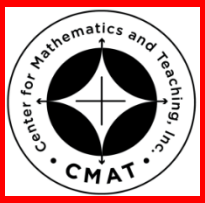
Name _____ Period _____ Date _____




MathLinks

**7-3**
**STUDENT PACKET**

# *MATHLINKS*: GRADE 7
# STUDENT PACKET 3
# INTEGER ADDITION AND SUBTRACTION

# WORD BANK

| Word or Phrase | Definition or Description | Picture or Example |
|---|---|---|
| absolute value | | |
| addend | | |
| additive identity property | | |
| additive inverse property | | |
| difference | | |
| integers | | |
| minuend | | |
| opposite | | |
| subtrahend | | |
| sum | | |

# INTEGER MODELS

**Summary**

We will think about positive and negative numbers using "hot pieces" and "cold nuggets" in the context of a temperature change model. We will represent positive and negative integers with counters.

**Goals**

- Explore integers using a temperature change model.
- Explore integers using a counter model.

## Warmup

Write the opposite of each expression.

| 1. $-10$ | 2. $7$ | 3. $0$ | 4. $-(-8)$ |
|---|---|---|---|
| | | | |

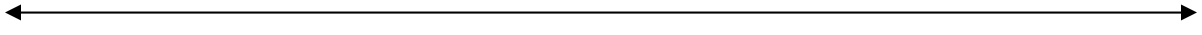
Simplify the absolute value expressions.

| 5. $\lvert 9 \rvert$ | 6. $\lvert -17 \rvert$ | 7. $\lvert 6-3 \rvert$ | 8. $\lvert -7-2 \rvert$ |
|---|---|---|---|
| | | | |

Write $>$, $<$, or $=$ in the blanks to make each statement true.

| 9. $-10 \_\_\_\_\_ -5$ | 10. $\lvert -10 \rvert \_\_\_\_\_ \lvert -5 \rvert$ | 11. $\lvert -2 \rvert \_\_\_\_\_ 2$ | 12. $\lvert -2 \rvert \_\_\_\_\_ -2$ |
|---|---|---|---|

13. Draw an arrow that represents $-3\frac{1}{4}$ on the number line below. Label the starting point and ending point.



# A TEMPERATURE CHANGE MODEL

Suppose scientists discover an amazing way to control the temperature of liquid. They invent "hot **p**ieces" and "cold **n**uggets" that when added change a liquid's their temperature. If you have a liquid that you want to cool down, place some cold **n**uggets in it. They never melt! Too cold now? Put some hot **p**ieces in.

THINK:

| | | |
|---|---|---|
| Hot **P**ieces | **P**ositive ( + ) | Put in Hot → The liquid gets hotter. |
| Cold **N**uggets | **N**egative ( – ) | Put in Cold → The liquid gets colder. |

In other words:

| | |
|---|---|
| Put in 1 hot **p**iece | 1 degree hotter → + (+1) |
| Put in 1 cold **n**ugget | 1 degree _____ → + (-1) |

Write the change in the liquid's temperature. Each problem is independent of the others.

Example:

Put in 2 hot **p**ieces. Answer: *The liquid becomes 2 degrees hotter.*

1. Put in 4 cold **n**uggets.

2. Put in 1 hot **p**iece and 1 cold **n**ugget.

3. Put in 2 hot **p**ieces and 1 cold **n**ugget.

4. Put in 2 hot **p**ieces and 4 cold **n**uggets.

# A TEMPERATURE CHANGE MODEL (Continued)

There are other ways to control the temperature of the liquid. Rather than putting hot **p**ieces and cold **n**uggets in the liquid, you can take out **p**ieces or **n**uggets that are already there.

THINK:

| | | |
|---|---|---|
| Hot **P**ieces | **P**ositive ( + ) | Take out Hot → The liquid gets colder. |
| Cold **N**uggets | **N**egative ( – ) | Take out Cold → The liquid gets hotter. |

In other words:

| | | |
|---|---|---|
| Take out 1 hot **p**iece | | 1 degree _____ → - (+1) |
| Take out 1 cold **n**ugget | | 1 degree _____ → - (-1) |

Write the change in the liquid's temperature. Each problem is independent of the others.

5. Take out 2 hot **p**ieces.

6. Take out 4 cold **n**uggets.

7. Take out 1 hot **p**iece and 1 cold **n**ugget.

8. Take out 2 hot **p**ieces and 1 cold **n**ugget.

9. Take out 2 hot **p**ieces and 4 cold **n**uggets.

# TEMPERATURE CHANGE MODEL PRACTICE

Using hot **p**ieces and cold **n**uggets in the temperature change model, what is the change in temperature if you do the following?

| Put in… | Take out… |
|---|---|
| 1. 3 hot **p**ieces? | 2. 4 hot **p**ieces? |
| 3. 6 cold **n**uggets? | 4. 9 cold **n**uggets? |
| 5. 2 hot **p**ieces and 2 cold **n**uggets? | 6. 5 hot **p**ieces and 5 cold **n**uggets? |
| 7. 4 hot **p**ieces and 1 cold **n**ugget? | 8. 2 hot **p**ieces and 6 cold **n**uggets? |

9. Using hot **p**ieces and/or cold **n**uggets, write three different ways to increase the temperature of a liquid by 3 degrees.

