# $7^{TH}$ GRADE MATHEMATICS

## UNIT 1

## OPERATIONS WITH RATIONAL NUMBERS

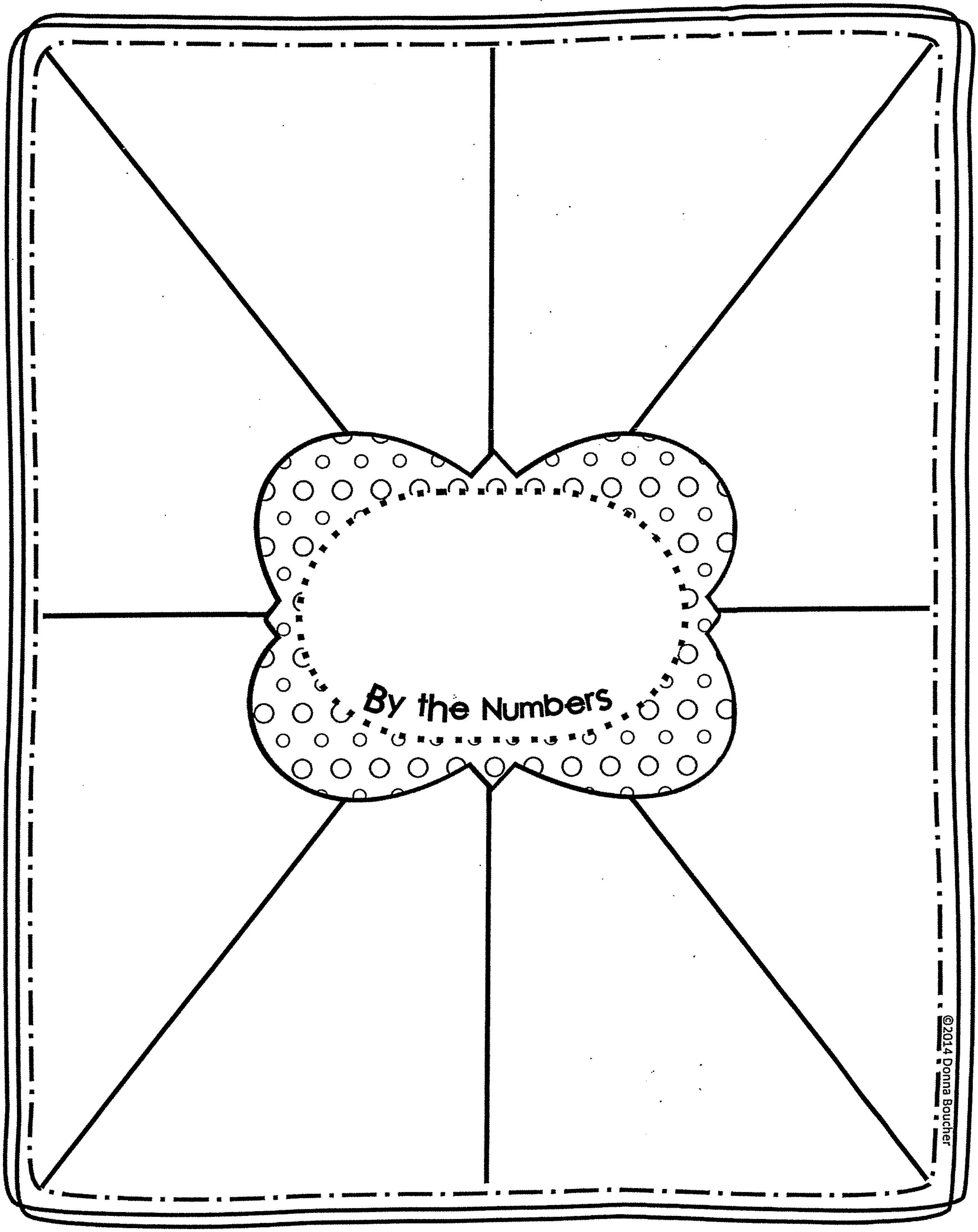
WORTH COUNTY MIDDLE SCHOOL

2016 - 2017

# Unit 1: Operation with Rational Numbers

Unit Essential Question: How do I apply and extend previous understandings of operations with fractions to add, subtract, multiply and divide rational numbers?

| Positive and Negative Numbers | Opposites | Absolute Value | Rational Numbers |
|---|---|---|---|
| Lesson EQ:<br>What models can be used to show addition and subtraction of positive and negative rational numbers?<br><br>What strategies are most useful in helping me develop algorithms for adding, subtracting, multiplying, and dividing positive and negative rational numbers?<br><br>How do I use a number line to model addition and subtraction of rational numbers? | Lesson EQ:<br>How can I use models to prove that opposites combine to 0?<br><br>What real life situations combine to make 0? | Lesson EQ:<br>How can I represent absolute value on a number line? | Lesson EQ:<br>How do I convert a rational number to a decimal using long division?<br><br>How can I solve real life problems with rational numbers? |
| Vocabulary:<br>Algorithms<br>Integers<br>Positive numbers<br>Negative numbers | Vocabulary:<br>Additive Inverse<br>Multiplicative inverse<br>Zero pairs<br>Opposite numbers | Vocabulary:<br>Absolute value | Vocabulary:<br>Long division<br>Rational numbers Repeating decimals<br>Terminating decimals |
| CCGPS:<br>MCC7.NS.2 a, b, c | CCGPS:<br>MCC7.NS.1a, b | CCGPS:<br>MCC7.NS.1c | CCGPS:<br>MCC7.NS.1c, d<br>MCC7.NS.2 a, b, c, d<br>MCC7.NS. 3 |


By the Numbers

# Unit 1 Georgia Standards of Excellence

Apply and extend previous understandings of operations with fractions to add, subtract, multiply and divide rational numbers.

MGSE7.NS.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

MGSE7.NS.1a Show that a number and its opposite have a sum of 0 (are additive inverses). Describe situations in which opposite quantities combine to make 0. For example, your bank account balance is -$25.00. You deposit $25.00 into your account. The net balance is $0.00.

MGSE7.NS.1b Understand $p + q$ as the number located a distance from $p$, in the positive or negative direction depending on whether $q$ is positive or negative. Interpret sums of rational numbers by describing real world contexts.

MGSE7.NS.1c Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.

MGSE7.NS.1d Apply properties of operations as strategies to add and subtract rational numbers.

MGSE7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

MGSE7.NS.2a Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. Georgia Department of Education Georgia Standards of Excellence Framework GSE Grade 7 ·

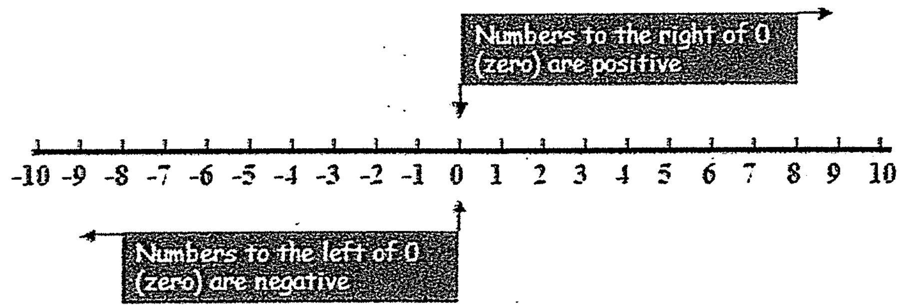
MGSE7.NS.2b Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.

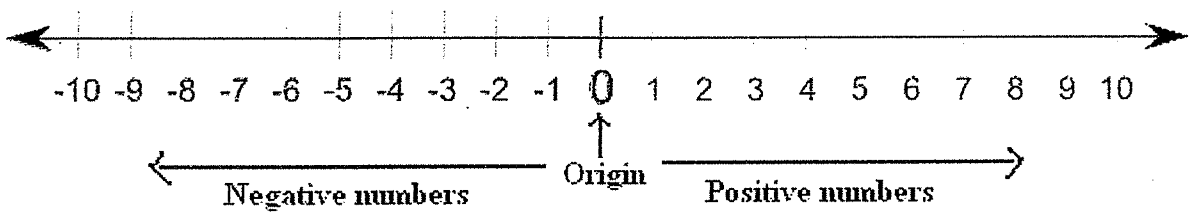
MGSE7.NS.2c Apply properties of operations as strategies to multiply and divide rational numbers.

MGSE7.NS.2d Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

MGSE7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers.

# Lesson 1: Positive and Negative Numbers




## 11-1 Integers in Real-World Situations

**Additional Example 1: Identifying Positive and Negative Numbers in the Real World**

**Name a positive or negative number to represent each situation.**

**A. a jet climbing to an altitude of 20,000 feet**

Positive numbers can represent *climbing* or *rising*.

+20,000

**B. taking $15 out of the bank**

Negative numbers can represent *taking out* or *withdrawing*.

