a day at the park. Estimate and discuss amount of tickets they would need for the day.

Teacher Facilitation

- Give each student an envelope that has tickets. (SR6) Each envelope should have varying amount from 2 – 4 tickets. Have students remove tickets and count to discover they do not have enough tickets to get on a ride.
- Ask students what is our problem? What do we need to do to solve our problem? Call on a student to write an equation that represents our situation if we wanted to ride the Dragon's Lair Rollercoaster 4+x=9. Provide assistance to students who can state the equation but have difficulty recording it.
- Repeat with 3 different envelopes

Student Application

- Have students play the game, Do You Have Enough Tickets? (TR5 and SR7)
- Using the game students will practice writing and solving equations with missing numbers. (Adapted from "Have A Wild Ride", Charlotte Keadle)

Embedded Assessment

- Assess students on understanding through teacher observation during launch and teacher facilitation activities.
- Student discussions within small groups and student discussion in large group at closing will aid in ongoing assessment. Student application will also be assessed.

Reteaching

- If the students have difficulty understanding the concept of finding the missing number in the game format, have students use number generators to create number sentences.
- Students record equation created in their math log. 4+☐=12
- When students have an understanding of solving equations they may go back to using the game format.

Extension

- Give students an opportunity to create his/her own cards and equations for another classmate to solve.
- Pose "How many tickets do you need?" problems for students to solve. Say, for example, "You have 8 tickets. You need enough tickets for your brother and you to go on the Water Waves attraction. How many more tickets do you need to purchase?
- Record the equation 8 + x = 4 +4. Point to the 8, the x, and the 4+4 one by one, and have the students tell what each symbol represents. Ask them what is the value of x?

Summative Assessment:

Have students complete the Dragon's Den Amusement Park Assessment (SR8). Together with teacher observations, How Far Is It activity, and BCR's, they will be used as a form of assessment.
The answer key can be found on TR6.

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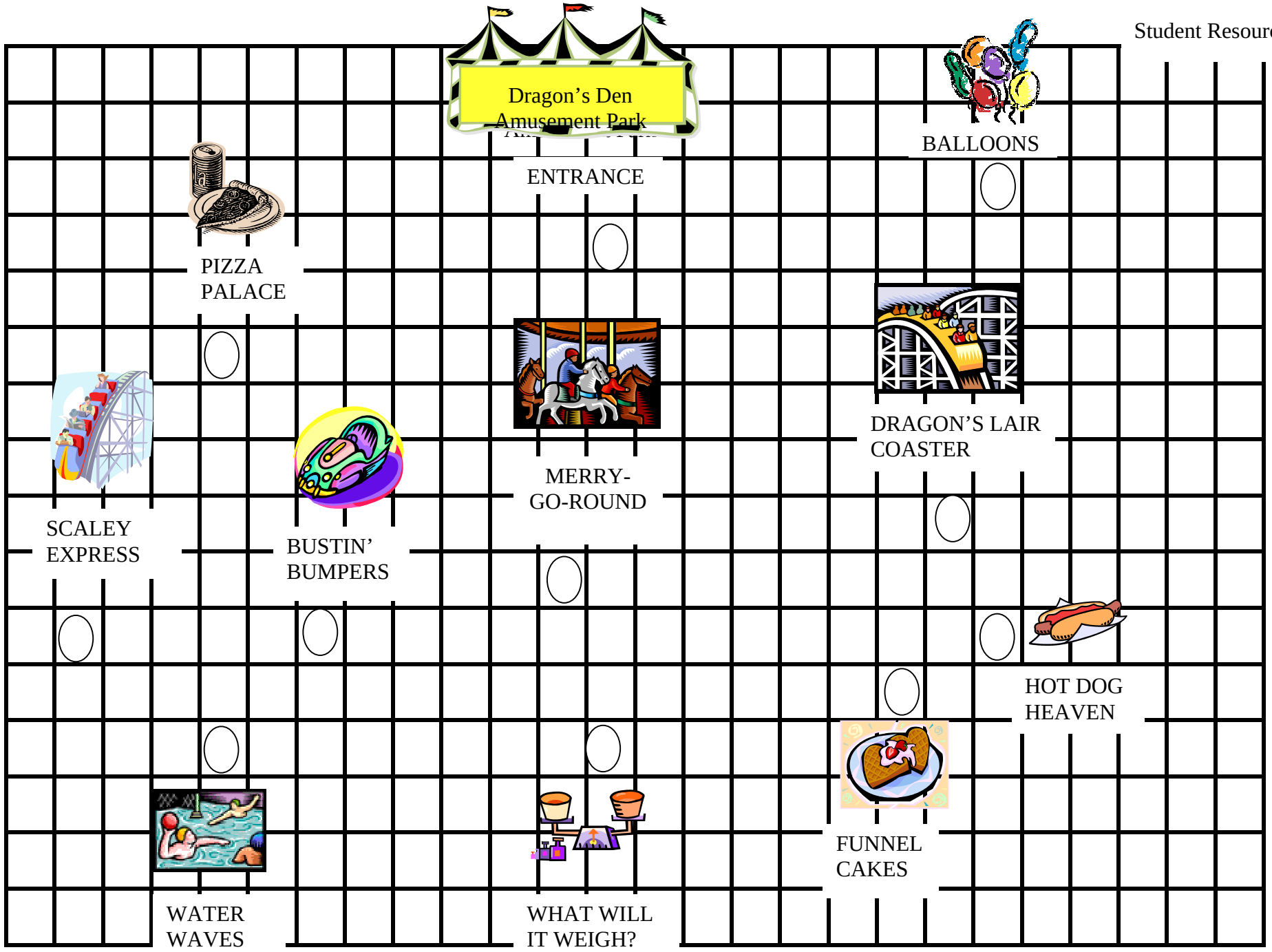