10. Using hot **p**ieces and/or cold **n**uggets, write three different ways to decrease the temperature of a liquid by 2 degrees.

11. You put 4 hot pieces into the liquid, but changed your mind about wanting to increase the temperature. What are two things you can do to return the liquid to the previous temperature?

12. You put 3 cold nuggets into the liquid, but changed your mind about wanting to decrease the temperature. What are two things you can do to return the liquid to the previous temperature?

# A COUNTER MODEL

We can use different counters to represent positive numbers and negative numbers.

A positive counter is represented by _____ .
(the manipulative you are using)

It is recorded using a plus (+).

A negative counter is represented by _____ .
(the manipulative you are using)

It is recorded using a minus (–).

A "zero pair" is represented by one _____ and one _____.

1. Record a value of 5 in two different ways.

Example:

+ + + + + +
–

2. Record a value of -3 in three different ways.

Record a value of 4 in the following ways.

| 3. Use more than 7 counters. | 4. Use less than 7 counters. | 5. Use exactly 7 counters. |
|---|---|---|
| | | |

Build and draw the following situations.

6. Start with a value of 2.
What can you place on your work space to change this into a value of zero?

Draw the result.

7. Start with a value of -3.
What can you place on your work space to change this into a value of zero?

Draw the result.

# COUNTER MODEL PRACTICE

2. What is the name of one positive with one negative counter? _____ _____

Build each value using positive and negative counters. Record diagrams in the spaces provided. If the value cannot be built as indicated, explain why.

| | |
|---|---|
| 2. A value of 7 | 3. A value of -8 |
| 4. A value of zero using 4 counters | 5. A value of zero using 8 counters |
| 6. A value of 3 | 7. A value of 3 (different from your answer in problem 6) |
| 8. A value of -6 | 9. A value of -6 (different from your answer in problem 12) |
| 10. A value of -7 using *at least* 11 counters | 11. A value of 3 using *exactly* 8 counters |

Build and draw the following situations.

12. Start with a value of 4.
What can you place on your work space to change this into a value of zero?

Draw the result.

13. Start with a value of -5.
What can you place on your work space to change this into a value of zero?

Draw the result.

14. Try to represent *any* odd value with an even number of counters. What do you notice?

# ADDITION: COUNTERS AND TEMPERATURE

**Summary**

We will use counter and temperature change models to generalize rules for integer addition.

**Goals**

- Explore the meaning of integer addition.
- Develop rules for integer addition using counter and temperature change models.
- Understand the concepts of additive identity and additive inverse.

## Warmup

Write the opposite of each number.

| | | |
|---|---|---|
| 1. 9 → _____ | 2. -3 → _____ | 3. 0 → _____ |

4. Explain what it means for a number to be an opposite of another number. Use an example on a number line to support your explanation.

Simplify each absolute value expression.

| | | |
|---|---|---|
| 5. $\lvert 8 \rvert$ = _____ | 6. $\lvert -5 \rvert$ = _____ | 7. $\lvert 0 \rvert$ = _____ |

8. Explain what it means to find the absolute value of a number. Use an example on a number line to support your explanation.

9. From a standing position, where do you end up if you move one yard backward and then one yard forward?

10. Starting with a certain amount of money, how much more or less do you have if you gain one dollar and then lose one dollar?

# ADDITION 1

Use the scripts in these templates to help you think through integer addition problems.
**Do not write on this template.**

| Think counter model<br>(Begin with a work space that has a value equal to 0.) | Connect to temperature change model<br>(Begin with a temperature equal to zero degrees.) |
|---|---|
| • Build _____ ____.<br>positive/negative<br>• The plus (+) means to add.<br>• Add _____ _____ counter(s).<br>positive/negative<br>• The result is ___ _____ counter(s).<br>positive/negative | • Create a liquid temp. of ____ degree(s).<br>• The plus (+) means to put in.<br>• Put in _____ _____.<br>hot piece(s)/cold nugget(s)<br>• The liquid is now _____ degree(s). |

Compute each sum. Think about the counter model, and connect to the temperature change model. Show your work by drawing positive (+) and negative (–) symbols.

| | |
|---|---|
| 1. (4) + (3) = _____ | 2. (-4) + (-3) = _____ |
| 3. (5) + (2) = _____ | 4. (-3) + (-2) = _____ |
| 5. (6) + (4) = _____ | 6. (-6) + (-1) = _____ |

# ADDITION 1 (Continued)

Compute each sum. Think about the counter model. Connect to the temperature change model. Show your work by drawing positive (+) and negative (–) symbols.

