TABLE OF CONTENTS

Lesson 1 UNDERSTAND INTEGERS

PART **ONE:** Learn about integers

How can you represent numbers less than zero?

Explore

Recall that **whole numbers** are the set of numbers 0, 1, 2, 3, …

You and a friend are playing a quiz-show game. A correct answer wins 5 points. A wrong answer loses 5 points.

If you answer the first question incorrectly and lose 5 points, what is your score?

Score	
You	Friend
?	0

Think

Integers are the set of whole numbers and their opposites.
…, $^{-}3$, $^{-}2$, $^{-}1$, 0, 1, 2, 3, …

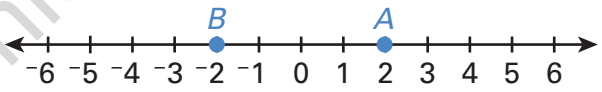
Opposites are pairs of numbers that are the same distance from zero on a number line.

How far is point *A* from 0? 2

How far is point *B* from 0? 2

What is the opposite of 2? $^{-}2$

What is the opposite of $^{-}2$? 2



Connect

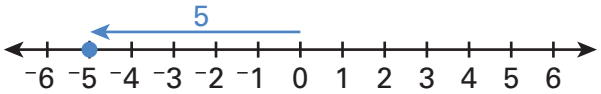
Positive integers can represent gains, or increasing quantities. They are shown using a positive sign ($^{+}2$) or no sign (2).

Negative integers can represent losses, or decreasing quantities. They are shown using a negative sign ($^{-}2$).

Zero is neither positive nor negative.

So if you lose 5 points, your score is $^{-}5$.

The **absolute value** of a number is how far the number is from zero. The absolute value of $^{-}5$ is 5.



Score	
You	Friend
$^{-}5$	0

Let's Talk

Read the definition of "opposite". Discuss what you think the opposite of zero is.

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Think It Through

Fill in the blanks as you solve the problem.

Read each statement.

What integer can be written to represent each value? Are the two integers opposites?

- The temperature is 6° below zero.
- I earned $12 babysitting.

■ The temperature is 6° below zero.

How far from zero is this temperature? _____

Is this temperature a positive integer or a negative integer? _____

What integer represents this value? _____

■ I earned $12 babysitting.

How far from zero is this amount of money? _____

Is this amount of money a positive integer or a negative integer? _____

What integer represents this value? _____

■ Draw each integer on the number line.

14
12
10
8
6
4
2
0
−2
−4
−6
−8
−10
−12
−14

Numbers are opposites if they have an equal distance from zero. This distance is also called the absolute value.

Solution: The temperature 6° below zero is represented by the integer _____. I earned $12 babysitting is represented by the integer _____. Are the two integers opposites? _____

Your Turn

Now, use what you know to solve this problem.

1. Avery drives to City A, which is 45 m below sea level. Then she drives to City B, which is 22 m above sea level. What integers can be used to represent these statements? Which city is closer to sea level? Explain.

City A _____ City B _____

Which city is closer to sea level? _____

_____

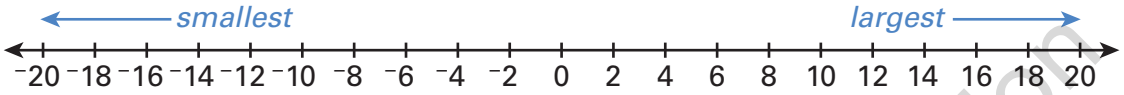
PART **TWO:** Learn about comparing and ordering integers

How can a number line help you compare and order integers?

Explore

You can use a number line to **compare** two numbers and to **order** three or more numbers.

On a number line, numbers are shown in order from smallest to largest, from left to right.



What is the order of the integers $^{-}8$, $^{-}14$, 16 and 10 from *largest* to *smallest*?

Think

Look at the integers on a number line.

Positive integers are to the right of zero, so they are all larger than negative integers.

Which is further from zero, 16 or 10? 16

Which is larger, 16 or 10? 16

So 16 is to the right of 10 on the number line.

Which is warmer, 16°C or 10°C?

Negative integers are to the left of zero, so they are all less than positive integers.

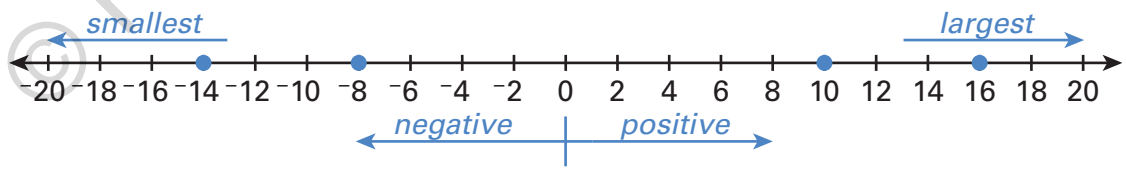
Which is closer to zero, $^{-}8$ or $^{-}14$? $^{-}8$

Which is larger, $^{-}8$ or $^{-}14$? $^{-}8$

So $^{-}8$ is to the right of $^{-}14$ on the number line.

