

UNIT

2

Integers

Canada has 6 time zones. This map shows the summer time zones.

- What time is it where you are now?
 - You want to call a friend in Newfoundland. What time is it there?
 - In the province or territory farthest from you, what might students be doing now?
- What other questions can you ask about this map?



Pacific

Mountain

British Columbia

Alberta

Saskatchewan

Yukon Territory

Northwest Territories

Victoria Island

What You'll Learn

- Model integers with coloured tiles.
- Add integers using coloured tiles and number lines.
- Subtract integers using coloured tiles and number lines.
- Solve problems involving the addition and subtraction of integers.

Why It's Important

- We use integers when we talk about weather, finances, sports, geography, and science.
- Integers extend the whole number work from earlier grades.





Central

Eastern

Atlantic

Newfoundland

Key Words

- negative integer
- positive integer
- zero pair
- opposite integers

2.1

Representing Integers

Focus Use coloured tiles to represent integers.

One of the coldest places on Earth is Antarctica, with an average annual temperature of about -58°C . This is a **negative integer**.



One of the hottest places on Earth is Ethiopia, with an average annual temperature of about $+34^{\circ}\text{C}$. This is a **positive integer**.

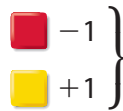


We can use yellow tiles to represent positive integers and red tiles to represent negative integers.

One yellow tile  can represent $+1$.

One red tile  can represent -1 .

A red tile and a yellow tile combine to model 0:



We call this a **zero pair**.

Explore



You will need coloured tiles.

- ▶ One of you uses 9 tiles and one uses 10 tiles. You can use any combination of red and yellow tiles each time. How many different integers can you model with 9 tiles? How many different integers can your partner model with 10 tiles?
- ▶ Draw a picture to show the tiles you used for each integer you modelled. Circle the zero pairs. Write the integer each picture represents. How do you know?





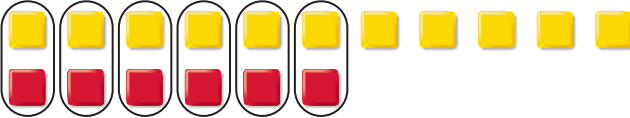
Reflect & Share

Compare your models with those of your partner.
Which integers did you model? Your partner?
Were you able to model any of the same integers?
Why or why not?

Connect

We can model any integer in many ways.

Each set of tiles below models $+5$.

- 
- 
- 

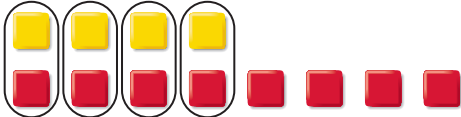
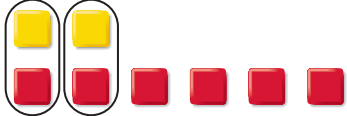

Each pair of 1 yellow tile and
1 red tile makes a zero pair.
The pair models 0.

Example

Use coloured tiles to model -4 in three different ways.

A Solution

Start with 4 red tiles to model -4 .
Add different numbers of zero pairs.
Each set of tiles below models -4 .

- 
- 
- 

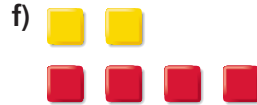
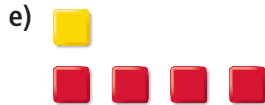
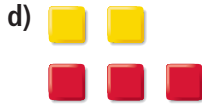
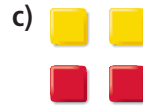
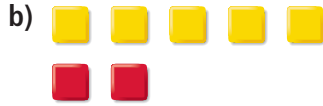
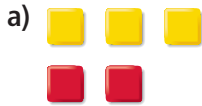
Adding 4 zero pairs does not
change the value.

Adding 2 zero pairs does not
change the value.

Adding 7 zero pairs does not
change the value.

Practice

1. Write the integer modelled by each set of tiles.



2. Draw yellow and red tiles to model each integer in two different ways.

- a) -6 b) $+7$ c) $+6$ d) -2
 e) $+9$ f) -4 g) 0 h) $+10$

3. Work with a partner.

Place 10 yellow and 10 red tiles in a bag.