-15

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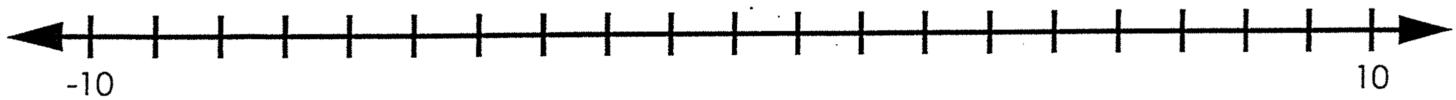
Name: ___________________________________

# Integers

**a.** Label these integers on the number line: **-6, 8, -9, 0, 2, -2**




**b.** Label these integers on the number line: **-7, -1, 0, 4, 7, -5**


**c.** On a number line, **positive** numbers are located ______________ of **zero.**
(**right** or **left**)

**d.** On a number line, **negative** numbers are located ______________ of **zero.**
(**right** or **left**)

**e.** On a number line, **-5** would be located ______________ of **5.**
(**right** or **left**)

**f.** On a number line, **-30** would be located ______________ of **-20.**
(**right** or **left**)

## Hot Air Balloon

**I. Make a balloon model and vertical number line.**

When using hot air balloons to add or subtract integers, there are several important things to remember. They are:

- The **first number** indicates where the balloon starts.
- The **sign** tells you if you will be adding or subtracting something from the balloon. An addition sign tells you that you will be adding something to the hot air balloon and a subtraction sign tells you that you will be subtracting something from the balloon
- The **second number** tells you what you will add or subtract from the balloon (either bags of gas if the number is positive or bags of sand if the number is negative).

| **II. Reason quantitatively: What happens to the balloon when…** | | **Mathematically** |
|---|---|---|
| **Add bags of gas** | *Fill in the blanks: (up or down)*<br><br>**Balloon goes ________** | *Fill in the blanks: ( + or - )*<br><br>3 bags of gas (___3)<br>10 bags of gas (___10) |
| **Add bags of sand** | **Balloon goes ________** | 3 bags of sand (____3)<br>10 bags of sand (____10) |
| **Subtract bags of gas** | **Balloon goes ________** | Subtract 3 bags of gas___(___3)<br>Subtract 10 bags of gas ___(__10) |
| **Subtract bags of sand** | **Balloon goes ________** | Subtract 3 bags of sand __(__3)<br>Subtract 10 bags of sand ___(__10) |

**II. Use a number line and a model of a hot air balloon. Model each problem and answer the questions that follow; the first one gives you hints as to the types of answers you should give.**

When using hot air balloons to add or subtract integers, there are several important things to remember:

- The first number indicates where the balloon starts.
- The sign tells you if you will be adding or subtracting something from the balloon. An addition sign tells you that you will be adding something to the hot air balloon and a subtraction sign tells you that you will be subtracting something from the balloon
- The second number tells you what you will add or subtract from the balloon (either bags of gas if the number is positive or bags of sand if the number is negative).

$-3 + 6$

1. Where does the balloon start? (#)________
2. Do you add or subtract something from the balloon? (operation)_________________
3. What do you add or subtract from the balloon? (# bags of?) ___________________
4. Where does the balloon end up? (#)___________

$4 + (-7)$

5. Where does the balloon end up?_______________

**-3 + -5**

6. Where does the balloon end up?_______________

What do you think happens to the balloon if you take away sand instead of adding sand?

$-3 - (-9)$

7. Where does the balloon start?________________
8. Do you add or subtract something from the balloon?_________________________
9. What do you add or subtract from the balloon?_____________________________
10. Where does the balloon end up?_______________

What do you think happens to the balloon if you take away gas bags instead of adding gas bags?

$6 - 9$

11. Where does the balloon end up?_______________

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**−6 − 2**

12. Where does the balloon end up?_______________

**III. For the following questions, look for patterns that you discovered in sections I and II. Model the expressions with your balloon and number line to answer each. Describe what you did with the air balloon. Be sure to include where you began, whether you added or subtracted bags, what types of bags, and your ending point in relation to your starting point.**

*Sample: If a and b are positive numbers, explain a+b*

*I will begin with my balloon above zero to represent a on the number line. Next, I would continue to move my balloon further up on the number line to represent the addition of a positive number (b). This models adding a gas bag to my balloon. My final destination would definitely be above zero on the number line, making my final answer positive.*

1. If a and b are positive numbers, explain (-a) + (-b)

2. If a and b are positive numbers, explain a + (-b)

3. If a and b are positive numbers, explain a - (-b)

4. If a and b are positive numbers explain a - b; describe this situation two ways: use the idea of the subtraction of gas bags *and* the addition of sand bags in your explanation

5. If a and b are positive numbers explain (-a) - (-b)

6. If a and b are positive numbers explain (-a) + b

7. If a, b, and c are all positive numbers, explain a + b+ (-c)

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**Investigate these conjectures.**

1. What happened when you were adding integers that had the same signs; (-a) + (-b) and a + b?

2. What rule can you make by your discovery? Explain.

3. What happened when you were adding integers that have different signs (a positive integer and a negative integer: (-a) + b and a + (-b))?

4. What rule can you make by your discovery? Explain.

# RULES FOR INTEGERS ( SIGNED NUMBERS)

## ADDITION

+ and + = +

− and − = −

**+** (big) and - (little) = +

+ (little) and **—** (big) = −

## SUBTRACTION

ADD THE OPPOSITE!

(Change the subtraction sign to an addition sign.
Change the sign of the second number.
Now follow the Addition rules!)

## MULTIPLICATION AND DIVISION

+ and + = +

− and − = +

+ and − = −

− and + = −

Compliments of Lois Terms www.loisterms.com

| | |
|---|---|
| **+** and - = + | means: "Big positive plus little negative equals a positive." |
| + and **—** = - | means: "Little positive plus big negative equals a negative." |

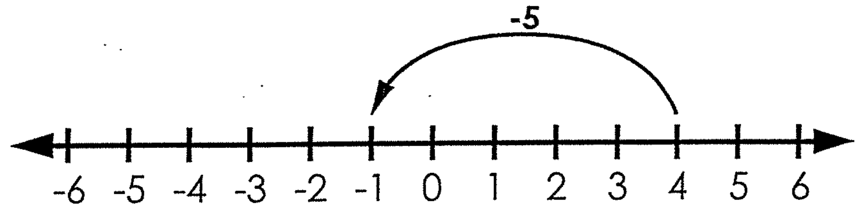
Name: ______________________________

# Adding Integers

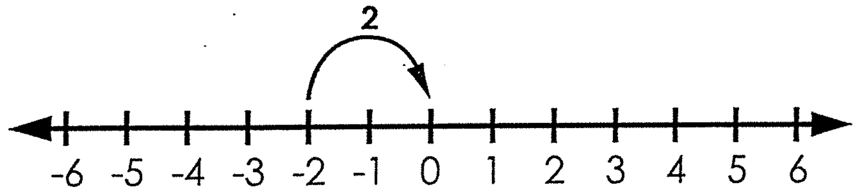
Use the number lines to solve.

examples:

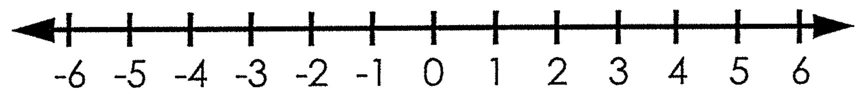
4 + (-5) = **-1**



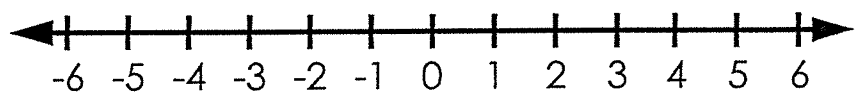

-2 + 2 = **0**



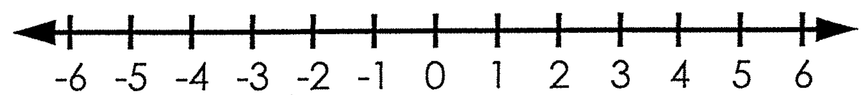

**a.** -3 + 7 = ____________



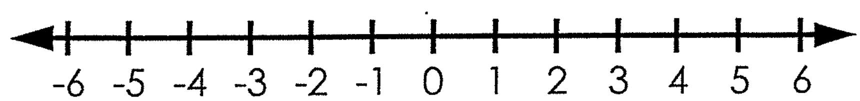

**b.** 2 + (-5) = ____________



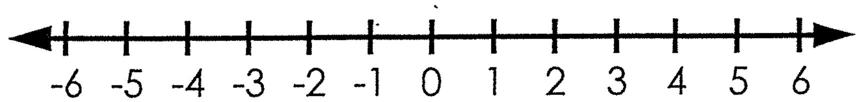

**c.** -1 + (-2) = ____________



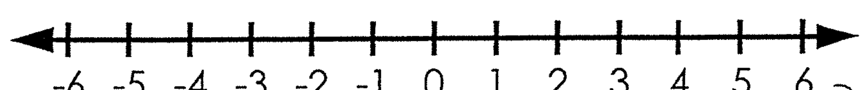

**d.** 6 + (-4) = ____________




**e.** -6 + 12 = ____________




**f.** 0 + (-1) = ____________

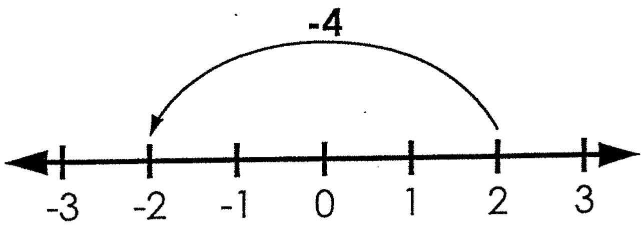


Name: ______________________________

# Subtracting Integers

Move **left** on a number line to subtract a positive integer.

