

# Equations and Expressions

## **Brief Overview:**

In this unit, students will use manipulatives, hands-on activities, problem solving, and real-world applications to interpret expressions and evaluate equations using variables. The variables or unknowns will be represented using letters and other symbols. Each lesson allows students to demonstrate their knowledge concretely, pictorially, and abstractly.

## **NCTM Content Standard/National Science Education Standard:**

- Represent the idea of a variable as an unknown quantity using a letter or a symbol
- Express mathematical relationships using equations
- Investigate how a change in one variable relates to a change in a second variable

## **Grade/Level:**

5<sup>th</sup> Grade

## **Duration/Length:**

Three 60 minute lessons and a summative assessment.

## **Student Outcomes:**

Students will be able to:

- Write, identify, and apply expressions
- Identify, write, solve, and apply equations

## **Materials and Resources:**

### **Lesson 1**

- Teacher Resource 1 – overhead
- Teacher Resource 2 “Mystery Number” – overhead
- Teacher Resource 3 “Matching Game” – cut out
- Teacher Resource 4 “ Question” – overhead
- Teacher Resource 5 “Expressions” and answer key – overhead
- Teacher Resource 6 “I have Game” – cut out
- Teacher Resource 10 “Write Expressions Answer Key”
- Teacher Resource 11 “Journal Response – Exit Slip Answer Key”

- Pattern Blocks or Unifix Cubes
- Chart Paper
- Student Resource 1 – “Expressions”
- Student Resource 2 “Write Expressions”
- Student Resource 3 “Write and Identify Expressions – extension
- Student Resource 4 “Journal Response – Exit Slip”
- Calculators

### **Lesson 2**

- Overhead with  $S \times 6 = 64$
- Dinosaur Deals by Stuart Murphy
- Cut-out colored rectangles or 16 index cards with pictures of coins
- Student Resource 5 “Balance it Out!”
- Student Resource 6 “Level It!”
- Student Resource 7 Exit Card
- Student Resource 8 “Balance it Out!” for struggling students
- Chart paper for each pair/group of students
- Pattern Blocks or Unifix Cubes
- Scales
- Base 10 Blocks
- Teacher Resource 7 Scale – overhead
- Teacher Resource 12 “Balance it!” Answer Key
- Teacher Resource 13 “Level It Answer Key”
- Teacher Resource 17 “Balance it!” for struggling students with answers
- Teacher Resource 18 “Exit Card” answer key
- Calculators

### **Lesson 3**

- Student Resource 9 “Venn Diagram”
- Student Resource 10 “Equation Resource”
- Student Resource 11 “Equation Rotation”
- Student Resource 12 “Translating”
- Student Resource 13 “Assessment”
- Teacher Resource 8 “Equation Resource” and answer key – overhead
- Teacher Resource 9 “Equation Rotation” directions
- Teacher Resource 14 “Venn Diagram Answer Key”
- Teacher Resource 15 “Translating” answer key
- Teacher Resource 16 “Assessment” answer key
- Chart Paper

## Development/Procedures:

### Lesson 1

#### Pre-Assessment

- Display Teacher Resource 1 on the overhead.
- Read the problem aloud to students.
- Say “*Write a number sentence to explain this word problem.*”  $663 + A = D$

#### Launch

- Display overhead called Mystery Number: Teacher Resource 2.
- Read aloud “Mystery Number” to the students.
- Say: “*You can use any manipulative you choose to help you solve for the missing number. You may work with a partner.*”
- When most students are finished, have some students share responses and come to the board/overhead to demonstrate and explain how they found the missing number.

#### Teacher Facilitation

- Give half the class a card with an expression on them. Give the other half a card with a word problem (Teacher Resource 3).
- Say: “*Some of you have an expression. Some of you have a word problem. In a minute, I am going to tell you to get up and find the word problem or expression that match. In other words, if you have an expression, you are looking for a word problem that explains your expression. If you have a word problem, find the expression that explains your problem. When you find your partner, sit down next to each other.*”
- While students are looking for their partners, display the statement on the board/overhead “*Support why the expression matches the word problem*” (Teacher Resource 4).
- When students are finished, have them hold up their cards.
- Check the students’ answers.
- If the answers are correct, draw their attention to the overhead with the question.
- Have them talk with their partner about why their cards match.
- Then on a piece of chart paper, have them tape the word problem, the matching expression, and then write their justification for why the cards match.
  - For justifications, responses should include why they match.
  - They should use words to describe the math operation from the expression and why it matches the word problem.
- Share justifications with the class using their posters.
- Distribute Student Resource 1, “Expressions Resource” and display Teacher Resource 5 on the overhead. Answers can be found on Teacher Resource 5 b.
- Read with students.

- Ask “*What are some other variables that we can use with expressions?*”
- Model the first three examples on the resource sheet.
- Write the answers on the overhead while students record answers on their resource sheet.
- Say “*I knew that we did not have a number to add to 5 and when we don’t have a number we use a variable. So a number added to 5 should look like  $M + 5$ .*”
- Do the same for the next two examples.
- Have students complete the last two examples on their own.
- Have students share their answers and explain why their answers makes sense.

### **Student Application**

- Using cards from Teacher Resource 6, play the game, “I Have.” Cut strips apart and give one to each student.
- Give each student Student Resource 2, “Writing Expressions.”
- Read directions aloud and have students complete independently.

### **Embedded Assessment**

Students will complete a Journal Response, Student Resource 4 “Journal Response – Exit Slip.”

### **Reteaching/Extension**

- Use Student Resource 2 to reteach students who struggled with the concept.
- For students who need an extension use Student Resource 3 with larger numbers and more wordy problems.

## **Lesson 2**

### **Pre-Assessment**

- Post the following equation on the overhead/board.  

$$S \times 4 = 64$$
- Ask students to write down how they would solve this problem. Emphasize that the students do not need to solve the problem. They need to explain how they would solve it.
  - Students may say they estimated, used guess and check strategy, division, and drew a picture
- Have students discuss with each other their way of solving and then ask some students to share with the class.

### **Launch**

- Read Dinosaur Deals by Stuart Murphy. This story develops a good understanding of a certain amount of dinosaurs on one side of the scale equaling a certain number of different dinosaurs on the other side of the scale. Some activities to do with this read aloud are:

- Using the diagrams in the story, discuss the different trades that are occurring. For example ask the students “*How many Allosaurus equals 1 Triceratops?*”
- Cut out rectangles of different colored construction paper and use them to represent each of the dinosaur cards in the story. Reread the story and have the child act out the trading of the cards.

Or –

- On 16 index cards draw different groups of coins. Each card should have a match that shows the same amount of money in different coins (for example, two quarters would match five dimes). Turn the cards face down. On alternating turns each player exposes 2 cards. If the cards match, the player keeps them and gets another turn. The player with the most cards wins.
- More possible questions and activities are displayed in the back of the book.

### **Teacher Facilitation**

- Give the students “Balance it Out!” Student Resource 5.
- Have them work in pairs or groups.
- Also, give the students shapes or any other type of manipulatives that would help them solve the problem.
- Have the students record their answers and explanations on chart paper to display and share with the class.
- Questions to ask if students are having difficulties:
  - *What can you use to represent the shapes on scale A?*
  - *What is a strategy you could use to solve for scale C? (*substitution*)*
  - *What does scale A tell you about a smiley face?*
- Students should be using manipulatives to represent the different shapes. They may also use numbers or other symbols to represent each shape.
- Students should be discussing ways of solving the problem in groups/partners.
- Students share how they solved the exploration problem with the class. (To save time, you may want to pick a few groups to share or you can have the students do a gallery walk to see each group’s poster.)
- Have a balance in the front of the class. Say: “*Just like with the scale in the story about Drew, I have a scale and I want to make both sides equal. If I put one 1000 block on this side what do I have to put on the other side to make it balance? I have no other 1000’s blocks to use.*”
- Some students might say another hundreds block. Ask: *Did anyone else think of a different way of figuring it out? Are there any other blocks that I can put on the scale to make it balance?*
- Have students come up with 3 ways of solving this problem.
- Have them think about the problem, write the problem, and then share the answer with a partner and the entire class.

- Students should begin replying with different combinations like one hundred 10 blocks, ten 100 blocks, ten 10 blocks + nine 100 blocks etc. Display student responses on the board/overhead.
- Then say: *“What if I place  $45 + 66$  on one side of the scale and  $B + 75$  on the other side of the scale, what needs to go on the other side to balance the scale?”*
- Display  $45 + 66 = B + 75$  on the board/overhead.
- Ask for student responses. They should say 36.
- Say: *“Let’s see if this is correct.”*
- Put 36 Base Ten blocks on the other side of the scale and ask students to explain why this answer is correct.
- Have students explain using the scale and what they know about numbers.
- Model how to solve this problem pictorially by drawing base ten blocks on each side of a scale
  - Distribute balances and Base Ten blocks, or other objects all weighing the same and representing numbers in the hundreds, thousands, tens, and ones to every two students or groups.
  - Display this problem from earlier in the lesson,  $45 + 66 = B + 75$ .
  - Substitute 36 for B.
  - Say: *“Explain why this is true? Have students turn to a partner and explain.*
  - If you notice a particular child gives an exceptional answer, highlight the response by repeating it to the class. If a student does not give a desired response say *“The equal sign means that both sides are the same amount. They are just represented differently.”*
  - Explain this using the base ten blocks and the scale.
  - Do the above steps for the problem  $100 + Z = 76 + 87$
  - After showing this with the scale, display Teacher Resource 7 “Scale.”
  - Model once again how to show they are equal by drawing the base ten blocks on each side. Have students work along with you using their blocks and scales.
  - Specify what a hundreds, thousands, tens, and ones block looks like when drawing them by drawing an example of each.