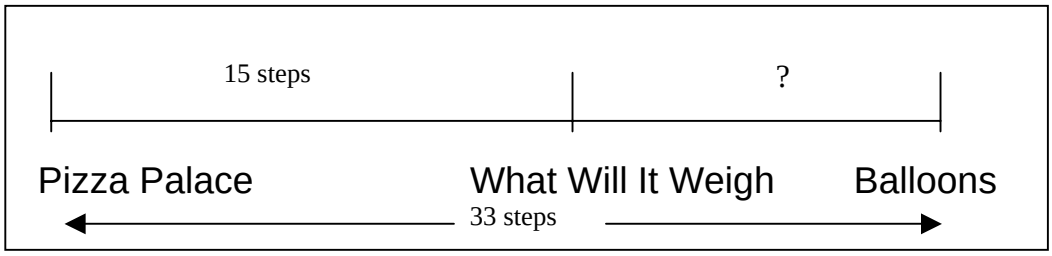
Key: 1 box = 1 step

You can only move up or down. You may not move diagonally.

Name _____ Date _____

How Far Is It?
Student Worksheet

Look at the diagrams to help you solve problems.

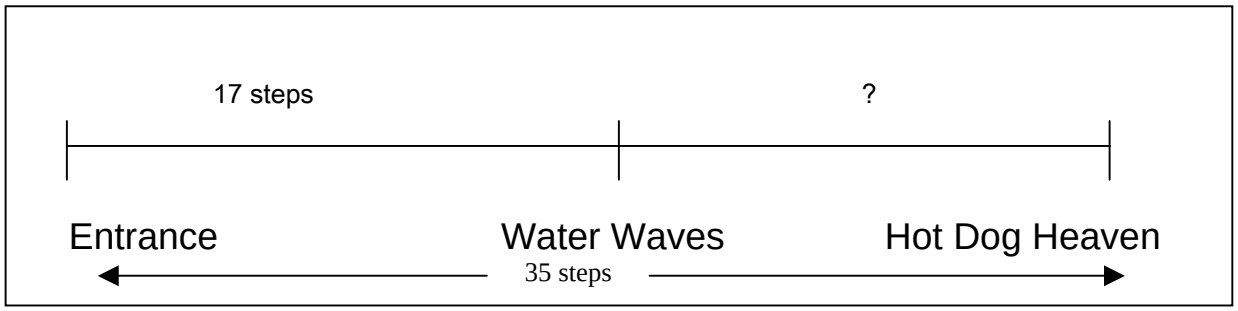


1. Equation: _____
2. ? = _____
3. How did you find the unknown amount?

_____

_____

_____



4. Equation: _____
5. ? = _____
6. How did you find the unknown amount?

_____

_____

_____

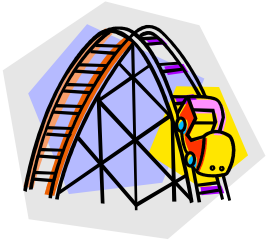
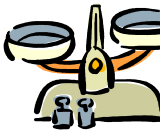
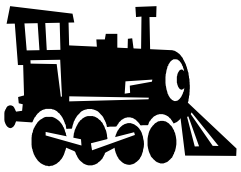
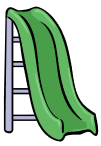
What Will It Weigh?
Student Recording Sheet