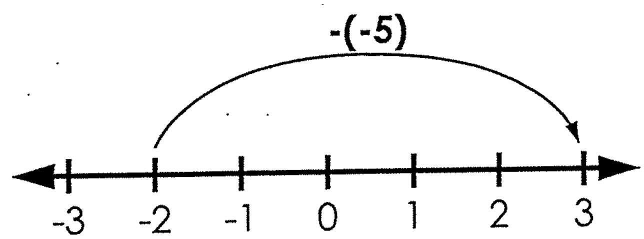
2 - 4 = **?**




2 - 4 = **-2**

Move **right** on a number line to subtract a negative integer.

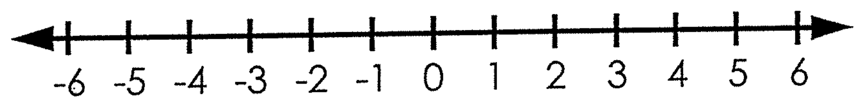
-2 - (-5) = **?**



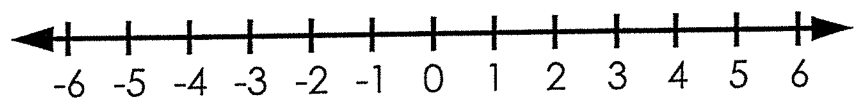

-2 - (-5) = **3**

Use the number lines to solve.

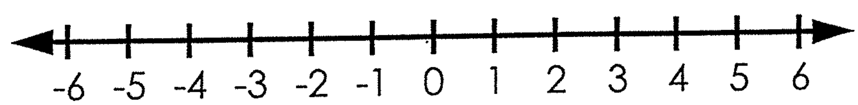
**a.** 4 - 7 = ______________



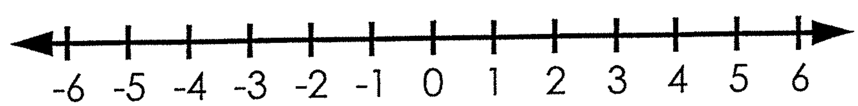

**b.** -1 - (-3) = ______________



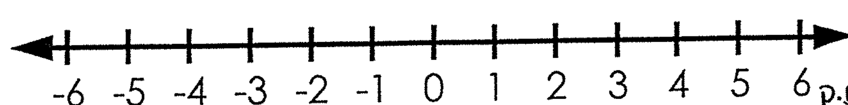

**c.** 0 - 5 = ______________




**d.** 1 - 3 = ______________




**e.** -4 - (-4) = ______________

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## Debits and Credits

Suppose you have been given a checkbook. Your checkbook has a ledger for you to record your transactions. There are two types of transactions that may take place, (1) deposits (money placed in the account) and (2) debits/ payments (money which you spend and it comes out of the account). The difference between debits and the deposits tells the value of the account. If there are more credits than debits, the account is positive, or "in the black". "in the black." If there are more debits than credits, the account is in debt, shows a negative cash value, or is "in the red."

**Vocabulary key –**
Transaction = debit or credit from an account
Debit (withdrawal) = Check or debit card usage written out of the checking account
Credit= Deposit of money put in the account

**Situation #1:**
Use the ledger to record the information and answer the questions.
**Note:** On August 12, your beginning balance is $0.00

1. On August 16, you receive a check from your Grandmother for $40 for your birthday.
2. On August 16, you receive a check from your Parents for $100 for your birthday.
3. On August 17, you purchase a pair of pants from Old Navy for $23.42.
4. On August 18, you find $5.19 in change during the day.
5. On August 19, you purchase socks from Wal-Mart for $12.76.

| DATE | TRANSACTION | PAYMENT (-) | DEPOSIT (+) | BALANCE |
|---|---|---|---|---|
| 8/12 | Beginning balance | | | $0.00 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

A. What is your balance after five transactions?

B. How much money did you deposit (show as a positive value)?

C. How much money did you pay or withdraw (show as a negative value)?

**Situation #2:**
Use the ledger to record the information and answer the questions.

**Note:** On May 5, your beginning balance is $8.00

1. On May 6, you spent $4.38 on a gallon of ice cream at Marty's Ice Cream Parlor.
2. On May 7, you spent $3.37 on crackers, a candy bar, and a coke from Circle H convenience store.
3. On May 8, you received $10 for cutting the neighbor's grass.
4. On May 8, you spent $14.80 on a downloaded book for your Kindle.

| DATE | TRANSACTION | PAYMENT (-) | DEPOSIT (+) | BALANCE |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

A. What is your balance after four transactions?

B. How much money did you deposit (show as a positive value)?

C. How much money did you pay or withdraw (show as a negative value)?

D. Can you really afford to spend $14.80 on a book for your Kindle? If not, how much money do you need to earn to have an account balance of $0?

**Situation #3:**
Use the ledger to record the information and answer the questions.
**Note:** On July 4, your beginning balance is (-$40).

Requirements:

- Use at least eight transactions, four of which are debits and four are credits.
- You must have an ending balance of $145.
- You must include debit and credit amounts that have cents in at least five of your transactions.

Be sure to fill out the ledger as you go.

| DATE | TRANSACTION | PAYMENT (-) | DEPOSIT (+) | BALANCE |
|---|---|---|---|---|
| | | | | |
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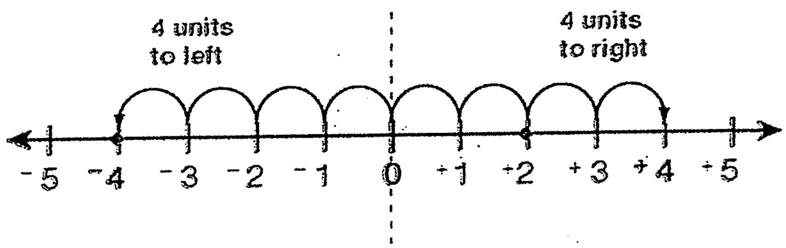
# Lesson 2: Opposites




$^{-}4$ and $^{+}4$
are opposites

Notes:

Name : ______________________ Score : __________

Teacher : ______________________ Date : __________

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1 ) Opposite value of 15 is _____

2 ) Opposite value of -9 is _____

3 ) Opposite value of -79 is _____

4 ) Opposite value of 73 is _____

5 ) Opposite value of 85 is _____

6 ) Opposite value of -43 is _____

7 ) Opposite value of -51 is _____

8 ) Opposite value of 43 is _____

9 ) Opposite value of -77 is _____

10 ) Opposite value of -30 is _____

11 ) Opposite value of 8 is _____

12 ) Opposite value of 74 is _____

13 ) Opposite value of 10 is _____

14 ) Opposite value of 27 is _____

15 ) Opposite value of 49 is _____

16 ) Opposite value of 35 is _____

17 ) Opposite value of 46 is _____

18 ) Opposite value of 8 is _____

19 ) Opposite value of -89 is _____

20 ) Opposite value of 41 is _____

21 ) Opposite value of -90 is _____

22 ) Opposite value of 67 is _____

23 ) Opposite value of 52 is _____

24 ) Opposite value of -99 is _____

25 ) Opposite value of 97 is _____

26 ) Opposite value of -26 is _____

27 ) Opposite value of 3 is _____

28 ) Opposite value of 61 is _____

29 ) Opposite value of 69 is _____

30 ) Opposite value of -45 is _____

NAME ______________________



# Check What You Know

## Adding and Subtracting Rational Numbers

Evaluate each expression.

| | a | b | c |
|---|---|---|---|
| 1. | opposite of 45 ________ | opposite of −9 ________ | opposite of −10 ________ |
| 2. | opposite of 21 ________ | opposite of 6 ________ | opposite of −31 ________ |
| 3. | opposite of 52 ________ | opposite of −89 ________ | opposite of 18________ |
| 4. | $\|7\| =$ ________ | $\|-34\| =$ ________ | $\|58\| =$ ________ |
| 5. | $-\|35\| =$ ________ | $-\|-56\| =$ ________ | $\|-39\| =$ ________ |

Identify the property of addition described as *commutative*, *associative*, or *identity*.