### **Student Application**

- Distribute Student Resource 6 “Level it!”.
- Say: *“Use the scale to show the equations on the handout.”*
- Say: *“You can use the scale for one problem. For the next problem, you can draw a picture and cross out to show each side as being equal.”*
- When students are finished, check answers as a class.
- Ask: *“How did you find the unknown number?”*
- Have students explain to the class how they found their answers.

### **Embedded Assessment**

- Distribute Student Resource 7 “Exit Card”.
- Say: *“Draw a picture to solve the equation and hand it in before you leave.”*

- Say: *“For the second equation, attempt to solve it without drawing a picture or using manipulatives.”*
- You can use this second problem as a pre-assessment for the next day.

### **Reteaching/Extension**

- When students are working on the application piece, those who are struggling can be taken to a back table. Give the scales to the students and together work through the problems using the manipulatives. Once they grasp the concept more, have the students display one or two equations pictorially.
- If there are students with Special Needs or who have quite a bit of difficulty use Student Resource 8.

## **Lesson 3**

### **Pre-Assessment**

Use the exit card from yesterday to assess whether students are able to move on to abstract representation of equations or if they need more review.

### **Launch**

- Display the problem  $21 \times \square = 189$ .
- Say: *“Create a story that explains this equation.”*
- Give students time to complete and then have students share.

### **Teacher Facilitation**

- Distribute Student Resource 9 “Expression vs. Equations” to each student.
- Give pairs of students two index cards one with an expression and one with an equation.
- Say: *“Use the Venn Diagram to note what is similar about equations and expressions.”*
  - Review yesterday’s lesson and review terminology of equation and expression. Discuss differences and similarities.
  - Say: *“Think about our lesson yesterday with balancing the scales. Explain what the symbol, =, means.”*
  - Distribute Student Resource 10 “Equation Resource.”
  - Display Teacher Resource 8 “Equation Resource.” Answer key can be found on Teacher Resource 8 b.
  - Read the definition of an equation.
  - Instruct students to read along with you.
  - Model the first two examples for the students.
  - Say: *“A number multiplied by 23 is 92. I know that “is” can mean ‘equal’ in math. I also know that there is not a number that we are multiplying times 23 so we must need a variable. Then the equation might look something like  $C \times 23 = 92$ . What is another variable we could use for this problem?”*

- Have students write down the information.
- Write down other possible answers that students give
- Say: *“A number added to 98 equals 156 added to 21. We once again do not have a number to add to 98 so this tells me that we need a variable. What is a variable that we could use to write this equation?”*
- Write down student responses on the overhead.
- Have students complete the rest of the resource sheet with a partner.
- Check answers when they are finished.
- Take the first problem  $23x = 92$ .
- Model finding the value of the unknown by using the inverse operation.
- Say: *“We need to find out what number multiplied by 23 gives us the answer of 92.”*
- Say: *“There are 2 ways you can do this. One way is to estimate what number we can multiply times 23. The other way is to use the inverse operation. What is the inverse operation of multiplication?”* (Students should say division.)
- Model finding the answer both ways.
- Say: *“For the second example ‘a number added to 98 equals 156 added to 21’ our equation was  $X + 98 = 156 + 21$ . When you have an equation like this you have to solve one side so that you know how to solve for the variable. What is  $156 + 21$ ?”*
- Wait for student responses.
- Say: *“Now we have a new equation. It is  $x + 98 = 177$ .”*
- Write this on the overhead or board.
- Say: *“Now I have to solve for the variable. One way to solve this variable is to use the inverse operation once again. What operation do you think we can use?”*
- Wait for student responses.
- Ask students to explain aloud why they said subtraction.
- Solve the problem using subtraction.

### **Student Application**

- Have students work in pairs and have them choose one of the equations from the sheet.
- Give each pair a chart paper.
- Have them write the equation on the paper.
- Then with their partner have them discuss how they might solve for the variable.
- Record on chart paper.
- Have students record a possible word problem to go with their equation.
- Have students share their posters and methods for solving each equation.
- Distribute Teacher Resource 9 “Equation Rotation Directions”, Students Resource 11 “Equation Rotation”
- Read directions aloud to students and show the students how to play using one example

**Assessment**

Game can be used for an informal assessment.

**Reteaching/Extension**

- If students are struggling with using the inverse operations then do not introduce multiplication and division. Use only addition and subtraction equations.
- Student Resource 12
- For students who need an extension, use multiple operations with the equations. For example  $X + 789 = 45 \times 123$ .

**Summative Assessment:**

The assessment contains some application problems and an extended journal response. The students have to be able to write and apply an expression to a real world situation. In addition to the application, they must take the expression and create an equation to solve how much money Frank made in all. The students should be able to identify, apply, and write an algebraic expression with 100% accuracy. They then should be able to take the expression and create an equation. When assessing the students understanding, look at their ability to write, identify, and apply expressions and equations. Their ability to add and subtract correctly is important but for this, the sole purpose of the assessment is to evaluate if the students are able to use expressions and equations.

Student Resource 13, Teacher Resource 16, (Answer Key)

**Authors:**

Kristen McCurdy  
Winfield Elementary School  
Carroll County Public Schools

Terry Wilkinson  
Ebb Valley Elementary School  
Carroll County Public Schools

# Expressions



Expression - expressions are one or a group of mathematical symbols representing a quantity. Expressions can contain numbers, symbols, or variables. Expressions **do not** contain equal signs or inequality signs.

Variable - a variable is any symbol that represents a number in an expression or equation.

What are some examples of variables?

Examples:

- A number plus five
- 3 times a number
- 3 times a number plus 5
- A number subtracted from 10
- 492 minus an unknown

**Write an Expression**

1. Sam earned \$20.00 for mowing the lawn. He earned  $d$  dollars for washing his neighbor's car. Write an expression that represents the amount of money that he earned all together.
  
2. Gregory had \$50.00 to spend. He spent \$23.75 getting his hair cut. He spent \$3.89 dollars on lunch. Write an expression that represents the amount of money that he spent all together.
  
3. Bailey had \$38.55 and spent it all in one day. She spent \$19.99 on a shirt and  $d$  dollars on a pair of pants. Write an expression that represents the amount of money that he spent on the pants.

**Write and Identify an Expression**

1. Sam earned \$20.00 for mowing the lawn. He earned  $d$  dollars for washing his neighbor's car. Write an expression that represents the amount of money that he earned all together.
2. If Sam earned \$32.50 for washing his neighbor's car, how much did he make in all?
3. Gregory had \$50.00 to spend. He spent \$23.75 getting his hair cut. He spent \$3.89 dollars on lunch. Write an expression that represents the amount of money that he spent all together.
4. How much does Gregory have left?
5. If Bailey had \$38.55 and spent it all in one day. She spent \$19.99 on a shirt and  $d$  dollars on a pair of pants. Write an expression that represents the amount of money that she spent all together.

## Journal Response – Exit Slip

Name: \_\_\_\_\_



Kristen has  $g$  number of Wii© games more than Terry.

Terry has 3 less than a dozen Wii© games.

Part A: Write an expression that demonstrates how many Wii© games Kristen has.

### Part B

Use what you know about writing expressions to explain *why* your answer is correct. Use words and numbers in your explanation.

---

---

---

---

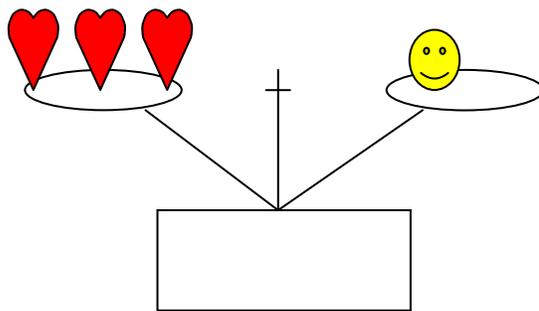
---

---

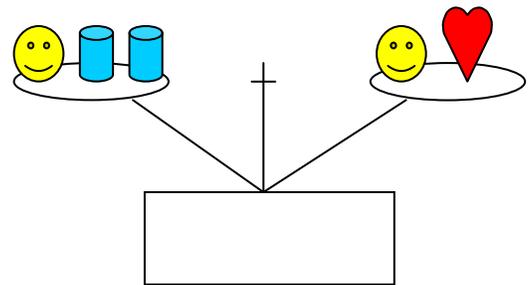


## Balance It Out!

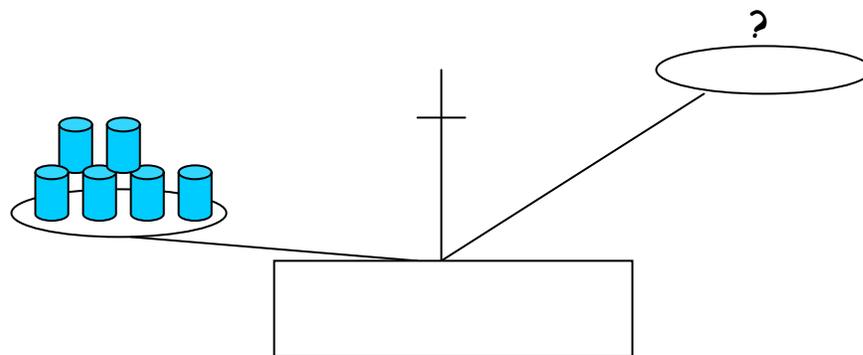
Drew was in science class and observed three different scales. Scales A and B are balanced, but scale C is not. Help Drew figure out which shapes he needs to put on scale C to balance the scale.