Which is warmer, $^{-}8$°C or $^{-}14$°C?

Connect



The largest integer is furthest to the right, in the positive direction.
The smallest integer is furthest to the left, in the negative direction.

The numbers in order from largest to smallest are 16, 10, $^{-}8$, $^{-}14$.

Let's Talk

If you know that the absolute value of x is more than the absolute value of y, can you be sure that $x > y$?

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Think It Through

Fill in the blanks as you solve the problem.

The data below represent the low temperatures in degrees Celsius over a school week for a town in the Australian Alps.

Monday	Tuesday	Wednesday	Thursday	Friday
$^{-}3$	2	4	$^{-}5$	0

What are the temperatures in order from smallest to largest?

- Negative numbers are always _____ than positive numbers and zero.

  Which is further from zero, $^{-}3$ or $^{-}5$? _____

  Compare $^{-}3$ and $^{-}5$: $^{-}3$ _____ $^{-}5$

- Positive numbers are always _____ than negative numbers and zero.

  Which is further from zero, 2 or 4? _____

  Compare 2 and 4: 2 _____ 4

Solution: The temperatures in order from smallest to largest are _____.

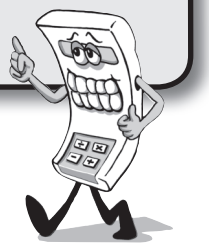
You can use symbols for less than and more than.

"$^{-}5$ is less than 2"

$-5 < 2$

"0 is more than $^{-}7$"

$0 > -7$



Your Turn **Now, use what you know to solve this problem.**

2. The temperatures (in °C) of another town in the Australian Alps are shown below.

Monday	Tuesday	Wednesday	Thursday	Friday
12	$^{-}12$	4	$^{-}8$	0

Which day was warmest? Which day was coolest?

_____

_____

PART **THREE:** Choose the right answer

Solve the problem. Then read why each answer choice is correct or not correct.

Solve

Some friends are playing a game in which they throw a ball into a bucket. A player wins a point when the ball goes into the bucket and loses a point when the ball misses the bucket.

The table shows the players' scores at the end of the game.

Player	Final score
Player 1	$^{-}2$
Player 2	0
Player 3	4
Player 4	$^{-}7$

Which list shows the scores in order from *smallest* to *largest*?

Ⓐ $^{-}7, ^{-}2, 0, 4$

Ⓑ $0, ^{-}2, 4, ^{-}7$

Ⓒ $^{-}2, ^{-}7, 0, 4$

Ⓓ $4, 0, ^{-}2, ^{-}7$

Check

Check whether you chose the correct answer.

Negative numbers are always less than positive numbers and zero. The smallest number is $^{-}7$ because it is further from zero than $^{-}2$.

So far, the numbers in order from smallest to largest are $^{-}7, ^{-}2$.

Zero is larger than all negative numbers but less than all positive numbers.

So far, the numbers in order from smallest to largest are $^{-}7, ^{-}2, 0$.

The last number is 4.

The numbers in order from smallest to largest are $^{-}7, ^{-}2, 0, 4$.

So, the correct answer is Ⓐ.

Why are the other answer choices not correct?

Ⓑ $0, ^{-}2, 4, ^{-}7$	The numbers are ordered by distance from zero instead of by value.
Ⓒ $^{-}2, ^{-}7, 0, 4$	The first number should be $^{-}7$ because it is smallest; it is furthest from 0 in the negative direction.
Ⓓ $4, 0, ^{-}2, ^{-}7$	These numbers are ordered from largest to smallest.

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Your Turn **Solve each problem. Use the hints to avoid mistakes.**

- **Positive numbers are always larger than negative numbers.**
- **Zero is larger than negative numbers but less than positive numbers.**

3. Charlie is choosing integers to represent different situations. Which situation can be represented by $^{-}13$?

Ⓐ time spent on homework

Ⓑ distance that was travelled in a race

Ⓒ the number of metres above sea level

Ⓓ temperature below 0°C

4. The final game scores of four students are shown below.

	Student A	Student B	Student C	Student D
Scores	0	$^{-}50$	100	$^{-}75$

Which student has the lowest score?

Ⓐ Student A

Ⓑ Student B

Ⓒ Student C

Ⓓ Student D

5. Which value is the least?

Ⓐ 7

Ⓑ $^{-}7$

Ⓒ 3

Ⓓ -3

6. The numbers below represent the average city temperatures in degrees Celsius.

$^{-}8$, 10, $^{-}6$, 0, 5

What are these temperatures in order from smallest to largest?