6. The sum of any number and zero is the original number. ____________________

7. When two numbers are added, the sum is the same regardless of the order of addends.

   ____________________

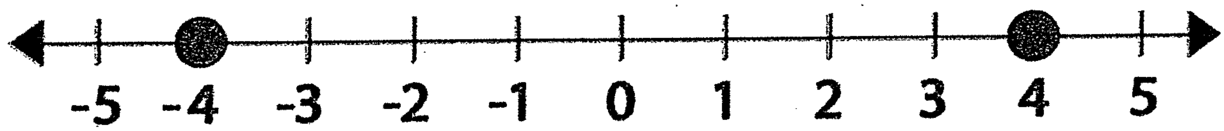
8. When three or more numbers are added, the sum is the same regardless of how the addends are grouped. ____________________

| | a | b |
|---|---|---|
| 9. | $7 + (1 + 9) = (7 + 1) + 9$ ____________________ | $3 + 0 = 3$ ____________________ |
| 10. | $9 + 5 = 5 + 9$ ____________________ | $8 + 10 = 10 + 8$ ____________________ |
| 11. | $6 + (-6) = 0$ ____________________ | $(6 + 3) + 7 = 6 + (3 + 7)$ ____________________ |
| 12. | $15 + 0 = 15$ ____________________ | $13 + 2 = 2 + 13$ ____________________ |

# Lesson 3: Absolute Value

How far away from zero are the following?

-4 and 4




Notice that both 4 and -4 are a distance of 4 units away from zero. This means that |4| and |-4| are both 4.

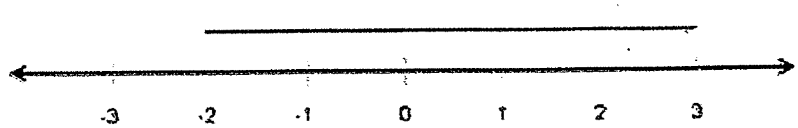
*Algebra EETT Grant*

## Absolute Value

**Definition**

Absolute value is the distance from 0 The absolute value, just like distance, is always positive.

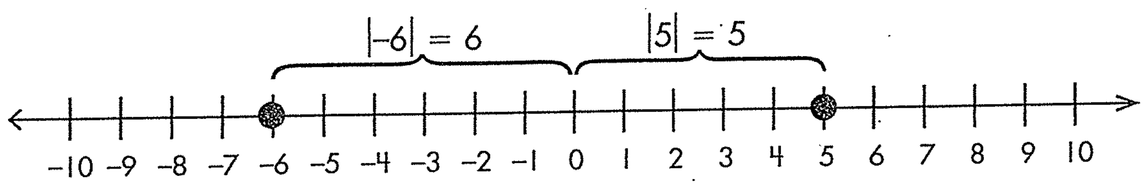
$$|-2| = 2 \qquad |3| = 3$$



NAME ____________________

# Lesson 1.2 Absolute Values and Integers

The **absolute value** of a number is the distance between 0 and the number on a number line. Remember that distance is always a positive quantity (or zero). Absolute value is shown by vertical bars on each side of the number.



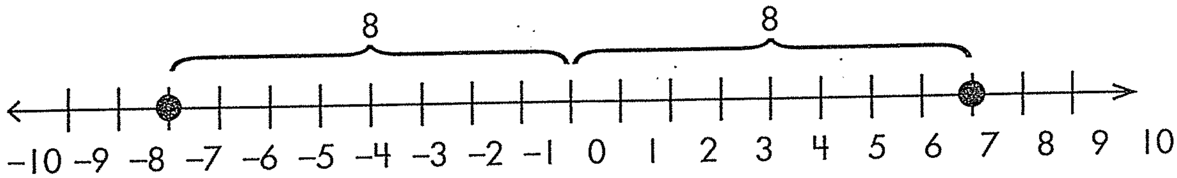

Evaluate the expressions below.

| | a | b | c |
|---|---|---|---|
| **1.** | $\lvert 91 \rvert =$ ______ | $\lvert -19 \rvert =$ ______ | $\lvert -9 \rvert =$ ______ |
| **2.** | $\lvert 1 \rvert =$ ______ | $\lvert -199 \rvert =$ ______ | $\lvert 0 \rvert =$ ______ |
| **3.** | $\lvert -762 \rvert =$ ______ | $\lvert 78 \rvert =$ ______ | $\lvert -302 \rvert =$ ______ |
| **4.** | $\lvert -4002 \rvert =$ ______ | $-\lvert 668 \rvert =$ ______ | $-\lvert -8701 \rvert =$ ______ |
| **5.** | $\lvert 23 \rvert =$ ______ | $\lvert -56 \rvert =$ ______ | $-\lvert 432 \rvert =$ ______ |
| **6.** | $\lvert -53 \rvert =$ ______ | $\lvert 694 \rvert =$ ______ | $-\lvert -274 \rvert =$ ______ |
| **7.** | $\lvert -516 \rvert =$ ______ | $\lvert 883 \rvert =$ ______ | $-\lvert 637 \rvert =$ ______ |
| **8.** | $\lvert 413 \rvert =$ ______ | $\lvert -590 \rvert =$ ______ | $\lvert 739 \rvert =$ ______ |
| **9.** | $\lvert -281 \rvert =$ ______ | $\lvert 40 \rvert =$ ______ | $-\lvert -826 \rvert =$ ______ |
| **10.** | $\lvert 206 \rvert =$ ______ | $\lvert 372 \rvert =$ ______ | $\lvert 973 \rvert =$ ______ |
| **11.** | $-\lvert 533 \rvert =$ ______ | $\lvert -836 \rvert =$ ______ | $\lvert 954 \rvert =$ ______ |
| **12.** | $\lvert -344 \rvert =$ ______ | $-\lvert -711 \rvert =$ ______ | $\lvert -219 \rvert =$ ______ |

NAME ________________

# Lesson 1.1 Understanding Absolute Value

The **absolute value** of a number is a number that is the same distance from zero on a number line as the given number, but on the opposite side of zero.




−8 and 8 are absolute value because they are the same distance from zero on opposite sides of the number line.

Evaluate the expressions below.

| | a | b | c |
|---|---|---|---|
| 1. | opposite of 19 ______ | opposite of −7 ______ | opposite of −2 ______ |
| 2. | opposite of 28 ______ | opposite of −50 ______ | opposite of 10 ______ |
| 3. | opposite of 92 ______ | opposite of −31 ______ | opposite of −74 ______ |
| 4. | opposite of 936 ______ | opposite of 76 ______ | opposite of 65 ______ |
| 5. | opposite of −32 ______ | opposite of −36 ______ | opposite of 73 ______ |
| 6. | opposite of 55 ______ | opposite of −47 ______ | opposite of 87 ______ |
| 7. | opposite of −61 ______ | opposite of 37 ______ | opposite of −23 ______ |
| 8. | opposite of 25 ______ | opposite of 68 ______ | opposite of −53 ______ |
| 9. | opposite of 71 ______ | opposite of −99 ______ | opposite of 90 ______ |
| 10. | opposite of 40 ______ | opposite of 44 ______ | opposite of −77 ______ |
| 11. | opposite of −52 ______ | opposite of 66 ______ | opposite of −95 ______ |
| 12. | opposite of 15 ______ | opposite of −20 ______ | opposite of −9 ______ |