7. (-3) + (-5) = _____

8. (2) + (7) = _____

In an addition sentence, the numbers being added are called the addends, and the result is called the sum.

addend + addend = sum

Put a box around each addend and circle each sum.

9. 25 + 54 = 79

10. 315 = 140 + 15 + 160

11. In problems 1-6, the addends have _____ sign(s).
the same/ different

12. How can you tell if the sum will be positive or negative in these examples?

13. Did you use zero pairs in these problems?

14. Create an expression with two negative addends so that the sum is negative.

# ADDITION 2

Use the scripts in these templates to help you think through integer addition problems.
**Do not write on this template.**

| Think counter model<br>(Begin with a work space that has a value equal to 0.) | Connect to temperature change model<br>(Begin with a temperature equal to zero degrees.) |
|---|---|
| • Build _____ ____.<br>positive/negative<br>• The plus (+) means to add.<br>• Add _____ _____ counter(s).<br>positive/negative<br>• The result is ___ _____ counter(s).<br>positive/negative | • Create a liquid temp. of ____ degree(s).<br>• The plus (+) means to put in.<br>• Put in _____ _____.<br>hot piece(s)/cold nugget(s)<br>• The liquid is now _____ degree(s). |

Compute each sum. Think about the counter model, and connect to the temperature change model. Show your work by drawing positive (+) and negative (–) symbols.

| | |
|---|---|
| 1. (4) + (-3) = _____ | 2. (-2) + 3 = _____ |
| 3. (-4) + 6 = _____ | 4. 5 + (-2) = _____ |

5. In problems 1-4, the addends have _____ sign(s).
the same/different

6. Why do zero pairs appear in these calculations?

7. Why is the sum always positive in these examples?

# ADDITION 2 (Continued)

Compute each sum. Think about the counter model, and connect to the temperature change model. Show your work by drawing positive (+) and negative (–) symbols.

8. (-4) + 3 = _____

9. -5 + 3 = _____

10. 5 + (-7) = _____

11. -4 + 2 = _____

12. In problems 8-11, the addends have _____ sign(s).
the same/different

13. Why do zero pairs appear in these calculations?

14. Why is the sum always negative in these examples?

15. Draw a diagram and write an equation with one positive addend and one negative addend so that:

a. the sum is positive.

b. the sum is negative.

c. the sum is zero.

16. Write a numerical equation with three addends so that:

a. two of the addends are negative and the sum is positive.

b. two of the addends are positive and the sum is negative.

c. two of the addends are negative and the sum is zero.

# PROPERTIES RELATED TO ADDITION AND ZERO PAIRS

**Additive Inverse Property**

For every number *a*,

$a + (-a) = 0$ and $-a + a = 0$.

A number plus its opposite is always _____.

**Additive Identity Property**

For every number *a*,

$a + 0 = a$ and $0 + a = a$.

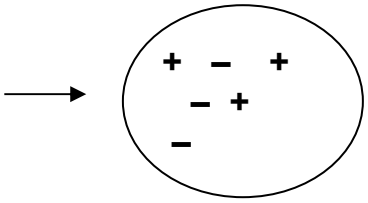
A number plus zero is always _____.

Answer these questions.

1. What is the value of the collection to the right? _____

   Write the value as a number sentence in TWO ways.

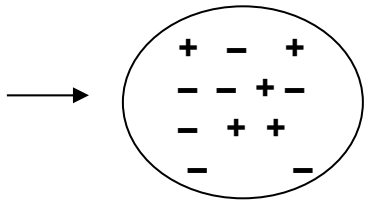
   _____ and _____




2. What is the value of the collection to the right? _____

   Write the value as a number sentence in TWO ways.

   _____ and _____




3. Using a combination of ten counters, draw a value of 4.

How many "zero pairs" are in your collection? _____

4. Does adding a "zero pair" to a number change the value of the number? _____

5. Why is -135 + 135 = 0? _____

6. Why is 73 + 0 = 73 ? _____

7. Explain the meaning of "zero pairs" in your own words. _____

_____

# ADDITION PRACTICE

Without computing, determine whether each sum is positive (> 0), negative (< 0), or zero (= 0).

| Example A: -4 + (-4) < 0<br>negative | Example B: 5 + (-4) > 0<br>positive | Example C: -8 + 8 = 0<br>zero |
|---|---|---|
| 1. -2 + (-11) | 2. 7 + (-3) | 3. -2 + (-6) |
| 4. 9 + 4 | 5. -6 + 4 | 6. 11 + (-4) |
| 7. -6 + (-1) | 8. -5 + 1 | 9. 1 + (-1) |

Compute each sum. Use positive symbols (+) and negative symbols (–) if needed.

| | | |
|---|---|---|
| 10. 7 + (-2) = _____ | 11. -9 + 9 = _____ | 12. -1 + (-3) = _____ |
| 13. 11 + 12 = _____ | 14. 3 + (-8) = _____ | 15. -5 + 6 = _____ |
| 16. 2 + (-2) = _____ | 17. -3 + (-6) = _____ | 18. 13 + (-3) = _____ |

Challenge: Compute each sum without drawing positive or negative symbols.

| | | |
|---|---|---|
| 19. -75 + (-25) | 20. -100 + 1 | 21. -80 + 120 |
| 22. -57 + 89 | 23. 17 + (-68) | 24. -37 + (-56) |

# SUBTRACTION: COUNTERS AND TEMPERATURE

**Summary**

We will use counter and temperature change models to generalize rules for integer subtraction.