Ⓐ $^{-}8$, $^{-}6$, 0, 5, 10

Ⓑ 10, 5, 0, $^{-}6$, $^{-}8$

Ⓒ $^{-}6$, $^{-}8$, 0, 5, 10

Ⓓ 0, 5, $^{-}6$, 10, $^{-}8$

PART **FOUR:** Write the best answer

Study the model. It is a good example of a written answer.

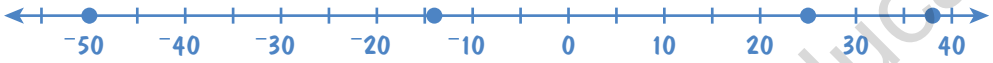
Student model

Show

A business report shows the amount of money a business has made (earnings) at the end of different weeks. What are these integers in order from largest to smallest?

Show each step. Then explain how you found the solution.

	Earnings ($)
Week 1	25
Week 2	$^{-}$50
Week 3	38
Week 4	$^{-}$14



The positive numbers are 25 and 38.
38 is further from zero on the number line than 25, so 38 > 25.

The negative numbers are $^{-}$50 and $^{-}$14.
$^{-}$14 is closer to zero on the number line than $^{-}$50, so $^{-}$14 > $^{-}$50.

☑ The student shows each step.

Solution: The integers in order from largest to smallest are 38, 25, $^{-}$14, $^{-}$50.

☑ The student correctly answers the question asked.

Explain

Explanation:

Positive numbers are always larger than negative numbers, so I compare the positive numbers first. 38 is further from zero on the number line than 25, so 38 is larger than 25. Next I compare the negative numbers. This is different because the number closest to the zero is the larger number. Because $^{-}$14 is closer to zero than $^{-}$50, I know that $^{-}$14 is larger than $^{-}$50. The integers in order from largest to smallest are 38, 25, $^{-}$14, $^{-}$50.

☑ The student gives important details about how to compare integers.

☑ The student uses the maths words *positive*, *negative*, *compare*, *integers* and *order*.

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Your Turn **Solve the problem. Use what you learned from the model.**

7. The table shows each student's score at the end of a question-and-answer game.

	Player A	Player B	Player C	Player D	Player E
Final score	$^{-}18$	$^{-}10$	4	$^{-}7$	12

What are these scores in order from largest to smallest?

Show each step. Then explain how you found the solution.

CHECKLIST

Did you . . .

- ☐ **show each step?**
- ☐ **answer the question asked?**
- ☐ **give important details?**
- ☐ **use maths words?**

Solution: _____

Explanation:

_____

_____

_____

_____

_____

As you solve comparing and ordering problems, you may want to:

- **compare positive numbers and negative integers separately when ordering integers.**
- **think about how far from zero each integer is.**

Solve each problem.

8. Which equation is true?

Ⓐ $0 < {}^{-}3$

Ⓑ $0 > 3$

Ⓒ $3 > 0$

Ⓓ ${}^{-}3 > 0$

9. The temperatures of several towns are shown below.

	Town W	Town X	Town Y	Town Z
Temperature (°C)	8	0	$^{-}2$	$^{-}4$

Which statement is true?

Ⓐ Town W is colder than Town Z.

Ⓑ Town X is colder than Town Z.

Ⓒ Town X is colder than Town Y.

Ⓓ Town Z is colder than Town Y.

10. Which number is the opposite of 12?

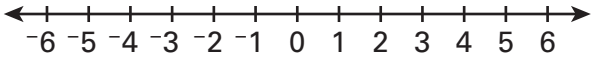
Ⓐ $^{-}12$

Ⓑ 12

Ⓒ 0

Ⓓ 21

11. Bridget is comparing numbers on a number line.



Which inequality is true?

Ⓐ ${}^{-}5 > 5$

Ⓑ ${}^{-}5 > {}^{-}6$

Ⓒ ${}^{-}5 > 0$

Ⓓ ${}^{-}5 > {}^{-}4$

12. Which integer is less than $^{-}1$?

Ⓐ 0

Ⓑ $^{-}1$

Ⓒ $^{-}2$

Ⓓ 1

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13. The elevation above sea level for several cities is shown.

	City A	City B	City C	City D
Elevation (metres)	78	$^{-}172$	$^{-}45$	105

Which elevation is further from sea level?

Ⓐ City A

Ⓑ City B

Ⓒ City C

Ⓓ City D

14. A baker is keeping track of the number of cupcakes made and sold during each day at the bakery. On the first four days, he writes:

$$9, {}^{-}2, 0, {}^{-}7$$

What are the integers in order from *smallest* to *largest*?

_____

In this order, do these numbers appear on a number line from left to right, or right to left?

_____

15. A scientist is collecting data about the temperature in degrees Celsius of a certain substance. The data are: $^{-}15$, $^{-}23$, 7, 15, $^{-}18$ and 0. What are these data in order from *largest* to *smallest*?

Show each step. Then explain how you found the solution.

Solution: _____

Explanation:

_____

_____

_____

_____

_____

_____