Chapter 2 – Integers

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Introduction to Integers

Name _____

1. Discuss each of the following situations with your group and write about what it means for a number to be positive, negative and zero.

a. Temperature

Positive:

Negative:

Zero:

b. Checking account balance

Positive:

Negative:

Zero:

c. Elevation

Positive:

Negative:

Zero:

d. Profit for a business

Positive:

Negative:

Zero:

2. Which is warmer: $-3^{\circ}F$ or $-5^{\circ}F$? Draw a number line to find or confirm your answer.

3. How much warmer is $20^{\circ}\mathrm{F}$ than $-10^{\circ}\mathrm{F}$? Draw a number line to find or confirm your answer.

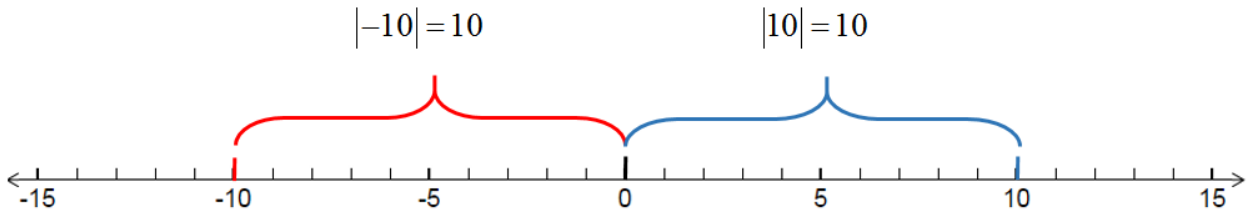
4. Write the opposite of each integer described using words and symbols.

a. We were 1000 feet above sea level.

b. The All-Star Brewing Company had a profit of $23,500 in 2015.

c. The temperature in degrees Celsius was 12 below zero.

As you noticed in problem 4, the opposite of a negative number is positive and the opposite of a positive number is negative. The **absolute value** of a number is the distance from zero to the number on a number line. In the example shown below, -10 and 10 both have an absolute value of 10 because they are both ten units away from zero. The absolute value, written with the number between two vertical bars, represents the value of the number without the sign.



5. Simplify the following expressions.

a. $|-3|$ b. $|3|$ c. $-|-3|$ d. $-|3|$

e. $-(-2)$ f. $|3+5|$ g. $-|9-2|$ h. $|-18|$

i. $-(4)$ j. $-|6|$ k. $-|-25|$ l. $-(-11)$

6. Arrange the following numbers in order from least to greatest: $11, -7, 0, 5, -3, -13, 2$

Adding Integers with Context

Name _____

For many students it is easier to remember sign rules when they put the problems into context. The two most useful contexts for adding integers, or signed whole numbers, are money and the number line. Try both and see which one you prefer.

MONEY

1. $\$6+\$7$
(you have $6, then get $7 more)

2. $\$2+(-\$7)$
(you have $2, then spend 7)

3. $-\$3+(-\$9)$
(you spend $3, then spend $9)

4. $-\$10+\$2$
(you spend $10, then get $2 back)

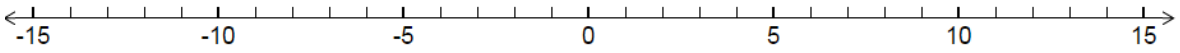
5. $11+(-4)$

6. $-14+7$

7. $-3+3$

8. $-9+(-9)$

THE NUMBER LINE



9. $4+5$
(start on 4, move right 5)

10. $4+(-5)$
(start on 4, move left 5)

11. $-4+(-5)$
(start on -4, move left 5)

12. $-7+3$
(start on -7, move right 3)

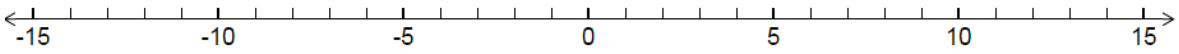
13. $15+(-6)$

14. $-13+2$

15. $-8+8$

16. $-6+(-6)$

17. Which context do you prefer and why?



Use either context to do these problems. Show your steps when there is more than one operation.