**Goals**

- Explore the meaning of integer subtraction.
- Develop rules for integer subtraction using counter and temperature change models.

## Warmup

For each problem, draw a diagram (if helpful) and find the result. Think about the counter model or the temperature change model as you work.

| | | |
|---|---|---|
| 1. -2 + 5 = _____ | 2. 4 + (-1) = _____ | 3. -2 + (-2) = _____ |
| 4. -2 + 2 = _____ | 5. -1 + 0 = _____ | 6. -9 + 2 = _____ |
| 7. 2 + 5 = _____ | 8. -4 + (-6) = _____ | 9. 3 + (-3) = _____ |
| 10. 8 + (-3) =_____ | 11. -8 + 5 = _____ | 12. -6 + 7 = _____ |

13. When adding two integers, the result is **Positive** when both addends are positive or when

_____.

14. When adding two integers, the result is **Negative** when both addends are

_____ or when _____

_____.

15. When adding two integers, the result is **Zero** when _____.

# SUBTRACTION 1

Use this template to help you think through integer subtraction problems.
**Do not write on the template.**

| Think counter model<br>(Begin with a work space that has a value equal to 0.) | Connect to temperature change model<br>(Begin with a temperature equal to zero degrees.) |
|---|---|
| • Build _____ ____.<br>positive/negative | • Create a liquid temp. of ____ degree(s). |
| • The minus ( – ) means to subtract. | • The minus ( – ) means to remove. |
| • Subtract _____ _____counter(s).<br>positive/negative | • Remove _____ _____.<br>hot piece(s)/cold nugget(s) |
| • The result is ____ _____counter(s).<br>positive/negative | • The liquid is now _____ degree(s). |

Compute each difference. Think about the counter model, and connect to the temperature change model. Show your work by drawing positive (+) and negative (–) counters.

| | |
|---|---|
| 1. (4) – (3) = _____ | 2. (-4) – (-3) = _____ |
| 3. (3) – (1) = _____ | 4. (-7) – (-2) = _____ |
| 5. (-5) – (-1) = _____ | 6. (7) – (4) = _____ |

# SUBTRACTION 1 (Continued)

Compute each difference. Think about the counter model, and connect to the temperature change model. Show your work by drawing positive (+) and negative (–) counters.

7. (-4) – (-4) = _____

8. (-5) – (-2) = _____

In a subtraction sentence, the number being subtracted from (starting value) is called the minuend, the number being subtracted (second number) is called the subtrahend, and the result is called the difference.

minuend – subtrahend = difference

Put a box around each minuend, underline each subtrahend, and circle each difference.

9. 59 – 13 = 46

10. 145 = 180 – 35

11. In problems 1-8, the minuend and subtrahend have _____ sign(s).
the same/different

12. Why is it unnecessary to introduce zero pairs in these problems?

13. Based on the examples above, do you think that subtraction always results in a value that is lesser than the minuend (first number)?

14. Create an equation for which one negative number is subtracted from another negative number, and the difference is zero.

# SUBTRACTION 2

Use this template to help you think through integer subtraction problems.
**Do not write on this template.**

| Think counter model<br>(Begin with a work space that has a value equal to 0.) | Connect to temperature change model<br>(Begin with a temperature equal to zero degrees.) |
|---|---|
| • Build _____ ____.<br>positive/negative | • Create a liquid temp. of ____ degree(s). |
| • The minus ( – ) means to subtract. | • The minus ( – ) means to remove. |
| Are zero pairs needed first? | Are zero pairs needed first? |
| • Subtract _____ _____counter(s).<br>positive/negative | • Remove _____ _____.<br>hot piece(s)/cold nugget(s) |
| • The result is ____ _____counter(s).<br>positive/negative | • The liquid is now _____ degree(s). |

Compute each difference. Think about the counter model, and connect to the temperature change model. Show your work by drawing positive (+) and negative (–) counters.

| | |
|---|---|
| 1. (3) – (4) = _____ | 2. (-1) – (-4) = _____ |
| 3. 4 – 5 = _____ | 4. -7 – (-10) = _____ |

5. The minuend and subtrahend have the same sign for problems 1-4. After building the minuend with counters, were there enough counters to remove the subtrahend? ____

   Explain how to use zero pairs to model subtraction for these problems.