Scale A



Scale B



Scale C

Which shapes are needed to make scale C balanced? Explain why your answer is correct.



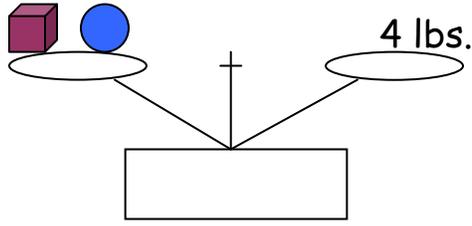
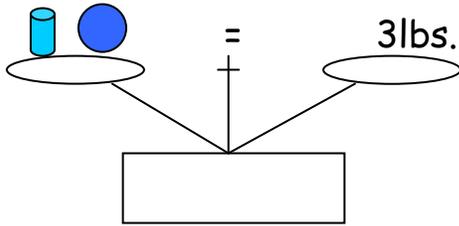
## Level It!!!

Directions: Find the weight of each block. Make a number sentence for each scale.

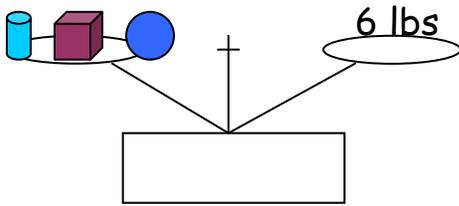
Example:

1.) + = 3lbs.

\_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_



\_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ = 6 lbs Find the weight for each shape

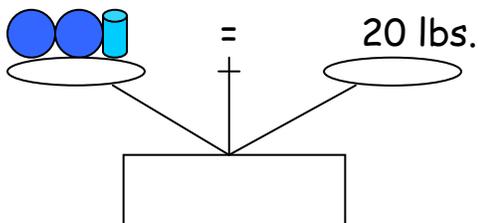
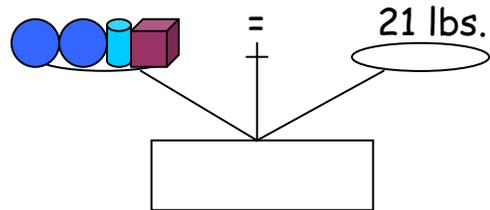
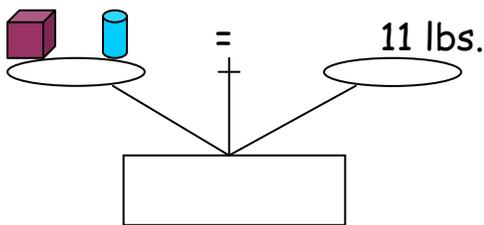


= \_\_\_\_\_

= \_\_\_\_\_

= \_\_\_\_\_

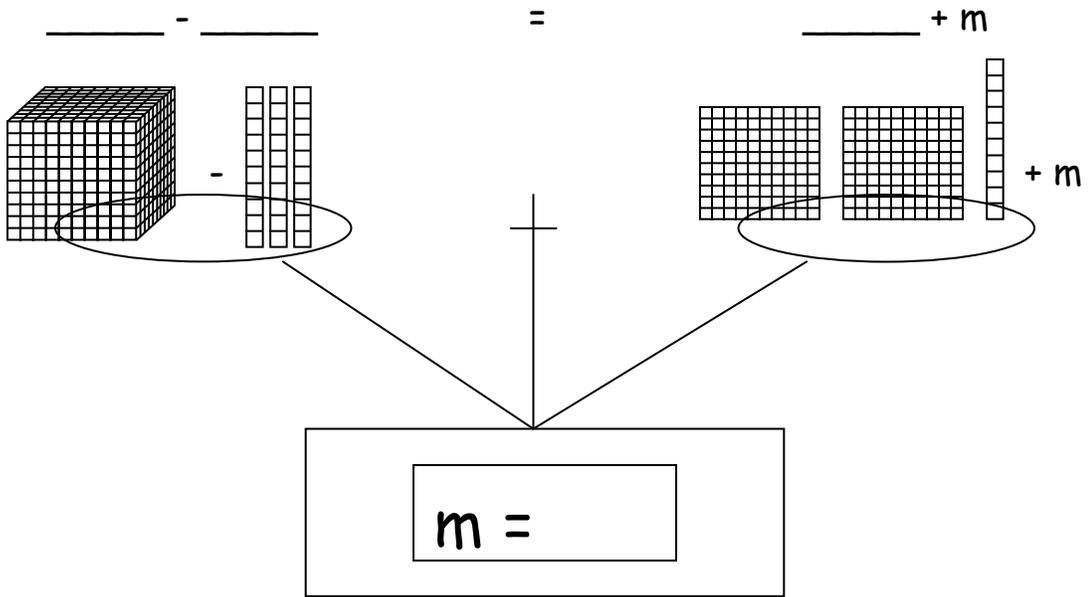
2.)



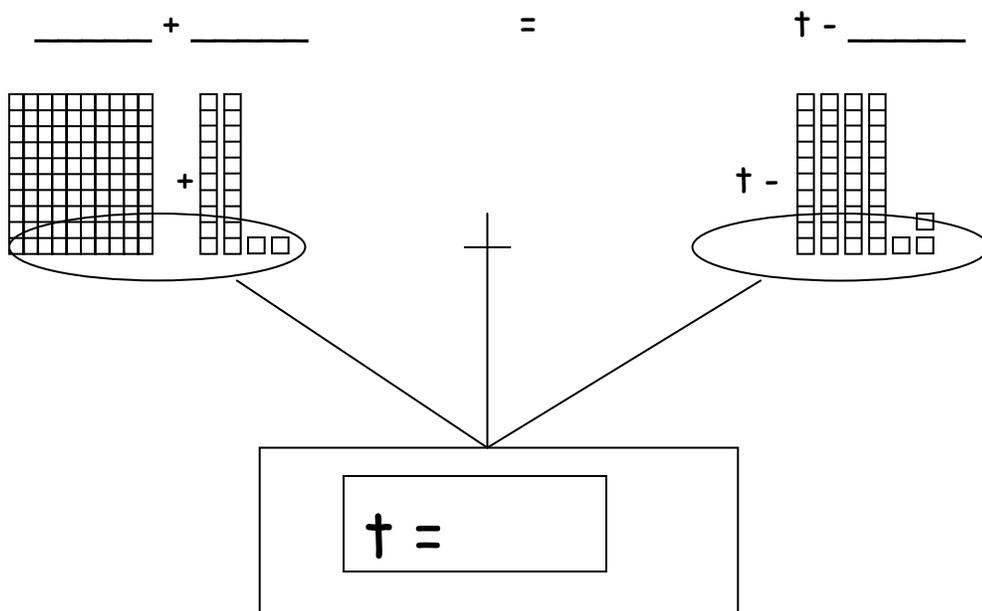
= \_\_\_\_\_ = \_\_\_\_\_

= \_\_\_\_\_

3.) Write the equation displayed on the scale. Solve for the unknown.



4.) Write the equation displayed on the scale. Solve for the unknown.



### 5.) Problem Solving

Dana carries two different backpacks to school. One backpack has 3 books inside. The other backpack has his lunch, his Nintendo DS, his baseball glove, and his trumpet. Each book weighs 12 ounces. How many ounces could the lunch, Nintendo DS, the baseball glove, and the trumpet weigh?

Are there any other possible solutions for this problem? If so, can you name 2 other possible solutions?

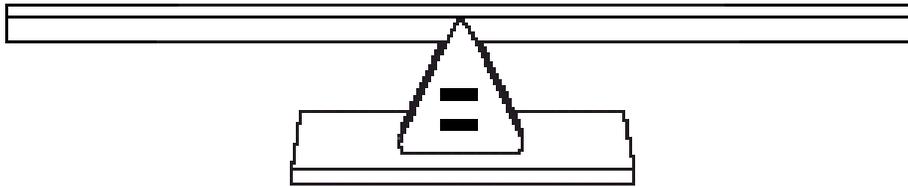
## Exit Card



Directions: Solve the equation by drawing a picture representing Base Ten Blocks.

1).

$$X + 64 = 252 + 14$$



$$X = \underline{\quad}$$

2). Try finding the unknown number without drawing a picture or using manipulatives.

$$278 + x = 863 - 291$$

$$X = \underline{\hspace{2cm}}$$

Why is your answer correct?