18. $-7+(-8)$

19. $-12+5$

20. $10+(-6)$

21. $3+(-8)$

22. $-6+(-8)+7+3$

23. $30+(-11)+3+(-16)$

24. The lowest elevation on the surface of our planet is at the Dead Sea in Israel, with an elevation of 1,401 feet below sea level. The highest elevation on the surface on our planet is at the top of Mt. Everest, which is 30,430 feet above the Dead Sea. Find the elevation at the top of Mt. Everest by adding two integers. Draw a picture, show your work and write your answer in a complete sentence.

25. At the end of last month your checking account balance was $307. So far this month you got paid $515, spent $284 on groceries, $28 on coffee at PCC, and returned an item to the store for a credit of $25. What is your new balance? Show all of your steps in an organized way and write your answer in a complete sentence.

Adding Integers Practice with Cards Name _____



Each group needs one standard deck of playing cards.

Black cards represent positive numbers

Red cards represent negative numbers

Joker = 0	Ace = 1	Jack = 11	Queen = 12	King = 13

Sum Compare

- Shuffle the cards and deal the whole deck among the players
- Keep your cards face down in a stack in front of you
- Let all face cards have a value of 10 and Jokers have a value of zero. Aces have a value of 1.
- At the same time, each player turns over 2 cards and add them together. Black cards represent positive numbers and red cards represent negative numbers. Say your sums out loud
- The person with the highest sum takes all the cards and sets them aside.
- If you run out of cards, shuffle your won cards and continue playing
- The winner is the person who gets the whole deck or has the most cards when time runs out

Collect Zero Together

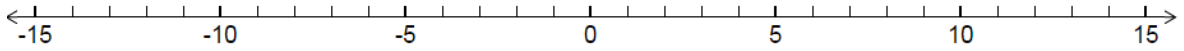
- Players in turn flip one card over and add it to the previous sum. Keep a running sun. Keep going until the group sum reaches exactly zero.
- The player who played the last card to make zero keeps all of the cards.
- The winner is the person who gets the whole deck or has the most cards when time runs out

Subtracting Integers with Context Name _____

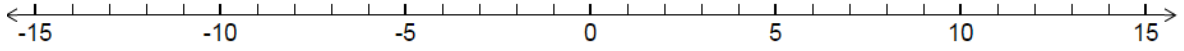
Try the number line and money contexts to subtract signed numbers and see which one you prefer.

1. Find each answer using the number lines provided.

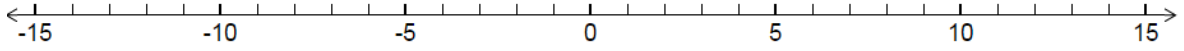
a. $5+(-8)=$ (Start at five, move to the _____ eight)



b. $5-8=$ (Start at five, move to the _____ eight)



c. $5-(-8)=$ (Start at five, move to the _____ eight)



2. Notice that the answers to 1.a and 1.b are the same. If you prefer addition you can change all subtractions to adding the opposite of the number being subtracted, as shown in Examples A and B. In 1.c you can see that subtracting a negative number is the same as adding because you move to the right.

Example A.

$$3-10=3+(-10)$$
$$=-7$$

Example B.

$$-6-(-10)=-6+10$$
$$=4$$

Use the number line context to do these problems:

3. $4-5$
(right 4, left 5)

4. $-5-11$
(left 5, left 11)

5. $-4-(-3)=-4+3$
(left 4, right 3)

6. $10-(-4)$
(right 10, right 4)

7. $15-(-3)$

8. $-9-1$

9. $-5-5$

10. $-4-(-4)$

Use the money context to do these problems:

11. $\$3-\$8$
(have 3, spend 8)

12. $-\$9-\$6$
(spend 9, spend 6)

13. $-\$1-(-\$4)$
(spend 1, make a return of 4, removing a debt)

14. $-9-(-8)$

15. $11-(-9)$

16. $-3-5$

17. $-10-10$

18. $-6-(-6)$

Use either context to do these longer problems. Show all of your steps.