# SUBTRACTION 2 (Continued)

Compute each difference. Think about the counter model, and connect to the temperature change model. Show your work by drawing positive (+) and negative ( – ) counters.

6. (-4) – 3 = _____

7. 2 – (-1) = _____

8. 5 – (-8) = ____

9. -5 – (2) = _____

10. In problems 6-9, the minuend and subtrahend have different signs. After building the minuend with the counter model, were there enough counters to remove the subtrahend? ____

    Explain how to use zero pairs to model subtraction for these problems.

11. Draw a diagram and write an equation where the difference of two numbers is:

    a. positive

    b. negative

    c. zero

12. In elementary school, some students are told that subtraction must always involve a lesser number subtracted from a greater number. Explain why this is false.

# SUBTRACTION PRACTICE

For each problem, draw a diagram and find the result. Think about the counter model or the temperature change model as you work.

| | | |
|---|---|---|
| 1. $-5 - (-2) =$ _____ | 2. $5 - (-2) =$ _____ | 3. $1 - 6 =$ _____ |
| 4. $1 - (-6) =$ _____ | 5. $6 - (-1) =$ _____ | 6. $0 - 8 =$ _____ |
| 7. $-4 - 2 =$ _____ | 8. $-7 - (-5) =$ _____ | 9. $4 - (-2) =$ _____ |
| 10. $-10 - (-8) =$ _____ | 11. $-8 - (-10) =$ _____ | 12. $8 - 10 =$ _____ |
| 13. $-1 - 7 =$ _____ | 14. $5 - 3 =$ _____ | 15. $0 - (-4) =$ _____ |

# COMPARING ADDITION AND SUBTRACTION

Compute. Show your work using positive symbols (+) and negative symbols (-). Use zero pairs if needed.

| | |
|---|---|
| 1a. 3 – (-1) = _____ | 1b. 3 + 1 = _____ |
| 2a. -6 – 4 = _____ | 2b. -6 + (-4) = _____ |
| 3a. 7 – 4 = _____ | 3b. 7 + (-4) = _____ |
| 4a. -5 – (-1) = _____ | 4b. -5 + 1 = _____ |
| 5a. -8 – 2 = _____ | 5b. -8 + (-2) = _____ |

6. Compare parts (a) and (b) for problems 1-5. These examples illustrate that subtracting a number is the same as _____.

Algebraically, for all integers *a* and *b*, we can write the integer subtraction rule as:
$a - b = a + (-b)$ ; another way to express this rule is $a - (-b) = a + b$

Find the difference using the subtraction rule. Check using counters or diagrams.

7. 5 – 3 = 5 + (_____) = _____

8. 4 – (-6) = 4 + (_____) = _____

9. -1 – 7 = -1 + (_____) = _____

10. -9 – (-2) = -9 + (_____) = _____

# MORE SUBTRACTION

Without computing, determine whether each sum is positive (> 0), negative (< 0), or zero (= 0).

| Example A: $-7-(-7)=0$ | Example B: $8-(-2)>0$ | Example C: $-9-4<0$ |
|---|---|---|
| zero | positive | negative |
| 1. $-5-(-11)$ | 2. $12-(-5)$ | 3. $-6-(-10)$ |
| 4. $7-3$ | 5. $-8-2$ | 6. $15-(-3)$ |
| 7. $-9-(-1)$ | 8. $-7-3$ | 9. $12-(-12)$ |

Compute each difference. Draw positive and negative counters if needed.

| | | |
|---|---|---|
| 10. $8-(-4)=$ _____ | 11. $-10-10=$ _____ | 12. $-5-(-8)=$ _____ |
| 13. $9-5=$ _____ | 14. $4-(-9)=$ _____ | 15. $-8-9=$ _____ |
| 16. $5-(-5)=$ _____ | 17. $-4-(-7)=$ _____ | 18. $14-(-3)=$ _____ |

Challenge: Compute each difference without drawing positive or negative counters.

| | | |
|---|---|---|
| 19. $-90-(-30)=$ _____ | 20. $-86-6=$ _____ | 21. $95-(-225)=$ _____ |
| 22. $108-55=$ _____ | 23. $-1000-1=$ _____ | 24. $-1000-(-1)=$ _____ |

# SKILL BUILDERS, VOCABULARY, AND REVIEW

## SKILL BUILDER 1

Compute.

| | |
|---|---|
| 1. $19.5 - 8.23$ | 2. $25.1 \bullet 3.2$ |
| 3. $1.34 \bullet 0.104$ | 4. $\frac{5}{12} + \frac{1}{4}$ |
| 5. $1\frac{5}{8} - \frac{3}{4}$ | 6. $1\frac{1}{2} \bullet 2\frac{4}{5}$ |

Name the property that illustrates why the expressions in columns A and B are equal. Then explain why each expression in column B is easier to compute.