Name of Animal	Operation	Weight of Known Stuffed Animal	Equals	Total Weight	Solution for the Unknown
Bunny	+	5	=	12	Bunny = 12 - 5 Bunny =7

YES	YES	YES
YES	YES	YES
YES	YES	YES

NO	NO	NO
NO	NO	NO
NO	NO	NO

Ticket Cards

Dragon's Lair 8 tickets 	Swings 8 tickets 
Bustin' Bumpers 6 tickets 	Ferris Wheel 4 tickets 
What Will It Weigh 2 tickets 	Movies 11 tickets 
Mountain Climb 9 tickets 	Magic Show 10 tickets 
Fireworks 8 tickets 	Train 6 tickets 
Record a Song 6 tickets 	Sail a Boat 7 tickets 
Arcade Game 4 tickets 	Slide 2 tickets 
Scaly Express 9 tickets 	Merry Go Round 3 tickets 

Student Tickets

Do You Have Enough Tickets?

Number sentence	Value of the blank die	Amusement Park Activity

Name _____ Date _____

Dragon's Den Amusement Park
Summative Assessment

Solve the problem for the missing number. Circle the correct letter of your answer choice.

1. Juan walked 9 steps to the Balloon stand. Then he walked to the Dragon's Lair Roller Coaster. Juan walked a total of 18 steps. How many steps was it from the balloons to the Dragon's Lair Roller Coaster?

   Ⓐ 9 steps Ⓒ 27 steps

   Ⓑ 17 steps Ⓓ 10 steps

2. Anna walked 11 steps. She walked 4 steps from the Water Waves to the Bustin' Bumpers. From the Water Waves she walked to the Pizza Palace. How many steps is it from Bustin' Bumpers to the Pizza Palace?

   Choose the correct number sentence to show how you would solve problem.

   Ⓐ 11 + 4 = ☐ Ⓒ ☐ - 4 = 11

   Ⓑ ☐ + 4 = 11 Ⓓ ☐ + 11 = 4

3. Brianna wanted to go on the Dragon's Lair and the Scaly Express Roller Coasters. To go on both rides she would need 17 tickets, but she only had 5 tickets. How many more tickets would she need?

   Ⓐ 22 tickets Ⓒ 12 tickets

   Ⓑ 19 tickets Ⓓ 23 tickets

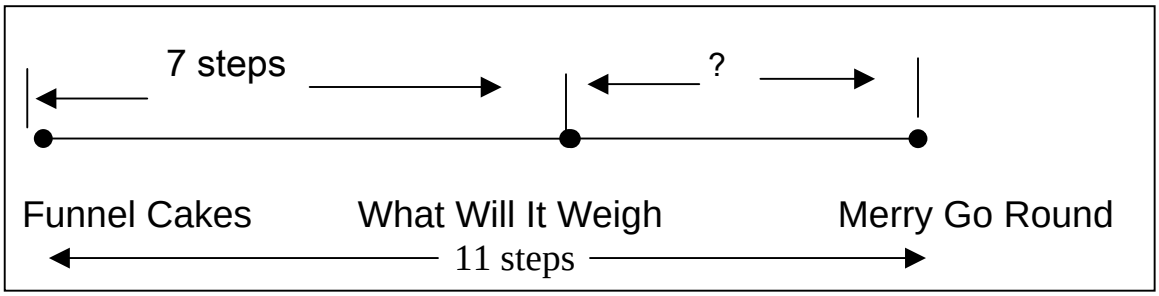
4. Solve for the unknown in the equation. ☐ + 17 = 29

Ⓐ 46 Ⓒ 12

Ⓑ 2 Ⓓ 16

Look at the diagrams to help you solve problems 5 and 6.