19. $-5-(-4)+10-1$

20. $(-11-2)+(-12-1)$

21. $15+(-7)+5-(-14)$

22. $4-5-(-11)-(-9)$

23. The balance you owed on your last credit card statement was $201. Since then you were charged $25 in interest, made purchases of $184 and $31, returned two items for credits of $11 and $16, and made a payment of $150. What is your new balance? Show your work and answer in a complete sentence.

24. Show how the returned items can be written as addition statements and as the subtraction of negative numbers.

Mixed Addition and Subtraction – Mixer Activity Name _____

Mixer Activity. Walk around the room and solve each set of problems with a **different partner**. Choose people that you don't know very well. You may ask other pairs for help. Sign each other's papers when you agree on the answers.

Problems	**Partner**
1. $-3+(-6)=$ 2. $-10+18=$ 3. $1-5-(-2)-6=$	
4. $5-(-10)=$ 5. $16+(-30)=$ 6. $20+(-2)+(-8)-10=$	
7. $-5-7=$ 8. $-3+(-12)=$ 9. $12-(-8)+4-5=$	
10. $-5-(-6)=$ 11. $18-27=$ 12. $-14+7-(-1)-6=$	
13. $-21-(-42)=$ 14. $-10+7=$ 15. $35+(-7)-10+8=$	

Multiplying Integers Name _____

Write each multiplication as an equivalent addition problem and make up a context for it. If needed you can change the order of the multiplication. Two examples are shown for you.

1. $3(\$10) = \$10 + \$10 + \$10 = \$30$ I earned $10 per hour for three hours for a total of $30.

2. $4(-\$3) = (-\$3) + (-\$3) + (-\$3) + (-\$3) = -\$12$ I spent $3 on a latte for four days. I spent $12 in total.

3. $5(-\$7) =$

4. $(-11)(4) =$

5. a. Using what you learned from problems 1-4, complete these problems and observe the pattern in the answers.

$-5 \cdot 4 =$

$-5 \cdot 3 =$

$-5 \cdot 2 =$

$-5 \cdot 1 =$

$-5 \cdot 0 =$

b. What can you say about the sign of a negative number multiplied by a positive number?

6. a. Use the pattern from problem 5 to continue filling in the answers.

$-5(-1) =$

$-5(-2) =$

$-5(-3) =$

$-5(-4) =$

b. What can you say about the sign of a negative number multiplied by a negative number?

7. Summarize the sign rules for multiplication.

Evaluate each expression.

8. $5(-7)$

9. $-3(14)$

10. $(-2)(-7)$

11. $-23(-100)$

12. $-5 \cdot 12$

13. $(-20)(40)$

14. $(-2)(-3)(-5)$

15. $10(-10)(10)(-10)(10)$

Expand each problem into a multiplication statement by identifying the base and use the sign rules to determine the answer. Two examples are shown for you.

16. $(-4)^2 = (-4)(-4) = 16$
The base is -4

17. $-4^2 = -4 \cdot 4 = -16$
The base is 4

18. $(-5)^4 =$

19. $-5^4 =$

20. $(-2)^3 =$

21. -2^3

22. $(-1)^{804}$

23. $(-1)^{805}$

What can you say about the sign of your answer if you have a negative base with an exponent?

Write the problem as a product of signed numbers, then find the answer and state it in a complete sentence.

24. The balance of the All-Star Widget Company was $-\$5,000$ in 2014. The following year, they lost 7 times that much. Write All-Star's balance at the end of 2015 as a signed number.

Dividing Integers Name _____

Fill in the blank in the multiplication problem and use it to answer the corresponding division problem.

1. a. $3\cdot\square=15$ b. $15\div3=$

2. a. $3\cdot\square=-15$ b. $-15\div3=$

3. a. $-3\cdot\square=15$ b. $15\div(-3)=$

4. a. $-3\cdot\square=-15$ b. $-15\div(-3)=$

What can you say about the sign rules for division?

Fill in the blank in the multiplication problem and use it to answer the corresponding division problem involving zero.

5. a. $5\cdot\square=0$ b. $0\div5=$

6. a. $-5\cdot\square=0$ b. $0\div(-5)=$

7. a. $0\cdot\square=7$ b. $7\div0=$

8. a. $0\cdot\square=-7$ b. $-7\div0=$

Summarize the rules for division with zero.