| | A | B | Property and Explanation |
|---|---|---|---|
| 7. | $3.5 + (1.5 + 2.8)$ | $(3.5 + 1.5) + 2.8$ | |
| 8. | $\frac{1}{3} \bullet 10 \bullet 3$ | $\frac{1}{3} \bullet 3 \bullet 10$ | |
| 9. | $4(5 - 0.2)$ | $4(5) - 4(0.2)$ | |

# SKILL BUILDER 2

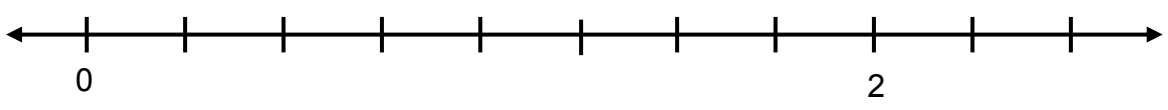
Compute.

| | |
|---|---|
| 1. $241 \bullet 22$ | 2. $315 \div 5$ |
| 3. $24 \div 0.4$ | 4. $25.5 \div 1.5$ |
| 5. $\frac{7}{10} \div \frac{4}{5}$ | 6. $6\frac{1}{3} \div 2\frac{2}{5}$ |

7. Bobbie and Bob have $350 to give to their grandchildren. If they have 8 grandchildren and each gets an equal amount, how much money would each grandchild get?

8. Graph each number on the number line and then write the numbers in order below.

$1\frac{1}{2}$ $\frac{3}{4}$ $\frac{5}{4}$ $\frac{1}{4}$ $1\frac{3}{4}$




_____ < _____ < _____ < _____ < _____

# SKILL BUILDER 3

Zack and Sam are making necklaces to give their friends. Zack uses $\frac{5}{6}$ feet of string to make one necklace and Sam uses $1\frac{1}{3}$ feet of string to make one necklace.

| | | |
|---|---|---|
| 1. How much string would Zack and Sam need to use in all if they both made one necklace? | 2. Whose necklace is longer, and by how much? | 3. Zack wants to make necklaces for 4 friends and Sam wants to make necklaces for 3 friends. How much string do they need in all? |

Zack and Sam have one spool of string that is 8 ft long.

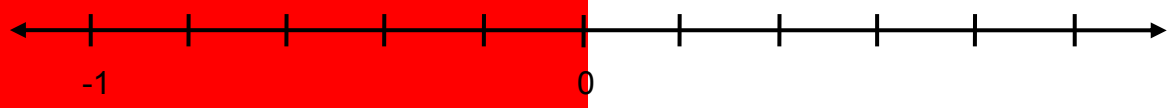
| | |
|---|---|
| 4. Do they have enough string to make the necklaces for their friends? | 5. If they had to share a spool equally, how many necklaces could each make? |

# SKILL BUILDER 4

Write the following rational numbers as decimals.

| | | |
|---|---|---|
| 1. $\frac{1}{5}$ | 2. $\frac{8}{3}$ | 3. $-4\frac{3}{8}$ |

4. Locate each number on the number line below and label it with its letter.




*A* 1 *B* -0.2 *C* $|-0.8|$

*D* the opposite of $\frac{3}{5}$ *E* $\left|-\frac{1}{5}\right|$ *F* $\frac{1}{10}$

5. What is the opposite of the opposite of -13?

6. Simplify. $-|-(18-9)|$.

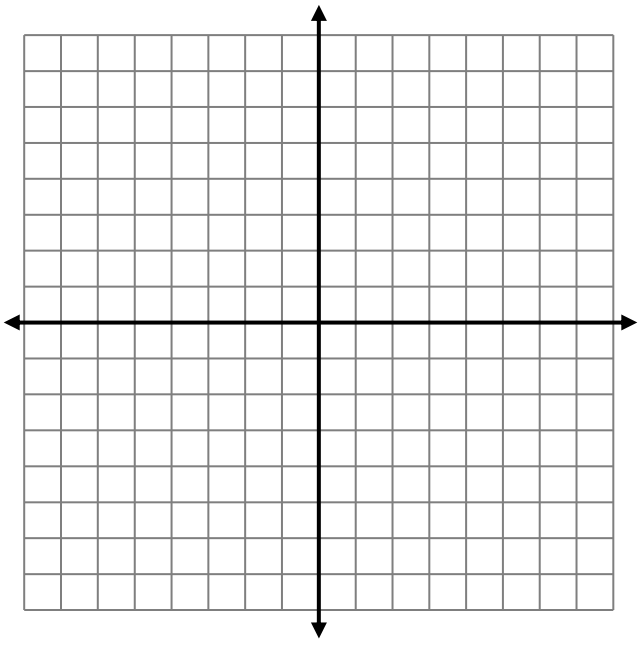
7. Each small square on the grid is a unit square. Graph the ordered pairs, and label them.