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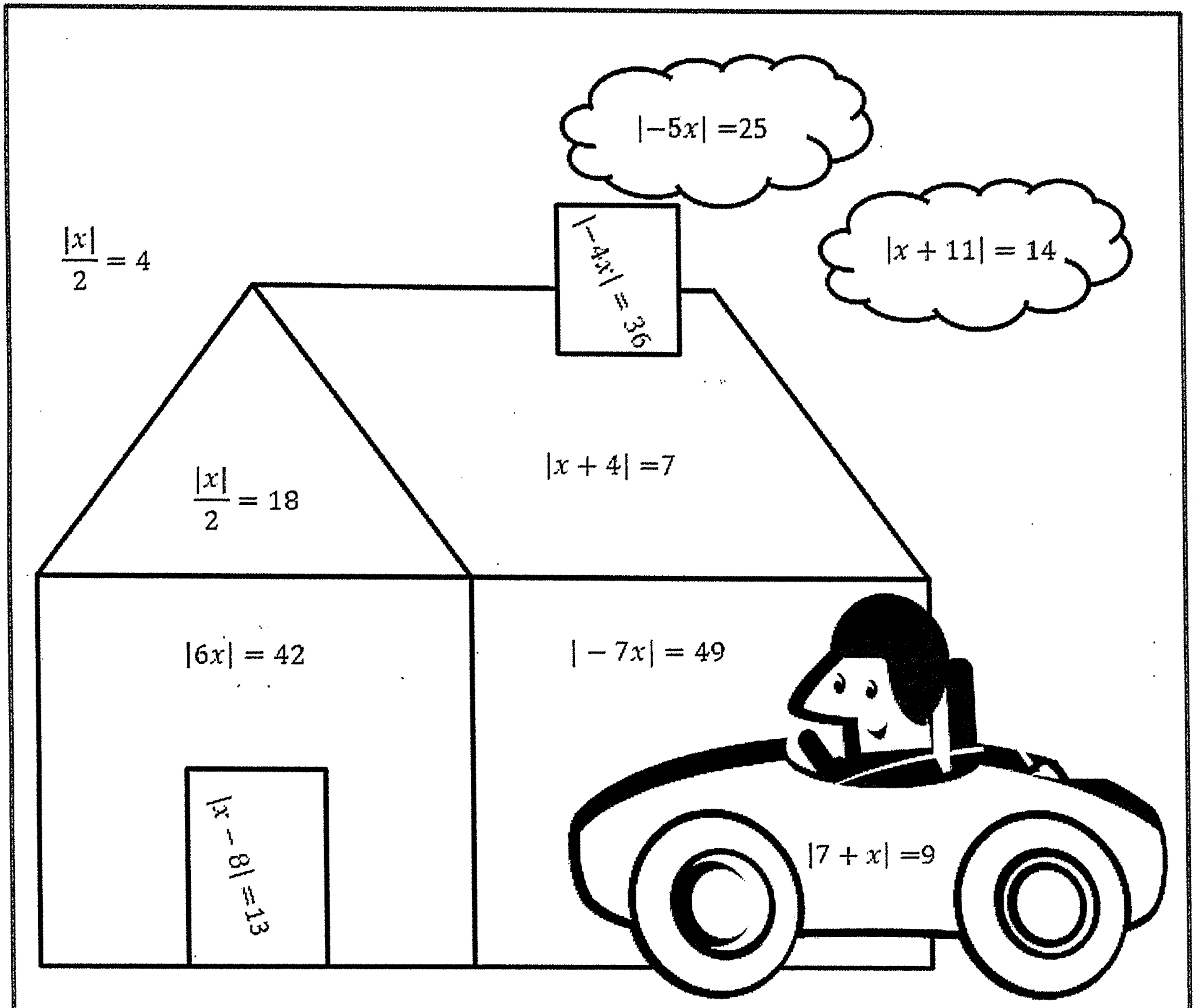
Instructions: Solve the absolute value equations, then use the chart to determine how to color the picture below.




| Value of X: | Color: |
|---|---|
| X= -7, 7 | Purple |
| X= 36, -36 | Green |
| X= -11,3 | Yellow |
| X= -5, 5 | Gray |
| X= -16, 2 | Red |
| X= -8, 8 | Blue |
| X= -25, 3 | Orange |
| X= -5, 21 | Brown |
| X = -9, 9 | Black |

TutorCircle

## Difference between Rational and Irrational Number

Difference between Rational and Irrational Number

Rational numbers are numbers that can be expressed as a ratio of two integers. They can be in fraction, decimal or whole number from. Example of rational number:- 1/2, 3/4 , -7/2, 8/1.

On the other side, irrational numbers are those numbers that cannot be expressed as a ratio of two integers. Example of irrational number: - √2, π, 5/0. Apart from definition, there are some other differences also, which are given as:

(1) Rational numbers are all positive and negative fraction, including integer and improper fraction.

An irrational number is a real number that cannot be written as a simple fraction.

**Know More About** Density Property of Real Number Worksheets

## Sets of Numbers

Natural Numbers 1, 2, 3, 4, ...

**Whole Numbers** 0, 1, 2, 3, 4, ...

Integers -3, -2, -1, 0, 1, 2, 3, 4,

Rational Numbers Any number that can be written as a fraction

note: All terminating or repeating decimals can be written as a fraction

$\frac{4}{2}, \frac{3}{4}, \frac{2}{3}, 0.\overline{3}, 4.\overline{527}, 5.18, \sqrt{9}$

Lesson 17 -

# INTEGER RULES

**Absolute value – The distance a number is from 0 on the number line. EX: $|-5| = 5$ and $|+5| = 5$

INTEGERS: The set of positive and negative WHOLE numbers and "0", {. . . -4,-3,-2,-1,0,1,2,3,4 . . .}

## Add Integers

**Same sign –add and keep the sign**

**If the signs are the same, add the numbers and keep the sign.**

**(+3) + (+2) = (+5)**
**(+) + (+) = (+)**

**(-3) + (-2) = (-5)**
**(-) + (-) = (-)**

**Different sign- subtract and keep sign of the number with the largest absolute value (the number that is the biggest without the sign) (*different* sign find the *difference*)**

**(-8) + (+2) = (-6)**

**(+8) + (-2) = (+6)**

## Subtract Integers

(Keep, Change, Change)

**You do not subtract, you add the opposite of the number.**

1) **Keep – the sign of the first number in the problem**
2) **Change – the subtraction (-) sign to an addition (+) sign**
3) **Change the sign of the number behind the subtract to it's opposite (Change a negative to a positive and a positive to a negative)**
4. **Use the rules for adding integers.**

**Ex: (-7) – (-4) =**
**K C C**
**(-7) + (+4) = -3**

## Multiply Integers

**If the signs are the same, you multiply and the product is positive.**

**Same sign = positive (+)**
**(+) ● (+) = (+)**
**(-) ● (-) = (+)**
**(-4) • (-2) = (+8)**

**If the signs are different, you multiply and the product is negative (-).**

**Different signs = negative (-)**
**(+) • (-) = (-)**
**(-) • (+) = (-)**
**(-4) • (+2) = (-8)**

**** In problems with more than two factors, an even number of negatives (2, 4) will be a positive answer. An odd number (1,3,5) will be a negative answer.**

## Divide Integers

**If the signs are the same, you divide and the quotient is positive.**

**Same sign = positive (+)**
**(+) ÷ (+) = (+)**
**(-) ÷ (-) = (+)**
**(-4) ÷ (-2) = (+2)**

**If the signs are different, you divide and the quotient is negative (-).**

**Different signs = negative (-)**
**(+) ÷ (-) = (-)**
**(-) ÷ (+) = (-)**
**(-8) ÷(+2) = (-4)**

**** In problems with more than two factors, an even number of negatives (2, 4) will be a positive answer. An odd number (1,3,5) will be a negative answer.**

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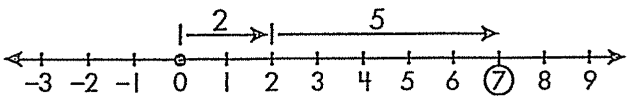
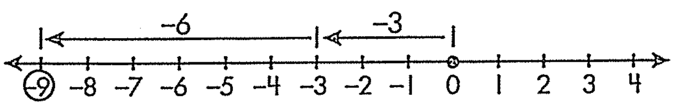
# Lesson 1.5 Adding Integers

The sum of two positive integers is a positive integer.



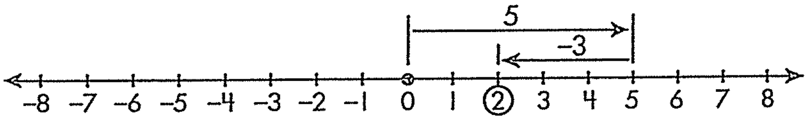

$$2 + 5 = 7$$

The sum of two negative integers is a negative integer.




$$-3 + -6 = -9$$

To find the sum of two integers with opposite signs, subtract the digit of lesser value from the digit of greater value and keep the sign of the greater digit.




$$5 + (-3) = 5 - 3 = 2$$

Add.

| | a | b | c | d |
|---|---|---|---|---|
| 1. | $3 + 4$ ______ | $-3 + (-4)$ ______ | $3 + (-4)$ ______ | $-3 + 4$ ______ |
| 2. | $-3 + (-3)$ ______ | $3 + (-3)$ ______ | $-3 + 3$ ______ | $3 + 3$ ______ |
| 3. | $5 + (-1)$ ______ | $-5 + 1$ ______ | $-5 + (-1)$ ______ | $5 + 1$ ______ |
| 4. | $-7 + 3$ ______ | $-7 + (-3)$ ______ | $7 + (-3)$ ______ | $7 + 3$ ______ |
| 5. | $4 + 7$ ______ | $4 + (-7)$ ______ | $-4 + (7)$ ______ | $-4 + (-7)$ ______ |
| 6. | $8 + (-8)$ ______ | $-8 + (-8)$ ______ | $8 + 8$ ______ | $-8 + 8$ ______ |
| 7. | $-3 + 0$ ______ | $3 + 0$ ______ | $-5 + (-6)$ ______ | $-5 + 6$ ______ |
| 8. | $5 + (-6)$ ______ | $5 + 6$ ______ | $-8 + 0$ ______ | $8 + 0$ ______ |
| 9. | $-3 + 6$ ______ | $-3 + (-6)$ ______ | $3 + 6$ ______ | $3 + (-6)$ ______ |
| 10. | $-6 + (-4)$ ______ | $-6 + 4$ ______ | $6 + (-4)$ ______ | $6 + 4$ ______ |

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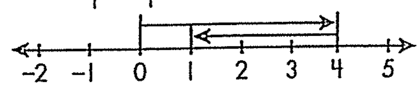
# Lesson 1.5 Adding Integers

To find the sum of two integers with different signs, find their absolute values. Remember, **absolute value** is the distance (in units) that a number is from 0, expressed as a positive quantity. Subtract the lesser number from the greater number. Absolute value is written as $|n|$.