Evaluate each expression.

9. $-12 \div 3$

10. $30 \div (-5)$

11. $\frac{-14}{-2}$

12. $90 / 10$

13. $-800 \div (-200)$

14. $\frac{-24000}{4}$

15. $-77 \div (-11)$

16. $-300 \div 6$

17. $\frac{50}{-2}$

18. $\frac{0}{-5}$

19. $-3 \div 0$

20. $0 \div (-7)$

21. $\frac{-13}{0}$

22. $-100000 \div 100$

Write each problem as a division of signed numbers, then find the answer and state it in a complete sentence.

23. An airplane descends 30,000 feet in 15 minutes. What is the average change in elevation for the plane during this period (in feet per minute)?

24. A company plans to split its tax deduction of $125,000 evenly over the next 5 years. How much will they deduct per year?

Mixed Operations with Integers Bingo Name _____

Preparation for Order of Operations

Fill in your bingo card by randomly placing an integer from -15 to 15 in each square. Use an integer only once. You will not use every integer. As your instructor puts the problems on the board, shade in the correct answer. The middle square is a free space. Call out bingo when you have five shaded squares in a row – vertically, horizontally or diagonally. Your class may also play for four corners or black-out if time permits.

B	I	N	G	O
		FREE		

Bingo Problems and Answers – For the Instructor

Print one copy of this sheet for you and a blank bingo card for each student. Have students randomly place integers from -15 to 15 in the squares on the bingo card. They should use a number only once and will not use all of the numbers.

Put one problem at a time up on the board and give students time to calculate and color in the correct answer on their bingo card. The answers are integers from -15 to 15 in random order.

1. $14-16=-2$
2. $-55\div(-11)=5$
3. $-2+1=-1$
4. $(-2)^2=4$
5. $-4-1=-5$
6. $-2+14=12$
7. $-10-(-24)=14$
8. $-3^2=-9$
9. $(-56)(13)(0)(11)=0$
10. $(-2)^3=-8$
11. $-6-(-12)=6$
12. $-24\div 4=-6$
13. $3(-4)=-12$
14. $(-3)^2=9$
15. $-45\div(-3)=15$
16. $12+(-23)=-11$
17. $-2^2=-4$
18. $(13)^1=13$
19. $(-2)(-5)=10$
20. $-24\div 8=-3$
21. $(-1)^4=1$
22. $-4-3=-7$
23. $-7+14=7$
24. $19+(-16)=3$
25. $-6+(-8)=-14$
26. $-6-7=-13$
27. $-3(5)=-15$
28. $-18+20=2$
29. $-1\cdot 10=-10$
30. $-22+33=11$
31. $2^3=8$

Order of Operations with Integers

Name _____

Use the order of operations to complete each problem. Perform one operation at a time and write the answer in its place. Show each step vertically with an equal sign on each line. There are two examples to show you the proper form.

Example A:
$$18+4\left[2+3\cdot(-2)\right]=18+4\left[2+(-6)\right]$$
$$=18+4[-4]$$
$$=18+(-16)$$
$$=2$$

Example B:
$$\frac{-4-3\cdot 6+2}{9-2^2}=\frac{-4-18+2}{9-4}$$
$$=\frac{-22+2}{5}$$
$$=\frac{-20}{5}$$
$$=-4$$

1. $3+(-4)\cdot 5$

2. $(-40)\div(-4)\cdot 2$

3. $15-2\left[5-(-2)\right]$

4. $\dfrac{9\cdot 2+2|-5|}{(-2)^2}$

5. $3\left[1-2\left(10-8\right)\right]$

6. $\dfrac{22+20\div\left(-5\right)}{\left(-4+7\right)^2}$

7. $4\left(-9\right)+8\div\left(-2\right)-6\cdot5$

8. $-6^2-27\div3^2\cdot2-\left(-1\right)$

9. $5\left(-3\right)^2-\left(-2\right)\left(-2\right)^3$

10. $5\left(2-4\right)^2+15\div\left(9-6\right)$