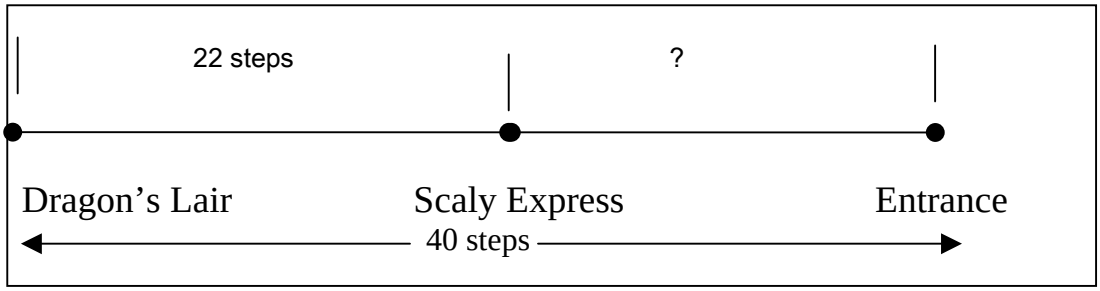
5. Solve for ?.



Ⓐ 18 steps Ⓒ 19 steps

Ⓑ 5 steps Ⓓ 4 steps

6. How would you solve for ?



Ⓐ 40 + 22 = ☐ Ⓒ ☐ - 22 = 40

Ⓑ 40 - 22 = Ⓓ 22 - ☐ = 40

Brief Constructed Response
Where Will We Go

Jason was at the Bustin' Bumpers. It took him 13 steps to walk to the funnel cake stand. Then he walked to the Dragon Lair roller coaster. He took a total of 17 steps.

Part A

How many steps was it from the Funnel Cake Stand to the Dragon roller coaster?

_____

Part B

Use what you know about problem solving to explain why your answer is correct. Use number and/or words in your explanation.

_____

_____

_____

_____

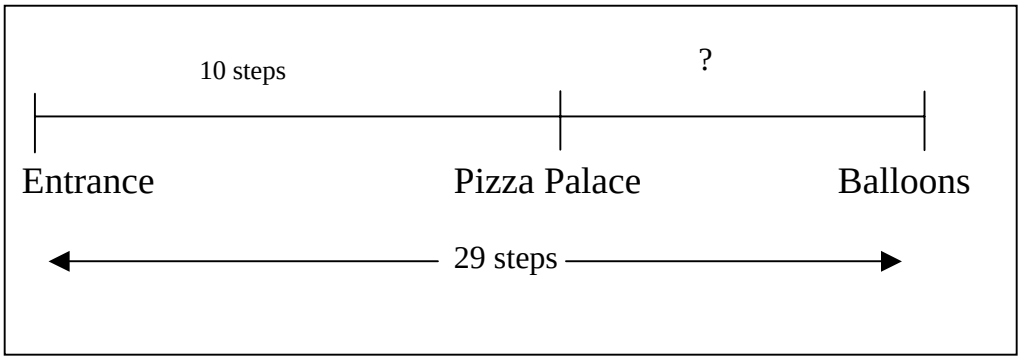
_____

_____

Teacher Overhead
Meet Me Over There

Jason was at the Bustin' Bumpers. It took him 13 steps to walk to the funnel cake stand. Then he walked to the Dragon Lair roller coaster. He took a total of 17 steps. How many steps was it from the Funnel Cake Stand to the Dragon roller coaster?

Meet Me Over There



What Will It Weigh?

Teacher Checklist (TR3)

Student Names	Did the student model the equation on the balance?	Did the student solve the equation?	Could the student explain his/her strategy?

Yes or No

Is this equation correct?

13 + ? = 17

? = 5

Game Directions
Do You Have Enough Tickets

Materials:

Ticket Game Cards and recording Sheet for each player
1 number generator (die)
1 blank number generator (die)

Directions:

1. The player whose birthday falls earliest in the year goes first.
2. Player 1 picks a game card.
3. Player 1 rolls the dice (one blank and one number generator) and constructs a number sentence using the numbers shown. Any operation or combination of operations may be used.
4. Player 1 then records the number sentence in the first column of the chart (SR5)
5. Player 1 solves for the unknown value of the blank die
6. Player 1 writes the name of the amusement park activity chosen.
7. Player 2 repeats steps 2-6.
8. If a player cannot find a combination resulting in a match, he/she must forfeit a turn.
9. Winner is the person with the most cards wins.

Variations:

1. Play in teams of 2 or 3 students.
2. Another variation is to add a second number generator.

How Far Is It?
Answer Key

1. 15 + ? = 33 or 33 – 15 = ?
2. ? = 18
3. Answer will vary
4. 17 + ? = 35 or 35 – 17 = ?
5. ? = 18
6. Answer will vary

Summative Assessment

Answer Key

1. A
2. C
3. B
4. B
5. D
6. C

BCR Answer Key

Part A: 4 steps

Part B: Use the BCR Rubric

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.**