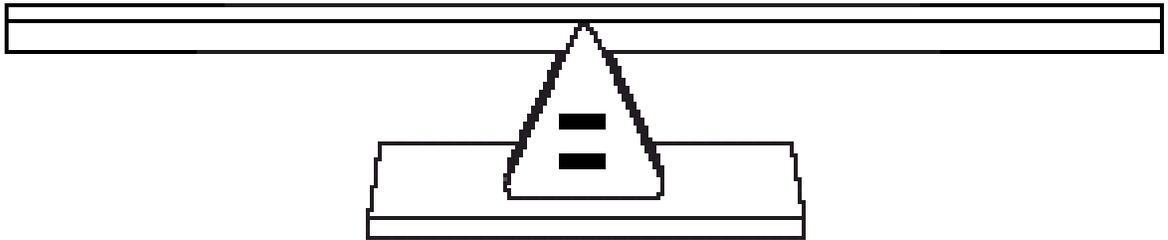
Is your answer the only possibility? Why or why not?

## Balance It Out!!!

Directions: Using your cubes and scale, find the missing number in each number sentence that will balance the scale.

Equation:  $x + 3 = 5$

$$X + 3 = 7 + 5$$

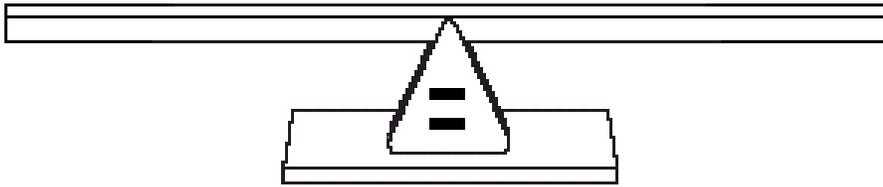


Draw a picture of what you have on your scale.

$$X = \underline{\quad}$$

2.) Equation:  $x - 5 = 4 + 9$

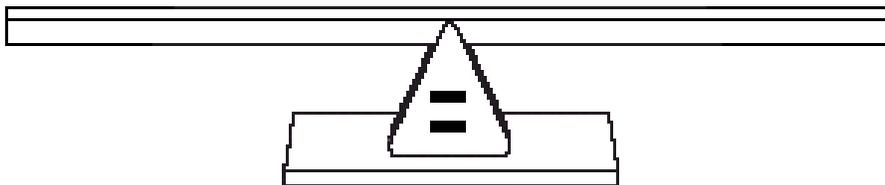
=



$x = \underline{\hspace{2cm}}$

3.) Equation:  $10 - x = 3 + 12$

=



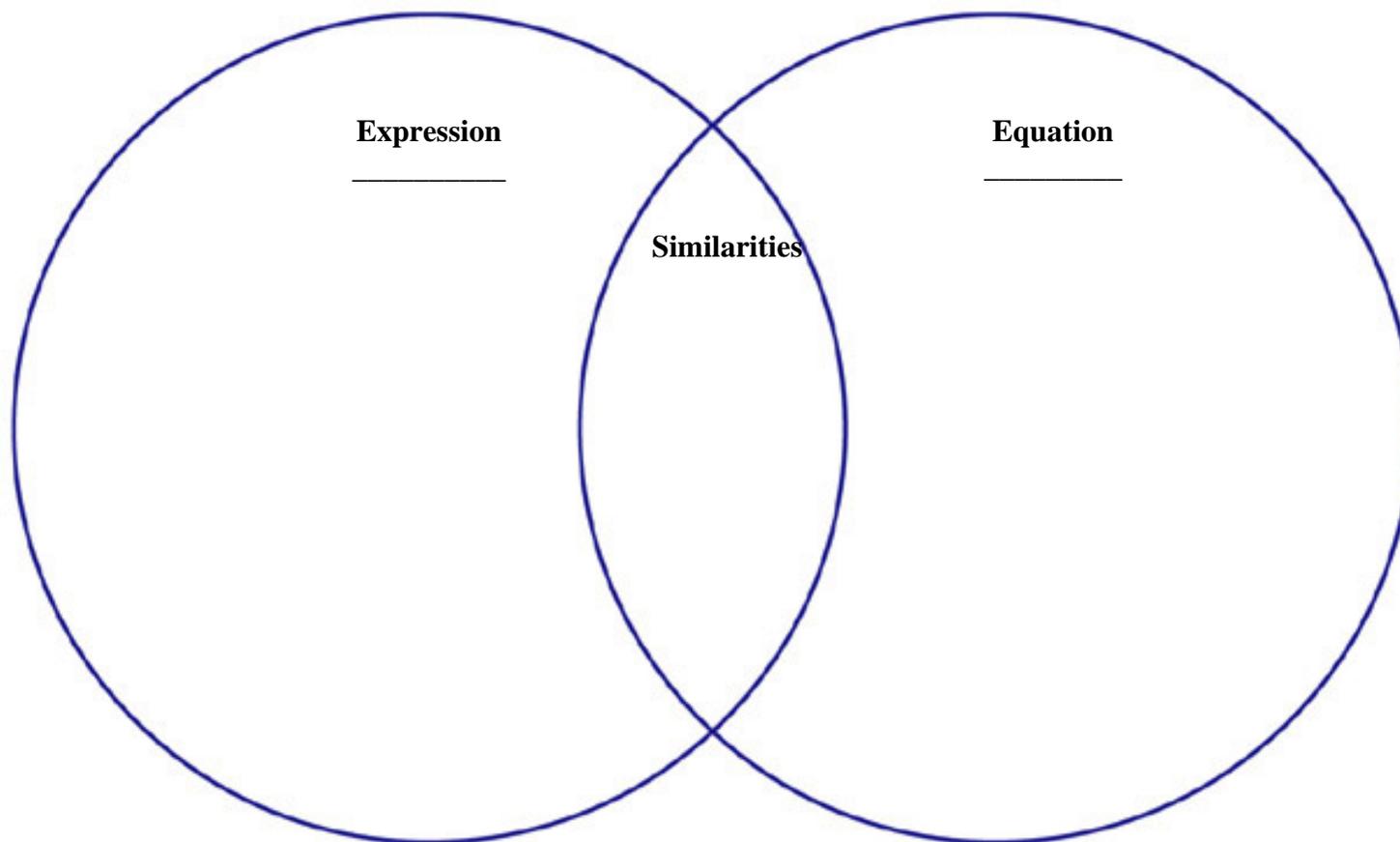
$x = \underline{\hspace{2cm}}$

Name:

Student Resource 9

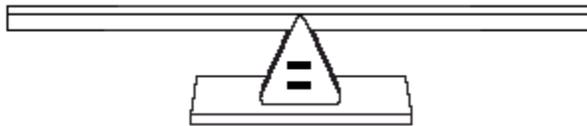
## Expressions V. Equations

**Directions:** Write the expression and the equation. Then write the similarities and differences between them



# Equations Resource

$$456 + 67 = B + 86$$



Equation: An equation is a math sentence with an equal sign. It shows that two expressions are equal or have the same value.

A number multiplied by 23 is 92

A number added to 98 equals

156 added to 21

A number subtracted from 987

is the same as 457 added to

123

A number subtracted from 765

equals 231 added to 276

A number multiplied by 41

equals a 100 added to 64

# Equation Rotation

## Student Record Sheet

Copy Problem

Write Equation

Solve for Unknown

1.

2.

3.

4.

5.

6.

7.

Copy Problem

Write Equation

Solve for Unknown

8.

9.

10.

11.

12.

13.

14.

Copy Problem  
15.

Write Equation

Solve for Unknown

16.

Translating Verbal Statements

# Into Equations

Express each of the following problems algebraically. Solve for  $n$ .  
(Hint: Use  $n$  as the unknown number and create an equation from the problem.)

1. A number minus 26 is 18

$$n - 26 = 18$$

$$n = 44$$

2. 7 more than 2 times a number is 13

3. The product of 5 and a number is 10

4. six times a number subtracted from 49 is 5

5. two less than three times a number is 28

6. Twice the sum of a certain number and 26 is 72



## Expression and Equations Assessment

Directions: Read each problem and answer carefully.

### Expressions:

1. Herman bought a new DVD for \$9.96. He also bought a new movie for  $d$  dollars. Write an expression that shows how much money he spent all together.
2. Beth had  $n$  number of video games. She sold 16 to Game Stop and got \$63.25 in return. Write an expression to show how many games she has left over.

### Equations:

3. Complete the table.

Problem	Equation	Value for the unknown
---------	----------	-----------------------

3 times a number plus

5 is  $23 + 9$

A number subtracted

from 15 times 42 is

124

4. Cody buys three erasers. Each eraser costs 10 cents. Payton buys two spiral pencils and two markers. She pays the same amount as Cody does. The pencils cost the same. The markers cost the same. The prices of erasers, pencils, and markers are different. What could the prices of each pencil and each eraser be?