The sum has the same sign as the integer with the larger absolute value.

$-4 + 3 = -1$

$|-4| = 4 \quad 4 - 3 = 1$




$4 > 3$, so the sum is negative.

Add.

| | a | b | c |
|---|---|---|---|
| 1. | $6 + 2 =$ ______ | $9 + (-4) =$ ______ | $7 + (-9) =$ ______ |
| 2. | $-4 + 7 =$ ______ | $-3 + (-6) =$ ______ | $-12 + 11 =$ ______ |
| 3. | $-16 + 0 =$ ______ | $13 + (-24) =$ ______ | $-6 + 8 =$ ______ |
| 4. | $0 + (-9) =$ ______ | $-1 + 2 =$ ______ | $1 + (-2) =$ ______ |
| 5. | $-4 + 4 =$ ______ | $3 + (-6) =$ ______ | $7 + (-17) =$ ______ |
| 6. | $-45 + 21 =$ ______ | $41 + 44 =$ ______ | $33 + 25 =$ ______ |
| 7. | $27 + (-39) =$ ______ | $20 + 1 =$ ______ | $3 + (-3) =$ ______ |
| 8. | $-12 + (-12) =$ ______ | $35 + (-26) =$ ______ | $-22 + 16 =$ ______ |
| 9. | $31 + 17 =$ ______ | $-9 + (-6) =$ ______ | $-47 + 36 =$ ______ |
| 10. | $4 + 5 =$ ______ | $-43 + 35 =$ ______ | $24 + (-33) =$ ______ |

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# Lesson 1.3 Subtraction as an Inverse Operation

Subtraction is the same as the process of adding the additive inverse, or opposite, of a number to another number.

$$7 - 4 = 7 + (-4)$$

Write an equivalent equation using the additive inverse.

| | a | b |
|---|---|---|
| 1. | 8 − 3 = ______ | 9 − 2 = ______ |
| 2. | 12 + (−7) = ______ | 8 + (−12) = ______ |
| 3. | 52 − 13 = ______ | 23 − 10 = ______ |
| 4. | 67 + (−11) = ______ | 45 + (−6) = ______ |
| 5. | 30 − 15 = ______ | 74 − 23 = ______ |
| 6. | 3 + (−56) = ______ | 62 + (−32) = ______ |
| 7. | 87 − 85 = ______ | 54 − 20 = ______ |
| 8. | 50 + (−17) = ______ | 41 + (−12) = ______ |
| 9. | 89 − 57 = ______ | 46 − 40 = ______ |
| 10. | 96 + (−20) = ______ | 94 + (−90) = ______ |
| 11. | 83 − 67 = ______ | 98 − 34 = ______ |
| 12. | 76 + (−20) = ______ | 90 + (−76) = ______ |



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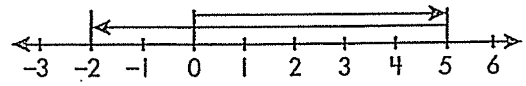
# Lesson 1.6 Subtracting Integers

To subtract an integer, add its opposite.

$5 - 7 = 5 + (-7) = -2$




Subtract.

| | a | b | c |
|---|---|---|---|
| 1. | $3 - 11 =$ ______ | $5 - 2 =$ ______ | $-4 - 6 =$ ______ |
| 2. | $-12 - 3 =$ ______ | $-5 - (-6) =$ ______ | $14 - 19 =$ ______ |
| 3. | $4 - 19 =$ ______ | $-11 - (-1) =$ ______ | $16 - (-27) =$ ______ |
| 4. | $-6 - (-6) =$ ______ | $-11 - 0 =$ ______ | $-2 - 2 =$ ______ |
| 5. | $8 - 1 =$ ______ | $8 - (-1) =$ ______ | $-13 - 3 =$ ______ |
| 6. | $43 - 15 =$ ______ | $-27 - (-39) =$ ______ | $-24 - (-38) =$ ______ |
| 7. | $-46 - (-31) =$ ______ | $-48 - (-47) =$ ______ | $-38 - (-17) =$ ______ |
| 8. | $9 - (-6) =$ ______ | $15 - (-1) =$ ______ | $-19 - (-22) =$ ______ |
| 9. | $(-3) - 24 =$ ______ | $-11 - 44 =$ ______ | $42 - 45 =$ ______ |
| 10. | $-33 - 12 =$ ______ | $-37 - (-40) =$ ______ | $5 - (-32) =$ ______ |



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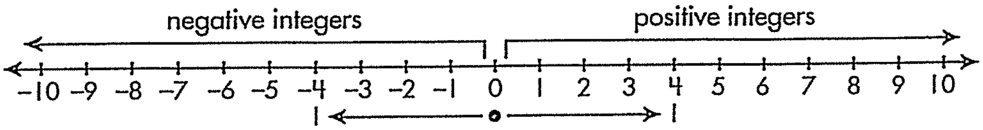
# Lesson 2.1 Adding and Subtracting Integers

Integers are the set of whole numbers and their opposites. Positive integers are greater than zero. Negative integers are less than zero. A negative integer is less than a positive integer. The smaller of two integers is always the one to the left on the number line.




The opposite of 4 is −4. They are both 4 spaces from 0.

The sum of two positive integers is positive. The sum of two negative integers is negative.

**Examples**: $4 + 3 = 7$ $\quad -4 + (-3) = -7$

To find the sum of two integers with different signs, find their absolute values. Absolute value is the distance (in units) that a number is from 0 expressed as a positive quantity. Subtract the lesser number from the greater number. The sum has the same sign as the integer with the larger absolute value.

**Example**: $-4 + 3 = -(4 - 3) = -1$

To subtract an integer, add its opposite.

Add or subtract.

| | a | b | c |
|---|---|---|---|
| **1.** | $2 + 4 =$ ______ | $-2 + (-4) =$ ______ | $2 + (-4) =$ ______ |
| **2.** | $4 - 2 =$ ______ | $-4 - 2 =$ ______ | $4 - (-2) =$ ______ |

Draw a number line to show the opposite of each number.

| | a | b |
|---|---|---|
| **3.** | What is the opposite of −6? | What is the opposite of 2? |

Draw a number line to represent the solution.

**4.** A hiker began hiking at an elevation of 3 feet below sea level. She increased her elevation by 5 feet. What was her resulting elevation?

**5.** The outside temperature was 2°C. The temperature decreased by 4°C. What was the resulting temperature?

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# Lesson 2.3 Multiplying Integers

The product of two integers with the same sign is positive.

$3 \times 3 = 9$
$-3 \times -3 = 9$

The product of two integers with different signs is negative.

$3 \times (-3) = -9$
$-3 \times 3 = -9$

Multiply.

| | a | b | c | d |
|---|---|---|---|---|
| 1. | $3 \times 2 =$ ____ | $-4 \times 6 =$ ____ | $8 \times (-3) =$ ____ | $-3 \times (-4) =$ ____ |
| 2. | $-8 \times 7 =$ ____ | $6 \times (-5) =$ ____ | $-3 \times (-8) =$ ____ | $-4 \times 11 =$ ____ |
| 3. | $16 \times (-2) =$ ____ | $-4 \times (-1) =$ ____ | $8 \times (-11) =$ ____ | $-7 \times (-10) =$ ____ |
| 4. | $5 \times 8 =$ ____ | $6 \times (-6) =$ ____ | $-13 \times (-2) =$ ____ | $-9 \times 9 =$ ____ |
| 5. | $17 \times (-1) =$ ____ | $5 \times (-2) =$ ____ | $-14 \times 3 =$ ____ | $-7 \times (-5) =$ ____ |
| 6. | $(-6) \times 0 =$ ____ | $7 \times 3 =$ ____ | $6 \times (-10) =$ ____ | $(-3) \times (-5) =$ ____ |
| 7. | $8 \times (-2) =$ ____ | $(-4) \times (-10) =$ ____ | $10 \times (-3) =$ ____ | $3 \times 5 =$ ____ |
| 8. | $9 \times (-4) =$ ____ | $10 \times 4 =$ ____ | $10 \times (-4) =$ ____ | $5 \times 9 =$ ____ |
| 9. | $0 \times (-10) =$ ____ | $11 \times 11 =$ ____ | $2 \times 3 =$ ____ | $(-4) \times (-12) =$ ____ |
| 10. | $(-4) \times (-6) =$ ____ | $(-10) \times (-2) =$ ____ | $3 \times 12 =$ ____ | $4 \times 7 =$ ____ |



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# Lesson 2.3 Multiplying Integers

Multiply.