   *A* (-4, 5)

   *B* (0,-3)

   *E* (5, -1.5)

   *F* (-4.5, -3.5)



# SKILL BUILDER 5

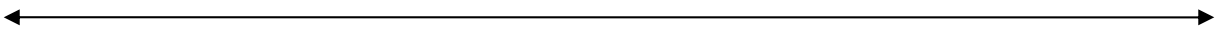
Using hot **p**ieces and cold **n**uggets in the temperature change model, describe the change in temperature if you did the following.

| Put in… | Take out… |
|---|---|
| 1. 5 hot **p**ieces? | 2. 8 hot **p**ieces? |
| 3. 2 cold **n**uggets? | 4. 7 cold **n**uggets? |
| 5. 1 hot **p**iece and 1 cold **n**ugget? | 6. 3 hot **p**ieces and 3 cold **n**uggets? |
| 7. 6 hot **p**ieces and 3 cold **n**uggets? | 8. 3 hot **p**ieces and 9 cold **n**uggets? |

Show each value using diagrams of positive and negative counters.

| | |
|---|---|
| 9. A value of 6 | 10. A value of -3 |
| 11. A value of zero using 6 counters | 12. A value of zero using 10 counters |
| 13. A value of -4 | 14. A value of -4 (different than problem 13) |
| 15. A value of 5 | 16. A value of 5 (different than problem 15) |

17. On the line below, draw an arrow that starts at -4 and represents $2\frac{1}{3}$. Draw in hatch marks with an appropriate scale. Label as needed to make your work clear.



# SKILL BUILDER 6

1. Order these integers using a "less than" symbol ( < ). -4, 9, -8, 7, -2, 0, 5

2. What is the opposite of the opposite of $-|9-4|$?

Without computing, determine whether each sum is positive (> 0), negative (< 0), or zero (= 0).

| | | |
|---|---|---|
| 3. -55 + (-16) | 4. 35 + (-14) | 5. -41 + 28 |
| 6. 12 + 74 | 7. 56 + -44 | 8. -72 + 72 |

Compute each sum. Draw positive and negative counters if needed.

| | | |
|---|---|---|
| 9. 7 + (-2) = _____ | 10. -10 + 9 = _____ | 11. -3 + (-3) = _____ |
| 12. 13 + 8 = _____ | 13. 9 + (-1) = _____ | 14. -4 + 1 = _____ |
| 15. 5 + (-3) = _____ | 16. -2 + (-9) = _____ | 17. 1 + (-7) = _____ |

Challenge: Compute each sum without drawing positive or negative counters.

| | | |
|---|---|---|
| 18. -60 + (-20) | 19. -50 + 20 | 20. -35 + (-15) |
| 21. -63 + 93 | 22. -101 + 1 | 23. -450 + (-225) |

# SKILL BUILDER 7

For each problem, draw a diagram and find the result. Think about the counter model or the temperature change model as you work.

| | | |
|---|---|---|
| 1. -2 – (-2) = _____ | 2. 9 – (-1) = _____ | 3. 5 – 6 = _____ |
| 4. -3 – (-6) = _____ | 5. 2 – (-3) = _____ | 6. -3 – 7 = _____ |
| 7. -8 – 1 = _____ | 8. -10 – (-5) = _____ | 9. 5 – (-1) = _____ |
| 10. -10 – (-12) = _____ | 11. -4 – (-11) = _____ | 12. 3 – 3 = _____ |

13. Leo has $20. Leo owes his mom $15 for a movie ticket and $35 for the school yearbook. Write an expression that describes how much Leo will owe his mom after he pays her what he has. How much will he still owe his mom?

14. On the line below, draw an arrow that represents $-\frac{3}{4}$ and ends at $-\frac{1}{2}$. Draw in hatch marks with an appropriate scale. Label as needed to make your work clear.

# SKILL BUILDER 8

Compute. Draw positive or negative counters if needed.

| | | |
|---|---|---|
| 1. -3 – 6 | 2. 9 – (-2) | 3. -12 + 4 |
| 4. -10 + -2 | 5. 6 – 2 | 6. -6 + (-4) |
| 7. -6 – 3 + (-4) | 8. 7 – 10 – 4 | 9. -5 + 2 + (-3) |

10. One day at noon, the temperature in Alaska was 85° lower than the temperature in California. If the California temperature was 70°F at noon, what was the Alaska temperature at noon?

11. Here is a tape diagram that represents a mixture of grape juice (G) and water (W). Stacey wants to make 45 cups of this juice mixture for the school picnic. How much grape juice and how much water should she use?

| | | | | |
|---|---|---|---|---|
| G | G | G | W | W |

12. Megan and James rent a rowboat at VB Rentals. Megan rows $1\frac{1}{2}$ miles upstream. Then James rows $2\frac{3}{4}$ miles downstream. Draw an arrow to represent the situation. How far are they from VB Rentals after James rows the boat?

# FOCUS ON VOCABULARY

Complete each problem using vocabulary from the word list below. Some words may be used more than once or not at all.