## Extended Journal Response

**5. In the summer, Frank mows lawns for his neighborhood. For each lawn he mows, Frank receives \$45.25. He mowed an unknown number of lawns this summer**

**Part A:** Write an expression to represent how much money he earned this summer.

---

### Part B

- Use what you know about expressions and algebra to explain why your answer is correct. Use numbers and words in your explanation.
- If Frank mowed 23 lawns this summer plus weeded 15 flower beds for \$10 each, how much money does Frank earn this summer? Explain why your answer is correct using words and numbers.

---

---

---

---

---

---

---

---

Terry drove to Richmond, Virginia from Orlando, Florida. The distance is about 663 miles. She then drove to a city in South Dakota. How many miles did she drive in all?

# Mystery Number



Some frogs, dragonflies, and turtles were sitting around the pond. There were a total of 122 frogs, dragonflies, and turtles. There were 4 times as many dragonflies as there were frogs.

There are 22 turtles. There are 2 less turtles than frogs. How many frogs are around the pond?

How many dragonflies? (Answer: 22 Turtles; 24 Frogs; 96 Dragonflies)

$$100 - m$$

$$w - 100$$

$$s \div 100$$

$$100 \div x$$

$$100 + v$$

$$100n$$

$$\$12.95 - m \quad w - \$12.95$$

$$(\$12.95 + s) - \$12.95 \div x$$
$$\$15.00$$

$$\$12.95 + v \quad \$12.95n$$

Sam collects rocks and has saved 100 rocks. To help his friend start his own rock collection. He gave away an unknown amount of rocks. How many rocks did Sam give away?

There are an unknown number of yards to make field hockey fields across the United States. Each field hockey field is 100 yards. How many field hockey fields are there in the United States?

Greg has 100 CDs in his collection. After his birthday, he bought a number of new CDs. How many CD's does Greg have in all?

There is an unknown amount of gallons of water supplied to your school. During the first week, your school drank 100 gallons. How many gallons does the school have left?

There are 100 desks available to distribute to different classes. There is an unknown number of rooms. How many desks will each classroom get?

Peyton Manning throws an average of 100 passes per game. He has played in an unknown number of games. About how many passes does he throw for the season?

Sally had \$12.95 when she went to the grocery store. She spent an unknown amount of money. Write an expression that shows how much money Sally got back.

Pedro received \$12.95 from his mother. He already had an unknown amount of money in his sock drawer. He then spent \$15.00 on a CD. Write an expression that shows how much money Pedro has left.

Frank had an unknown amount of money and spent \$12.95 on a new shirt. Write an expression that shows how much money Frank has left after buying the shirt.

Sandra had \$12.95 to buy sodas. She bought an unknown amount of sodas. Write an expression to show how many sodas Sandra bought.

In her checking account, Kim had \$12.95. She deposited an unknown amount of money. Write an expression to show how much money Kim has all together.

For allowance, each of the children received \$12.95.

Write an expression that shows how much money was given in all.

Support why the expression  
matches the word problem.

# Expressions



Expression - expressions are one or a group of mathematical symbols representing a quantity. Expressions can contain numbers, symbols, or variables. Expressions **do not** contain equal signs or inequality signs.

Variable - a variable is any symbol that represents a number in an expression or equation.

What are some examples of variables?

Examples:

A number plus five  
3 times a number  
3 times a number plus 5  
A number subtracted from 10  
492 minus an unknown

# Expressions



Expression - expressions are one or a group of mathematical symbols representing a quantity. Expressions can contain numbers, symbols, or variables. Expressions **do not** contain equal signs or inequality signs.

Variable - a variable is any symbol that represents a number in an expression or equation.

What are some examples of variables?

*Any symbol, letter, or shape constitutes as a variable. Answers will vary*

Examples:

A number plus five	$N + 5$
3 times a number	$3n$
3 times a number plus 5	$3y + 5$ or $(3 \times y) + 5$
A number subtracted from 10	$10 - y$
492 minus an unknown	$492 - w$

I have  $n - 4$

Who has a number plus twenty-five?

I have  $x + 25$

Who has a dozen minus a number?

I have  $12 - c$

Who has an unknown times 50?

I have  $g \times 50$

Who has 10 plus a number minus 2?

I have  $10 + w - 2$

Who has 100 divided by an unknown?

I have  $100 \div s$

Who has 24 times an unknown?

I have  $24n$

Who has three times a number plus 6?

I have  $3n + 6$

Who has a number subtracted from 693?

I have  $693 - p$

Who has the number of days in a week plus an unknown?

I have  $7 + m$

Who has the number of quarts in 10 gallons minus a number?

I have  $40 - a$

Who has 6 times a number plus seventy-nine?

I have  $6x + 79$

Who has  $100 + 70 + 4$  subtracted from an unknown?

I have  $w - 174$

Who has a number times itself?

I have  $g \times g$  or  $g^2$

Who has a number times 45?

I have  $45h$

Who has the number of inches in a foot subtracted from an unknown?

I have  $y - 12$

Who has 100 times a number plus 66?

I have  $100s + 66$

Who has an unknown divided by 43?

I have  $r \div 43$

Who has 4,000 minus 1 plus a number?

I have  $3,999 + h$

Who has 4 multiplied by 6 minus a number?

I have  $24 - u$

Who has the number of pints in a quart times an unknown?

I have  $2 \times k$

Who has a number plus one million?

I have  $m + 1,000,000$

Who has the quadruple the amount of an unknown?

I have  $4c$

Who has 20,000 times a number?

I have  $20,000 \times Q$

Who has the number of feet in a yard subtracted from an unknown?

I have  $t - 3$

Who has a number plus the number of days in 3 weeks?

I have  $r + 21$

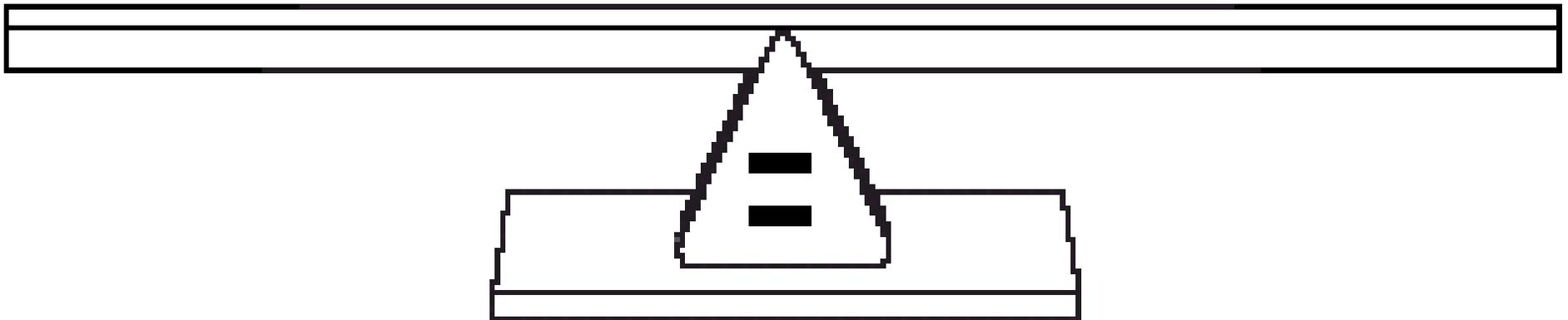
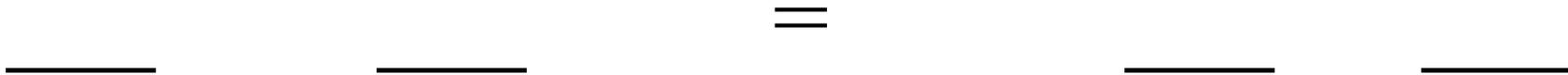
Who has 50 times 5 plus an unknown?

I have  $250 + y$

Who has  $70 \div 7$  minus an unknown

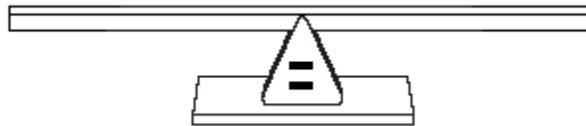
I have  $10 - h$

Who has  $12 \div 3$  subtracted from a number?



# Equations Resource

$$456 + 67 = B + 86$$



Equation: An equation is a math sentence with an equal sign. It shows that two expressions are equal or the same value.

A number multiplied by 23 is 92

A number added to 98 equals

156 added to 21

A number subtracted from 987

is the same as 457 added to

123

A number subtracted from 765

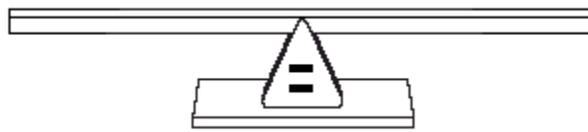
equals 231 added to 276

A number multiplied by 41

equals a 100 added to 64

# Equations Resource

$$456 + 67 = B + 86$$



Equation: An equation is a math sentence with an equal sign. It shows that two expressions are equal or the same value.