| | a | b | c |
|---|---|---|---|
| 1. | $2 \times 4 =$ ______ | $3 \times (-3) =$ ______ | $-12 \times (-12) =$ ______ |
| 2. | $9 \times (-7) =$ ______ | $9 \times 8 =$ ______ | $4 \times (-12) =$ ______ |
| 3. | $10 \times (-1) =$ ______ | $7 \times 4 =$ ______ | $6 \times (-5) =$ ______ |
| 4. | $(-2) \times 1 =$ ______ | $(-11) \times 2 =$ ______ | $12 \times 3 =$ ______ |
| 5. | $11 \times 2 =$ ______ | $7 \times 11 =$ ______ | $(-12) \times 7 =$ ______ |
| 6. | $8 \times 5 =$ ______ | $11 \times 7 =$ ______ | $1 \times (-6) =$ ______ |
| 7. | $6 \times (-2) =$ ______ | $9 \times (-4) =$ ______ | $(-4) \times (-3) =$ ______ |
| 8. | $2 \times 7 =$ ______ | $3 \times 8 =$ ______ | $3 \times (-7) =$ ______ |
| 9. | $(-6) \times (-3) =$ ______ | $(-8) \times 8 =$ ______ | $2 \times 5 =$ ______ |
| 10. | $6 \times 9 =$ ______ | $(-4) \times 8 =$ ______ | $6 \times (-5) =$ ______ |
| 11. | $12 \times 32 =$ ______ | $7 \times (-14) =$ ______ | $-19 \times (-4) =$ ______ |
| 12. | $11 \times (-41) =$ ______ | $4 \times 33 =$ ______ | $18 \times (-18) =$ ______ |
| 13. | $11 \times (-46) =$ ______ | $21 \times 4 =$ ______ | $13 \times (-5) =$ ______ |
| 14. | $(-27) \times 16 =$ ______ | $(-11) \times 36 =$ ______ | $(-6) \times (-92) =$ ______ |

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# Lesson 2.6 Dividing Integers

The quotient of two integers with the same sign is positive.

$8 \div 2 = 4$
$-8 \div (-2) = 4$

The quotient of two integers with different signs is negative.

$8 \div (-2) = -4$
$-8 \div 2 = -4$

Divide.

| | a | b | c |
|---|---|---|---|
| 1. | $12 \div 4 =$ _____ | $16 \div (-4) =$ _____ | $-8 \div 4 =$ _____ |
| 2. | $7 \div (-1) =$ _____ | $-14 \div 7 =$ _____ | $24 \div (-6) =$ _____ |
| 3. | $81 \div (-3) =$ _____ | $-63 \div 9 =$ _____ | $-55 \div (-5) =$ _____ |
| 4. | $21 \div (-7) =$ _____ | $-38 \div 2 =$ _____ | $-19 \div (-1) =$ _____ |
| 5. | $12 \div (-12) =$ _____ | $42 \div (-21) =$ _____ | $-60 \div (-10) =$ _____ |
| 6. | $20 \div 2 =$ _____ | $30 \div (-10) =$ _____ | $(-50) \div (-10) =$ _____ |
| 7. | $288 \div (-18) =$ _____ | $(-85) \div (-5) =$ _____ | $(-36) \div 4 =$ _____ |
| 8. | $136 \div (-8) =$ _____ | $(-171) \div 19 =$ _____ | $240 \div 15 =$ _____ |
| 9. | $168 \div 12 =$ _____ | $(-200) \div 20 =$ _____ | $14 \div (-7) =$ _____ |
| 10. | $240 \div (-15) =$ _____ | $(-120) \div (-8) =$ _____ | $102 \div (-17) =$ _____ |

NAME ________________________

# Lesson 2.6 Dividing Integers

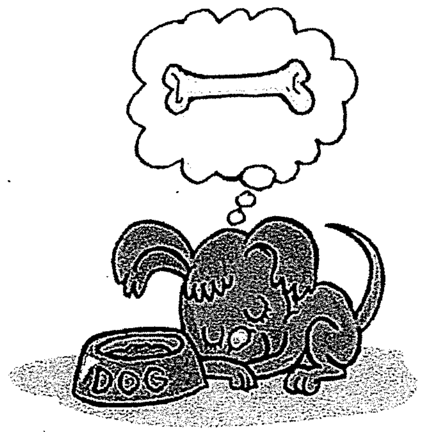
Divide.

| | a | b | c |
|---|---|---|---|
| 1. | (−140) ÷ (−10) = ____ | (−210) ÷ 15 = ____ | (−224) ÷ (−14) = ____ |
| 2. | (−13) ÷ (−1) = ____ | 120 ÷ 8 = ____ | 144 ÷ (−8) = ____ |
| 3. | 400 ÷ (−20) = ____ | 39 ÷ (−13) = ____ | (−3) ÷ 1 = ____ |
| 4. | (−200) ÷ 10 = ____ | 224 ÷ (−16) = ____ | 66 ÷ 11 = ____ |
| 5. | 88 ÷ 11 = ____ | (−60) ÷ 12 = ____ | 288 ÷ 16 = ____ |
| 6. | 288 ÷ (−16) = ____ | (−90) ÷ 6 = ____ | 90 ÷ (−10) = ____ |
| 7. | 133 ÷ 19 = ____ | 55 ÷ 5 = ____ | 128 ÷ 8 = ____ |
| 8. | 48 ÷ (−8) = ____ | (−306) ÷ 17 = ____ | (−64) ÷ 4 = ____ |
| 9. | 35 ÷ 5 = ____ | 34 ÷ (−17) = ____ | 252 ÷ (−14) = ____ |
| 10. | 51 ÷ 3 = ____ | (−18) ÷ (−9) = ____ | (−33) ÷ (−3) = ____ |
| 11. | 176 ÷ 11 = ____ | (−180) ÷ 15 = ____ | (−105) ÷ (−7) = ____ |
| 12. | (−96) ÷ 12 = ____ | 26 ÷ (−2) = ____ | (−54) ÷ (−9) = ____ |
| 13. | (−156) ÷ (−12) = ____ | (−248) ÷ 4 = ____ | (−272) ÷ (−34) = ____ |
| 14. | (−1037) ÷ (−17) = ____ | 688 ÷ 8 = ____ | 1008 ÷ (−42) = ____ |

Name: ______________________

# Dividing Integers

**Find the quotients.**




**a.** $9 \div (-3) =$ ______

**b.** $-42 \div 7 =$ ______

**c.** $-36 \div (-4) =$ ______

**d.** $-30 \div 5 =$ ______

**e.** $72 \div (-9) =$ ______

**f.** $0 \div (-3) =$ ______

**g.** $-121 \div 11 =$ ______

**h.** $-30 \div (-2) =$ ______

**i.** $-48 \div (-4) =$ ______

**j.** $-18 \div 6 =$ ______

**k.** $-49 \div 7 =$ ______

**l.** $56 \div (-7) =$ ______

**m.** $-63 \div (-9) =$ ______

**n.** $-36 \div 6 =$ ______

**o.** $-40 \div (-8) =$ ______

**p.** $-50 \div (-2) =$ ______

**q.** $-75 \div 25 =$ ______

**r.** If the quotient of the integers is positive, then...

- **a.** both integers must be negative
- **b.** both integers must be positive
- **c.** one integer is positive and the other is negative
- **d.** both integers must be negative or both must be positive

# 7.2 integers: addition and subtraction

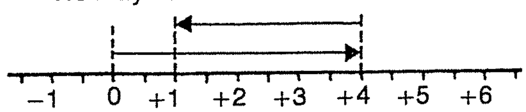
name ______________________

**Example 1**

Find the sum of $(+4) + (-3)$.

Solution

We may use a number line.




$(+4) + (-3) = +1$

**Example 2**

Subtract: $(+3) - (-2)$.

Solution

$(+3) - (-2)$ ← To subtract, we
$= (+3) + (+2)$ ← add the opposite.
$= +5$

**1** Add.

(a) $(+3) + (+2) =$ (b) $(-5) + (+2) =$

(c) $(-5) + (+6) =$ (d) $(+3) + (-5) =$

(e) $(-4) + (-3) =$ (f) $(+7) + (-4) =$

(g) $(-6) + (-3) =$ (h) $(+4) + (-5) =$

(i) $(-3) + (+7) =$ (j) $(-2) + (+2) =$

**2** Write the opposite.

(a) $-3$ (b) $+4$ (c) $-1$

(d) $-2$ (e) $+6$ (f) $-5$

**3** Subtract.

(a) $(+9) - (+3) =$ (b) $(+4) - (+6) =$

(c) $(-3) - (-2) =$ (d) $(-3) - (-5) =$

(e) $(-4) - (+3) =$ (f) $(+2) - (+6) =$

(g) $(+3) - (+1) =$ (h) $(+7) - (-6) =$

**4** Simplify. All operations are addition.

(a) $(-3) + (-2) + (+4) =$

(b) $(+2) + (-6) + (+4) =$

(c) $(-8) + (-6) + (+7) =$

(d) $(+6) + (-6) + (+2) =$

(e) $(+9) + (-8) + (+1) =$

**5** Simplify. All operations are subtraction.

(a) $(-3) - (-9) - (-4) =$

(b) $(-7) - (-4) - (-1) =$

(c) $(+2) - (-9) - (+7) =$

(d) $(-8) - (+2) - (-1) =$

(e) $(-4) - (+6) - (-1) =$

**6** Calculate. (Watch the signs.)

(a) $(+6) - (-4) + (-2) =$

(b) $(-5) + (+3) - (-7) =$

(c) $(-9) + (-2) - (-8) =$

(d) $(-7) + (+9) - (+8) =$

(e) $(-2) - (+6) + (+11) =$

(f) $(+4) - (-7) + (-9) =$

**7** Simplify.

(a) $(-3) - (-2) + (-5) =$

(b) $(-5) - (-3) + (-4) =$

(c) $(-3) + (-4) - (-5) =$

(d) $(+7) + (-3) - (-5) =$

(e) $(+5) - (-3) - (-7) =$

(f) $(+2) - (-5) + (-8) =$

Use with *MATH IS/2*, pages 217–221, and *MATH IS/2 2nd EDITION*, pages 316–324.