Name the property illustrated.

1. -5 + 5 = 0 _____

2. 0 + (-5) = -5 _____

3. -5 + 5 = 5 + -5 _____

4. 0 = 5 + (-5) _____

Give names to each part of the equations. Names may be used in more than one box.

| | | | | | | |
|---|---|---|---|---|---|---|
| 5. | | + | | = | sum | |
| 6. | | − | | = | | |
| 7. | | × | | = | | |
| 8. | | ÷ | | = | | |

Complete each statement.

9. The _____ _____ of a number is its distance from zero on the number line.

10. The _____ between two points on a line is the absolute value of their difference.

**Word List**

| | | |
|---|---|---|
| absolute | addend | additive identity property |
| additive inverse property | commutative property of + | difference |
| distance | dividend | divisor |
| factor | integer | minuend |
| negative | opposite | product |
| quotient | subtrahend | sum |

# SELECTED RESPONSE

Show your work on a separate sheet of paper.

1. Choose all the counter representations that result in positive 5.

   A. + + - - - - - - -

   B. + + + + + + -

   C. + - + - +

   D. + + + - - -
      + + + + +

2. Choose all the expressions that have a sum of 3.

   A. 6 + (-3) B. 6 + 3 C. 3 + (-6) D. 0 – 3

3. Choose all the expressions that have a sum of -5.

   A. 2 + (-3) B. -2 + (-3) C. 0 + (-5) D. 10 + (-5)

4. Choose all the expressions that have a difference of -2.

   A. 5 – 3 B. -3 – 5 C. 5 – (-3) D. 3 – 5

5. Choose all the expressions that have a result of -6.

   A. 5 – 1 B. 1 – 5 C. -1 – 5 D. -1 + (-5)

6. Compute. -6 – (-2) + 4

   A. 0 B. 8 C. -4 D. -8

7. Which one of the following is not possible? Choose all that apply.

   A. Build a value of 5 with 5 counters.

   B. Build a value of 5 with 6 counters.

   C. Build a value of 5 with 7 counters.

   D. Build a value of 5 with 8 counters.

8. The following representations has a value of 4: + + + + + + + - - - .
   Which of the following actions will change the value of the representation to 7? Choose all that apply.

   A. Add 3 negative counters.

   B. Add 3 positive counters.

   C. Take away 3 negative counters.

   D. Take away 3 positive counters.

# KNOWLEDGE CHECK

Show your work on a separate sheet of paper and write your answers on this page.

### 3.1 Integer Models

Find the value of the following collections of counters.

| | | |
|---|---|---|
| 1. + + - + + - + - + | 2. + - + - + - + - + - | 3. + - - - - - + |

4. Record at least three different ways to make a value of -2 with counters.

5. Explain at least three different ways to increase the temperature of a liquid by 3 degrees using the temperature change model.

### 3.2 Addition: Counters and Temperature

Compute each sum. Use positive symbols (+) and negative symbols (–) if needed. Explain why your answer makes sense using the temperature change model.

| | | |
|---|---|---|
| 6. 3 + (-7) | 7. -2 + (-3) | 8. -3 + 4 |

### 3.3 Subtraction: Counters and Temperature

9. Explain how forming zero pairs can help you in the process of adding or subtracting integers using the counter model.

Compute each difference. Use positive symbols ( + ) and negative symbols ( – ) if needed. Explain why your answer makes sense using the temperature change model.

| | | |
|---|---|---|
| 10. 3 − (-7) | 11. -2 − (-3) | 12. 3 − 4 |

# HOME-SCHOOL CONNECTION

Here are some problems to review with your young mathematician.

1. Use the counter model to create a value of 4 in three different ways.

2. Draw a diagram and write an equation where the sum of two numbers is zero.

3. Draw a diagram and write an equation where the difference of two numbers is negative.

4. James says that subtracting from a number always makes that number lesser. Do you agree or disagree with James's statement? Use examples or counterexamples to support your answer.

Parent (or Guardian) Signature_____

# COMMON CORE STATE STANDARDS – MATHEMATICS

| STANDARDS FOR MATHEMATICAL CONTENT | |
|---|---|
| 7.NS1a | 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.~~ Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.* |
| 7.NS 1b | 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.~~ Understand $p + q$ as the number located a distance $\|q\|$ from $p$, in the positive or negative direction depending upon whether $q$ is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. |
| 7.NS 1c | 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.~~ 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.~~ |
| 7.NS 1d | 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.~~ Apply properties of operations as strategies to add and subtract rational numbers. |

| STANDARDS FOR MATHEMATICAL PRACTICE | |
|---|---|
| MP2 | Reason abstractly and quantitatively. |
| MP3 | Construct viable arguments and critique the reasoning of others. |
| MP5 | Use appropriate tools strategically. |
| MP6 | Attend to precision. |
| MP8 | Look for and express regularity in repeated reasoning. |

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