A number multiplied by 23 is 92  $C \times 23 = 92$   
 $23C = 92$

A number added to 98 equals  
156 added to 21  $X + 98 = 156 + 21$

A number subtracted from 987  
is the same as 457 added to  
123  $987 - T = 457 + 123$

A number subtracted from 765  
equals 231 added to 276  $765 - S = 231 + 276$

A number multiplied by 41  
equals a 100 added to 64  $V \times 41 = 100 + 64$   
 $41V = 100 + 64$

# Equation Rotation

Need:

- Glue
- Scissors
- 16 sheets of Construction Paper

Before the Game:

1. Print out the game cards from the bottom of this document.
2. Fold all of the construction paper in half. ("Hamburger Style")
3. On the front of the construction paper, randomly glue all of the answer cards with the creases towards the top.
4. In the inside of the construction paper, glue all of the problem cards. Make sure the problem and its answer are not grouped together on the same piece of construction paper.
5. Hang all of the cards around the room. The students will be rotating to the different cards.

Playing the Game:

1. Have the students work in pairs.
2. Have each pair of students start at a card that is hung around the room. The beginning point does not matter.
3. The students open the card, record the problem, create the equation, and solve for the unknown. They record all of this information on Student Resource 11.
4. Give the students a few minutes to complete each equation.
5. When the students are done solving for the unknown, it is time to switch. The answers to all of the equations are on the front of the cards. The students locate their answer displayed on a different card that is in the room. If the students cannot find their answer, they have done something incorrectly, and you may need to assist them.
6. The students move to the card that corresponds with their answer from the equation that they just completed.
7. Then, the students open the new card, copy the problem, create the equation, and solve for the unknown.
8. The students continue to travel around the room until they have solved all of the equations or until enough time has passed.

## Problems

## Answers

23 plus a number  $w$  is 65  $w = 42$

A number  $w$  minus 61 is 28  $w = 89$

A number  $w$  divided by 4 is 3  $w = 12$

The difference between 52 and a number  $w$  is 3  $w = 49$

Nine times a number  $w$  is 54  $w = 6$

A number  $w$  multiplied by 3 is 21  $w = 7$

A number  $w$  plus 76 is 172  $w = 96$

70 divided by a number  $w$  is 10  $w = 7$

A number  $w$  minus  $w = 79$

33 is 46

6 times a number  $w$   $w = 2$

is 12

A number  $w$

multiplied by 10 is  $w = 8$

80

A number  $w$  plus 40  $w = 56$

is 96

A number  $w$  divided  $w = 44$

by 11 is 4

12 times a number  $w$   $w = 8$

is 96

25 divided by a  $w = 5$

number  $w$  is 5

69 plus a number  $w$   $w = 83$

is 152

### Write an Expression



1. Sam earned \$20.00 for mowing the lawn. He earned  $d$  dollars for washing his neighbor's car. Write an expression that represents the amount of money that he earned all together.

$$\text{\$}20.00 + d$$

2. Gregory had \$50.00 to spend. He spent \$23.75 getting his hair cut. He spent  $m$  dollars on lunch. Write an expression that represents the amount of money that he spent all together.

$$\text{\$}23.75 + m \quad (\text{note: } \text{\$}50.00 \text{ is extra information not needed})$$

3. If Bailey had \$38.55 and spent it all in one day. She spent \$19.99 on a shirt and  $d$  dollars on a pair of pants. Write an expression that represents the amount of money that she spent all together.

$$\text{\$}19.99 + d \quad (\text{note: } \text{\$}38.55 \text{ is extra information not needed})$$

### Write and Identify an Expression



1. Sam earned \$20.00 for mowing the lawn. He learned  $d$  dollars for washing his neighbor's car. Write an expression that represents the amount of money that he earned all together.

$$\text{\$}20.00 + d$$

2. If Sam earned \$32.50 for washing his neighbor's car, how much did he make in all?

$$\text{\$}20.00 + \text{\$}32.50 = \text{\$}52.50$$

3. Gregory had \$50.00 to spend. He spent \$23.75 getting his hair cut. He spent  $m$  dollars on lunch. Write an expression that represents the amount of money that he spent all together.

$$\text{\$}23.75 + m \quad (\text{\$}50.00 \text{ is extra information not needed})$$

4. If Gregory spent \$4.89 for lunch, how much does Gregory have left?

$$\text{\$}50.00 - \text{\$}23.75 - \text{\$}4.89 = \text{\$}21.36$$

5. If Bailey had \$38.55 and spent it all in one day. She spent \$19.99 on a shirt and  $d$  dollars on a pair of pants. Write an expression that represents the amount of money that she spent all together.  $\text{\$}19.99 + d$  ( $\text{\$}38.55$  is extra information not needed)

6. If Bailey spent 14.99 on a pair of pants, how much money does she have left?

$$\text{\$}38.55 - \text{\$}19.99 - \text{\$}14.99 = \text{\$}3.57$$

**Brief Constructed Response – Exit Slip**

Name: \_\_\_\_\_



Kristen has  $g$  number of Wii© games more than Terry.  
Terry has 3 less than a dozen Wii© games.

Part A: Write an expression that demonstrates how many Wii© games Kristen has.

Terry has 9 Wii© games. Therefore, Kristen has  $9 + g$  or  $g + 9$  Wii© games

**Part B**

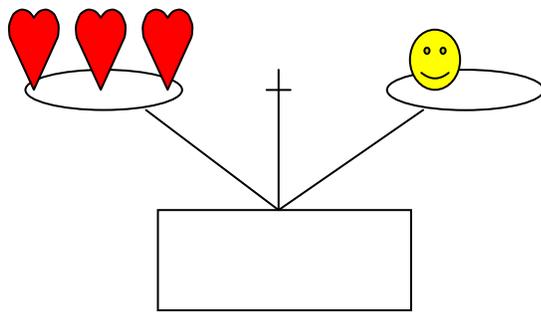
Use what you know about writing expressions to explain *why* your answer is correct. Use words and numbers in your explanation.

Answers will vary; however student should say that Terry has 9 Wii© games because she has 3 less than a dozen. A dozen has 12, so if she has 3 less, she has 9. Because Terry has 9 games, and Kristen has an unknown, or  $g$  amount of games more than Terry, the expression that demonstrates how many games Kristen has is  $9 + g$ . Some vocabulary that the student should include is expression, and a variable or unknown.

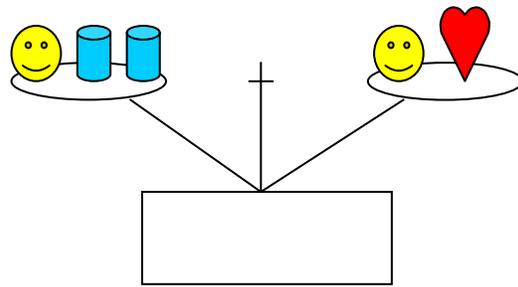


## Balance It Out!

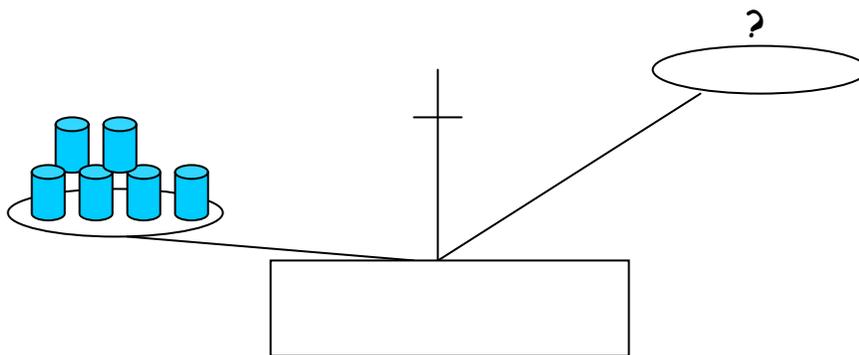
Drew was in science class and observed three different scales. Scales A and B are balanced, but scale C is not. Help Drew figure out which shapes he needs to put on scale C to balance the scale.



Scale A



Scale B



Scale C

Which shapes are needed to make scale C balanced? Explain why your answer is correct.

Answer could be 3 hearts

Answer could be 1 smiley face



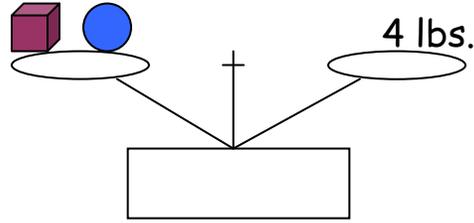
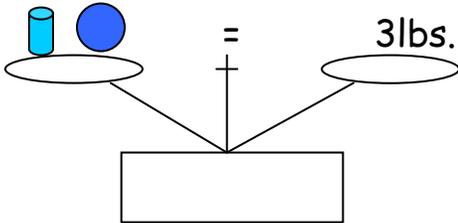
## Level It!!!