# 7.3 integers: multiplication and division

**name** ____________________

Multiplication and division of integers are related, as these examples show.

$(+6)(+3) = +18$
$(-6)(-3) = +18$
(same signs → positive integer)

$(+6)(-3) = -18$
$(-6)(+3) = -18$
(different signs → negative integer)

$\frac{+18}{+6} = +3$
$\frac{-18}{-6} = +3$
(same signs → positive integer)

$\frac{+18}{-6} = -3$
$\frac{-18}{+6} = -3$
(different signs → negative integer)

**1** Multiply.

(a) $(+5)(+4) =$ (b) $(+7)(+3) =$

(c) $(-2)(-9) =$ (d) $(-6)(-3) =$

(e) $(+3)(+5) =$ (f) $(-6)(-6) =$

(g) $(-3)(+3) =$ (h) $(-2)(+8) =$

(i) $(+2)(-1) =$ (j) $(+3)(-7) =$

**2** Divide.

(a) $(+8) \div (+2) =$ (b) $(-16) \div (-4) =$

(c) $(+9) \div (+3) =$ (d) $(-12) \div (-4) =$

(e) $(-20) \div (+10) =$ (f) $(-18) \div (+6) =$

(g) $(+24) \div (-6) =$ (h) $(-18) \div (+3) =$

(i) $(-12) \div (+3) =$ (j) $(+8) \div (-2) =$

(k) $(+15) \div (-5) =$ (l) $(+15) \div (-3) =$

**3** Simplify.

(a) $(-3)(+7) =$ (b) $(-5)(-1) =$

(c) $(-9)(-7) =$ (d) $(-2)(+1) =$

(e) $(-6)(-9) =$ (f) $(-4)(+6) =$

(g) $(+4)(+8) =$ (h) $(+8)(-3) =$

(i) $(-8)(-1) =$ (j) $(+1)(-5) =$

(k) $(+9)(-2) =$ (l) $(-7)(-4) =$

(m) $(+9)(+2) =$ (n) $(-3)(+7) =$

(o) $(+1)(-3) =$ (p) $(-5)(-4) =$

In the questions that follow, we may write +6 as 6. When we write 6, we know 6 means +6. However, we must write the negative sign to show −6.

**4** Simplify.

(a) $(30) \div (-5) =$ (b) $(-12) \div (-2) =$

(c) $(14) \div (7) =$ (d) $(-16) \div (-4) =$

(e) $(28) \div (-7) =$ (f) $(-21) \div (-3) =$

(g) $(-36) \div (9) =$ (h) $(32) \div (-8) =$

**5** Simplify. (Watch the operation signs!)

(a) $(-7)(-2) =$ (b) $(-16) \div (4) =$

(c) $(-3)(9) =$ (d) $(12) \div (-4) =$

(e) $(-24) \div (12) =$ (f) $(-3)(4) =$

(g) $(5)(-3) =$ (h) $(-6) \div (-3) =$

**6** Calculate.

(a) $(-3)(-2)(-3) =$

(b) $(-2)(3)(-2) =$

(c) $(16)(2) \div (-4) =$

(d) $(4)(-5)(5) =$

(e) $(-3)(-5)(-5) =$

(f) $(-6)(5)(-2) =$

(g) $(-16) \div (-2) \div (-8) =$

(h) $(1)(-1)(1) =$

Use with *MATH IS/2*, pages 230–243, and *MATH IS/2 2nd EDITION*, pages 334–347.

NAME ______________________________

# Lesson 4.2 Rational Numbers as Fractions

A number that can be written as the ratio of two integers is called a **rational number**. For example, the fraction $\frac{1}{3}$ is a rational number because it is the ratio 1 to 3. The number 2 is a rational number because it can be written as $\frac{2}{1}$, or the ratio of 2 to 1. A decimal is also a rational number because it can be written as a fraction. For example, $0.234 = \frac{234}{1,000}$.

A fraction whose numerator is greater than its denominator is called an **improper fraction.** An improper fraction can be changed to a **mixed numeral**, a number written as a whole number and a fraction. To change an improper fraction to a mixed numeral, divide the numerator by the denominator. For example, $\frac{18}{7}$ means $18 \div 7$. Because 7 divides into 18 two times with a remainder of 4, $\frac{18}{7}$ equals $2\frac{4}{7}$.

To change a mixed numeral into an improper fraction, multiply the whole number by the denominator and add the numerator. Place this number over the denominator.
For example, $4\frac{3}{5} = \frac{(4 \times 5) + 3}{5} = \frac{23}{5}$

Change the improper fractions to mixed numerals.

| | a | b | c | d |
|---|---|---|---|---|
| 1. | $\frac{23}{2} =$ ______ | $\frac{17}{9} =$ ______ | $\frac{29}{5} =$ ______ | $\frac{71}{3} =$ ______ |
| 2. | $\frac{45}{4} =$ ______ | $\frac{142}{15} =$ ______ | $\frac{100}{33} =$ ______ | $\frac{55}{7} =$ ______ |

Change the mixed numerals to improper fractions.

| | | | | |
|---|---|---|---|---|
| 3. | $4\frac{1}{3} =$ ______ | $5\frac{4}{9} =$ ______ | $2\frac{4}{5} =$ ______ | $3\frac{2}{7} =$ ______ |
| 4. | $7\frac{1}{4} =$ ______ | $9\frac{5}{6} =$ ______ | $6\frac{2}{9} =$ ______ | $8\frac{3}{8} =$ ______ |

## The Repeater vs. The Terminator

### Part One

The chart below includes 13 **unit fractions**, fractions with a numerator of 1. For this activity, first determine the prime factorization of the denominator of the unit fraction. Then, turn the fraction into a decimal and determine whether the fraction is repeating or terminating.

| UNIT FRACTION | PRIME FACTORIZATION OF DENOMINATOR | DECIMAL FORM | TERMINATES OR REPEATS |
|---|---|---|---|
| $\frac{1}{2}$ | PRIME | .5 | Terminates |
| $\frac{1}{3}$ | PRIME | $.\overline{3}$ | Repeats |
| $\frac{1}{4}$ | $2 \cdot 2$ | | Terminates |
| $\frac{1}{5}$ | | | |
| $\frac{1}{6}$ | | $.\overline{16}$ | Repeats |
| $\frac{1}{7}$ | | | |
| $\frac{1}{8}$ | $2 \cdot 2 \cdot 2$ | | |
| $\frac{1}{9}$ | | $.\overline{11}$ | |
| $\frac{1}{10}$ | | | Terminates |
| $\frac{1}{11}$ | | | |
| $\frac{1}{12}$ | | | |
| $\frac{1}{13}$ | PRIME | | |

*Answer the following questions based upon your results from the chart.*

1. Which fractions terminate?

2. Give another example of a fraction that can be turned into a terminating decimal. Justify why this fraction is a terminating decimal.

3. Consider the fractions $\frac{1}{3}, \frac{1}{7},$ and $\frac{1}{11}$. What do these fractions have in common?

4. What do you hypothesize about rational numbers with denominators that are prime numbers?

**Part Two**
Convert the following fractions into decimals. (You have calculated a few of them before!)

| Fraction | Decimal | Fraction | Decimal | Fraction | Decimal | Fraction | Decimal |
|---|---|---|---|---|---|---|---|
| $\frac{1}{4}$ | | $\frac{1}{8}$ | | $\frac{1}{9}$ | | $\frac{1}{11}$ | |
| $\frac{2}{4}$ | | $\frac{3}{8}$ | | $\frac{2}{9}$ | | $\frac{2}{11}$ | |
| $\frac{3}{4}$ | | $\frac{5}{8}$ | | $\frac{3}{9}$ | | $\frac{3}{11}$ | |
| $\frac{4}{4}$ | | $\frac{7}{8}$ | | $\frac{4}{9}$ | | $\frac{4}{11}$ | |

1. Do you notice a pattern between the fractions with denominators of 9 and their decimals? If so, what is the pattern?

2. **Without using a calculator,** what is the decimal form of $\frac{8}{9}$?

3. Do you notice a pattern between the fractions with denominators of 11 and their decimals? If so, what is the pattern?

4. **Without using a calculator,** what is the decimal form of $\frac{9}{11}$?