Directions: Find the weight of each block. Make a number sentence for each scale

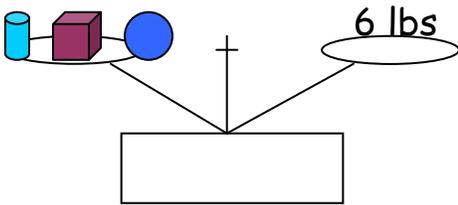
Example:

1.)  $\text{Cylinder} + \text{Ball} = 3 \text{ lbs.}$

$\text{Cube} + \text{Ball} = 4 \text{ lbs.}$



$\text{Cylinder} + \text{Cube} + \text{Ball} = 6 \text{ lbs}$  Find the weight for each shape



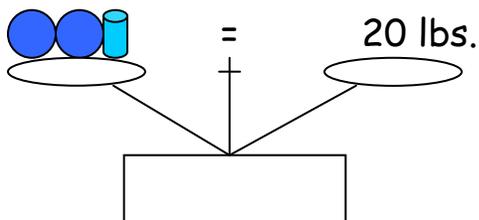
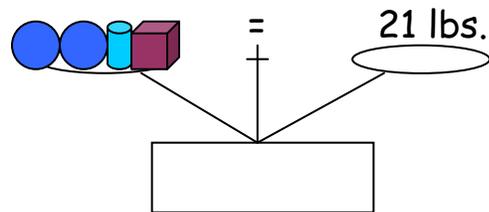
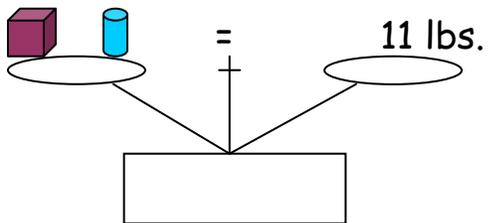
$\text{Cylinder} = 2$

$\text{Cube} = 3$

$\text{Ball} = 1$

---

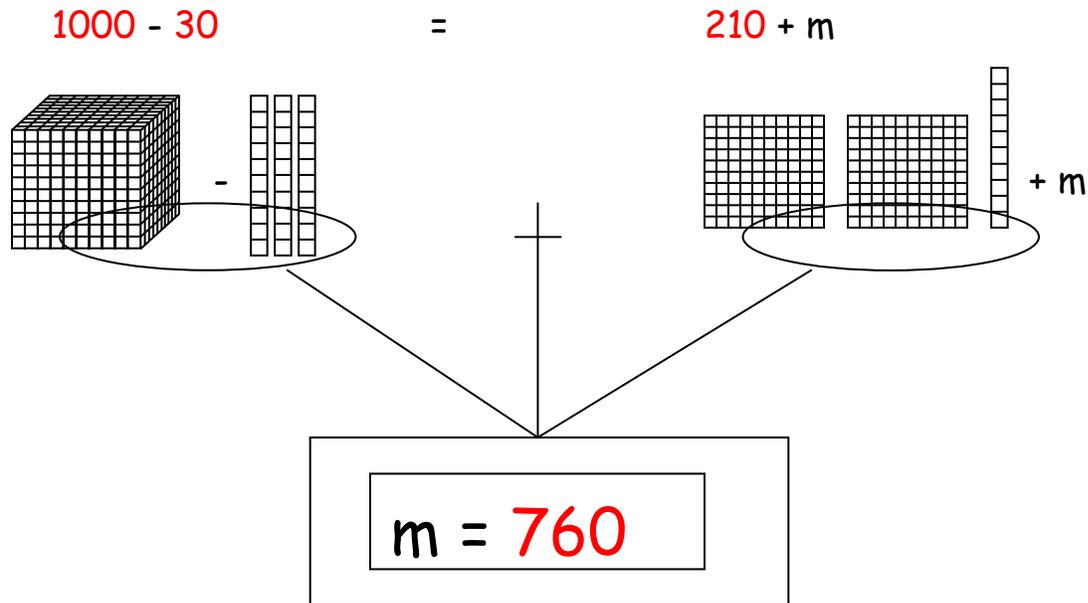
2.)



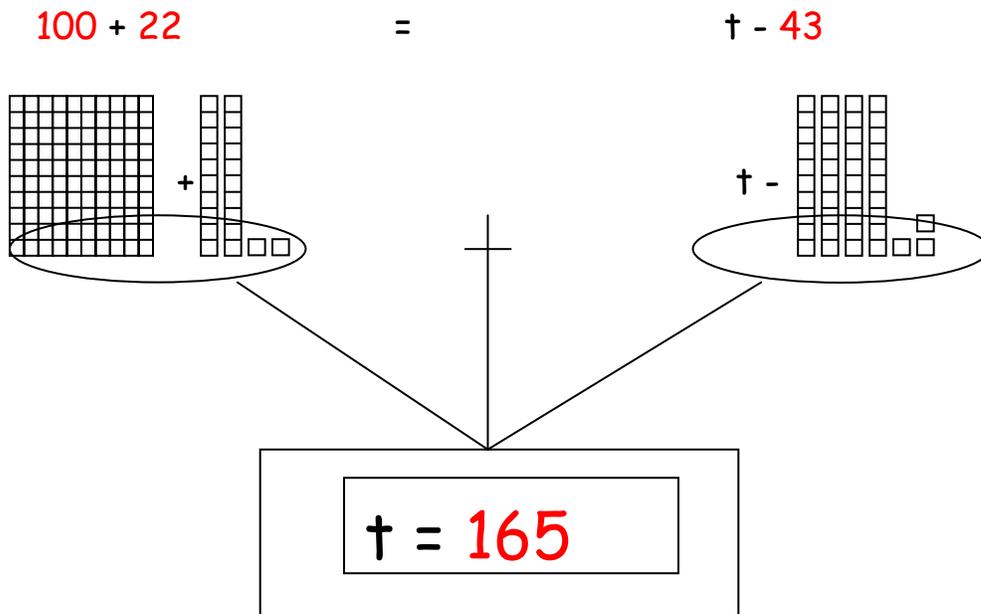
$\text{Cylinder} = 10$        $\text{Ball} = 5$

$\text{Cube} = 1$

3.) Write the equation displayed on the scale. Solve for the unknown.



4.) Write the equation displayed on the scale. Solve for the unknown.



### 5.) Problem Solving

Dana carries two identical backpacks that weight the same amount to school. One backpack has 3 books inside. The other backpack has his lunch, his Nintendo DS, his baseball glove, and his trumpet. Each book weighs 12 ounces. How many ounces could the lunch, Nintendo DS, the baseball glove, and the trumpet weigh?

*Answers will vary*

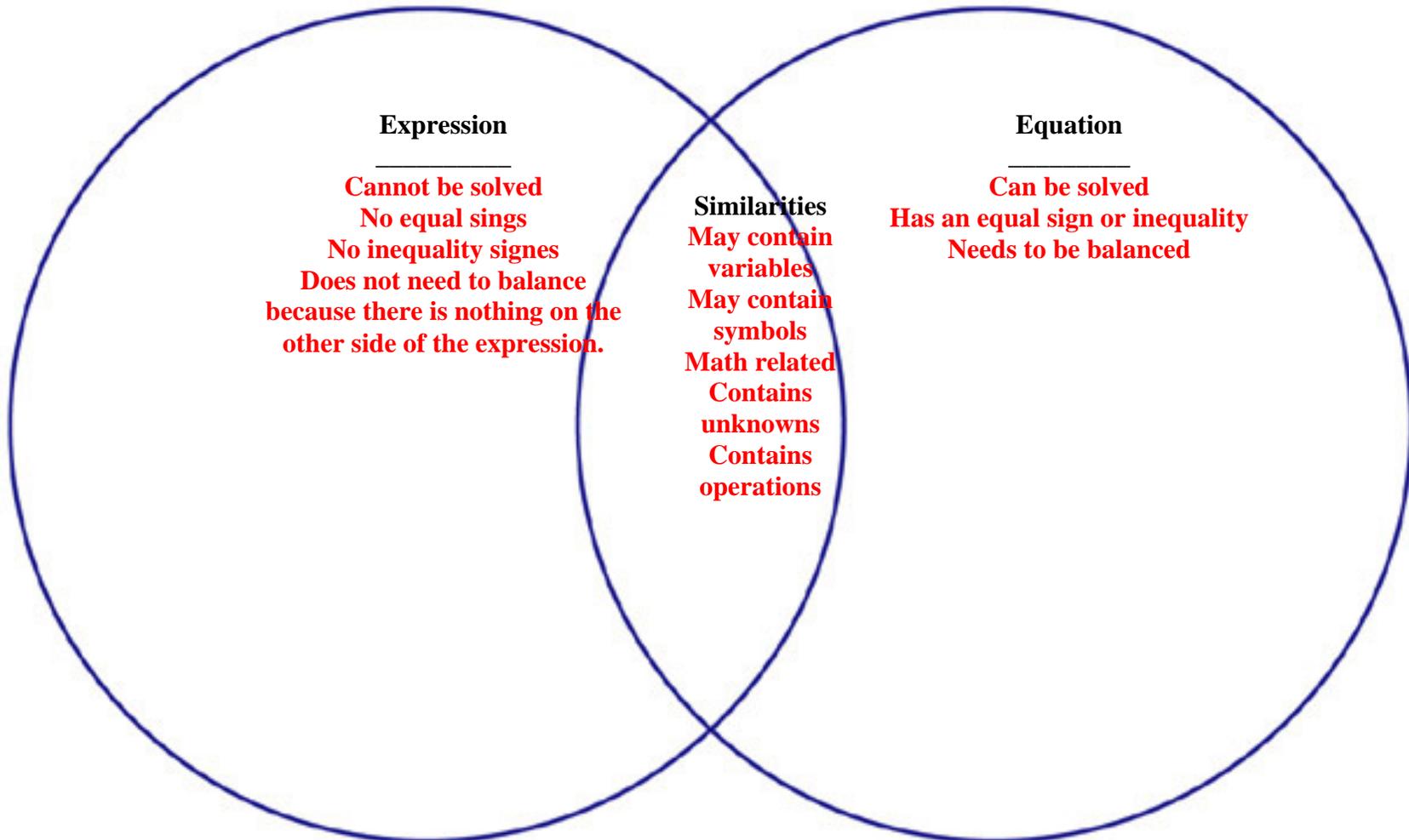
*Possible answers are: Lunch 6 ounces; DS 2 ounces; Baseball glove 10 ounces; Trumpet 18 ounces. No matter what, the four items needs to equal the weight of the three books which is 36 ounces.*

Are there any other possible solutions for this problem? If so, can you name 2 other possible solutions?

*Yes, there are other possible answers. All combined weights of the lunch, the DS, the baseball glove, and the trumpet needs to equal 36 ounces.*

## Expressions V. Equations

Directions: Write the expression and the equation. Then write the similarities and differences between them



## Translating Verbal Statements Into Equations

Express each of the following problems algebraically. Solve for  $n$ .  
(Hint: Use  $n$  as the unknown number and create an equation from the problem.)

1. A number minus 26 is 18

$$n - 26 = 18$$

$$n = 44$$

2. 7 more than 2 times a number is 13

$$2x + 7 = 13$$

$$x = 3$$

3. The product of 5 and a number is 10

$$5x = 10$$

$$x = 2$$

4. six times a number subtracted from 49 is 5

$$49 - 6x = 5$$

$$x = 7$$

5. two less than three times a number is 28

$$3x - 2 = 28$$

$$x = 10$$

6. Twice the sum of a certain number and 26 is 72

$$2x + 26 = 72$$

$$x = 23$$



## Expression and Equations Assessment

Directions: Read each problem and answer carefully.

### Expressions:

- Herman bought a new DVD for \$9.96. He also bought a new movie for  $d$  dollars. Write an expression that shows how much money he spent all together.

$$\$9.96 + d$$

- Beth had  $n$  number of video games. She sold 16 to Game Stop and got \$63.25 in return. Write an expression to show how many games she has left over.

$$n - 16$$

### Equations:

- Complete the table.

Problem	Equation	Value for the unknown
3 times a number plus 5 is $20 + 3$	$3n + 5 = 23 + 9$ or $3n + 5 = 32$	$n = 6$
6 times a number subtracted from 80 is 38	$80 - 6c = 38$	$c = 7$

- Cody buys three erasers. Each eraser costs 10 cents. Payton buys two spiral pencils and two markers. She pays the same amount as Cody does. The pencils cost the same. The markers cost the same. The prices of erasers, pencils, and markers are different. What could the prices of each pencil and each eraser be?

Answers Vary; however, the cost for Payton's supplies needs to equal 30 cents, the cost of Cody's erasers. Also, the cost of each eraser, pencil, and pencil cannot be the same. One example could be:  
 $10 + 10 + 10 = 8 + 8 + 6 + 6$

30 cents (Cody's erasers) = 16 cents (Payton's pencils) + 12 cents (Payton's markers)

## Extended Journal Response

**In the summer, Frank mows lawns for his neighborhood. For each lawn he mows, Frank receives \$45.25. He mowed an unknown number of lawns this summer**

**Part A:** Write an expression to represent how much money he earned this summer.

$\$45.25 \times M$  or  $\$45.25M$

### Part B

- Use what you know about expressions and algebra to explain why your answer is correct. Use numbers and words in your explanation.

- If Frank mowed 23 lawns this summer plus weeded 15 flower beds for \$10 each, how much money does Frank earn this summer? Explain why your answer is correct using words and numbers.

Students' responses will vary; however, students should explain how they received their

answer. Because Frank gets paid \$45.25 for each lawn, and the number of lawns is

unknown, you would have to multiply \$45.25 by the number of lawns to know how much

Frank earned in all.

Since Frank mowed 23 lawns, you would have to multiply \$45.25 times 23 and get

\$1040.75 for mowing lawns. Then, Frank weeded 15 flower beds at \$10 each, so he

earned \$150 for weeding. After earning \$1040.75 for mowing and \$150 for weeding,

Frank earned a total of \$1190.75.

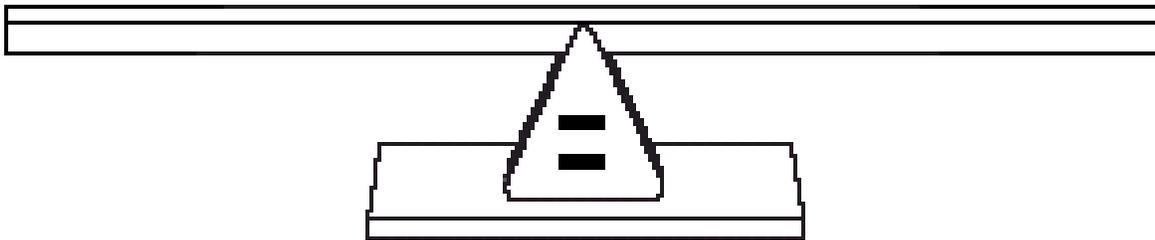
## Balance It Out!!!

Directions: Using your cubes and scale, find the missing number in each number sentence that will balance the scale.

Equation:  $x + 3 = 5$

$$X + 3 = 7 + 5$$

Students should draw a picture on the scale to help them solve. They can draw blocks, circles, or other symbols to represent wholes.

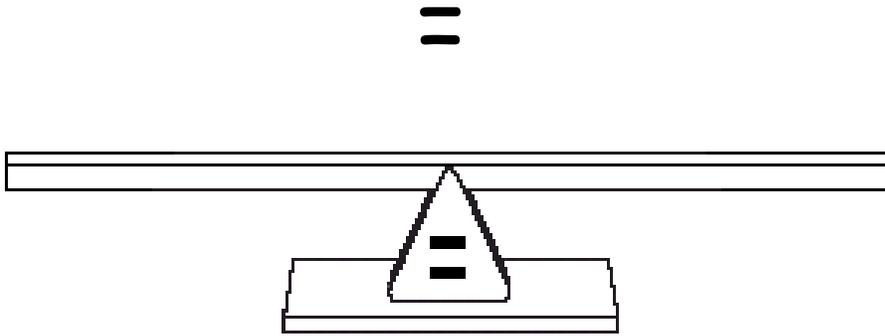


Draw a picture of what you have on your scale.

$$X = 9$$

2.) Equation:  $x - 5 = 4 + 9$

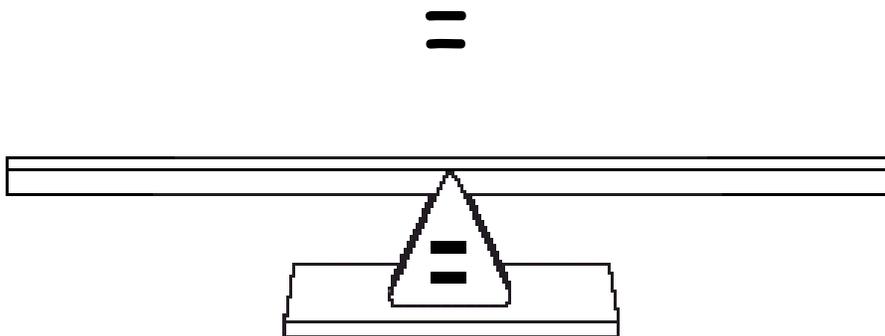
Students should draw a picture to solve for the unknown.



$x = 18$

3.) Equation:  $17 - x = 3 + 12$

Students should draw a picture to solve for the unknown.



$x = 2$

Answer Key

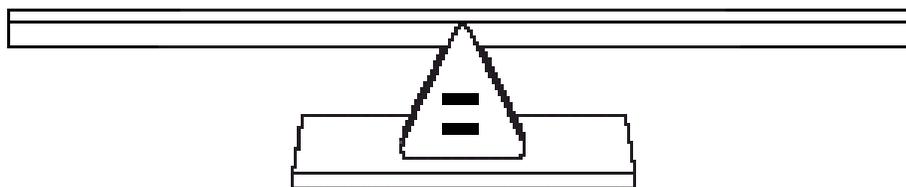
Exit Card



Directions: Solve the equation by drawing a picture representing Base Ten Blocks.

1). Students can use a square for the hundreds block, a line for the ten block, and a dot for the unit block to draw a picture for the situation.

$$X + 64 = 252 + 14$$



$$X = 202$$

2). Try finding the unknown number without drawing a picture or using manipulatives.

$$278 + x = 863 - 291$$

$$X = 294$$

Why is your answer correct?

Responses will vary. Students should explain why they solved the problem and how they know their answers are correct.  $863 - 291 = 572$ . Therefore,  $278 + x = 572$ . In order to solve for  $x$ , you can use the inverse operation for addition which is subtraction.

$$572 - 278 = 294$$

Is your answer the only possibility? Why or why not?

There is only one possible answer to the problem because there is only one number that will keep the equation balanced on both sides. In order for the equation to be true, the equation needs to be balanced or equal.