- a) Suppose you draw 6 tiles from the bag.
 What integers might the tiles model?
 List all seven possible integers.
- b) Without looking, draw 6 tiles from the bag.
 Record the integer that these tiles model.
 Repeat the experiment 9 more times.
 Which integer was modelled most often?



Math Link



Sports

In golf, a hole is given a value called **par**. Par is the number of strokes a good golfer takes to reach the hole.
 A score of $+2$ means a golfer took 2 strokes more than par, or 2 strokes over par.
 A score of -1 means a golfer took 1 stroke fewer than par, or 1 stroke under par.
 Some scores have special names.
 A score of $+1$ is a bogey.
 A score of -1 is a birdie.
 A score of -2 is an eagle.

In a golf tournament, the golfer with the fewest strokes wins the game.

4. Assessment Focus

- Choose an integer between -9 and $+6$.
Use coloured tiles to model the integer.
- How many more ways can you find to model the integer with tiles?
Create a table to order your work.
- What patterns can you find in your table?
- Explain how the patterns in your table can help you model an integer between -90 and $+60$.

- Suppose you have 10 yellow tiles, and use all of them.
How many red tiles would you need to model $+2$?
How do you know?
 - Suppose you have 100 yellow tiles, and use all of them.
How many red tiles would you need to model $+2$?
How do you know?

6. Write the integer suggested by each of the following situations.

Draw yellow or red tiles to model each integer.

Explain your choice.

- You move your game piece forward 9 squares on the game board.
- You ride down 5 floors on an elevator.
- You walk up 11 stairs.
- The temperature drops 9°C .
- You climb down 7 rungs on a ladder.

7. Write two integers suggested by each of the following situations.

- You deposit $\$100$ in your bank account, then pay back your friend $\$20$.
- While shopping in a large department store, you ride the elevator up 6 floors, then down 4 floors.
- The temperature rises 12°C during the day, then falls 8°C at night.



Reflect

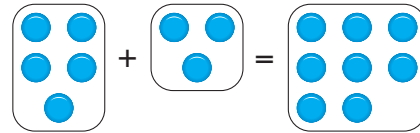
How is it possible to use coloured tiles to model any integer in many different ways?

2.2

Adding Integers with Tiles

Focus Use coloured tiles to add integers.

Recall that when you add two numbers, such as $5 + 3$, you can show the addition by combining 5 counters with 3 counters to obtain 8 counters.



You can add two integers in a similar way.

You know that $+1$ and -1 combine to make a zero pair.

We can combine coloured tiles to add integers.

Explore



You will need coloured tiles.

- Choose two different positive integers. Add the integers. Draw a picture of the tiles you used. Write the addition equation.
- Repeat the activity for a positive integer and a negative integer.
- Repeat the activity for two different negative integers.



Reflect & Share

Share your equations with another pair of classmates.

How did you use the tiles to find a sum of integers?

How can you predict the sign of the sum?

Connect

- To add two positive integers: $(+5) + (+4)$
We can model each integer with tiles.

$+5$:

$+4$:

Combine the tiles. There are 9 yellow tiles.

They model $+9$.

So, $(+5) + (+4) = +9$



This is an addition equation.

- To add a negative integer and a positive integer: $(-6) + (+9)$
We can model each integer with tiles. Circle zero pairs.



There are 6 zero pairs.

There are 3 yellow tiles left.

They model $+3$.

So, $(-6) + (+9) = +3$

- To add two negative integers: $(-3) + (-7)$
We can model each integer with tiles.



Combine the tiles. There are 10 red tiles.

They model -10 .

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

Example

The temperature rises 5°C , then falls 8°C .

- a) Represent the above sentence with integers. b) Find the overall change in temperature.

A Solution

- a) $+5$ represents a rise of 5°C .

-8 represents a fall of 8°C .

Using integers, the sentence is: $(+5) + (-8)$

- b) Model each integer with tiles.

Circle zero pairs.



There are 3 red tiles left.

They model -3 .

So, $(+5) + (-8) = -3$

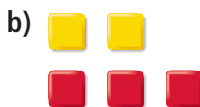
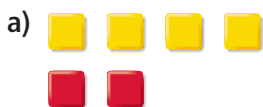
The overall change in temperature is -3°C .

Practice

Use coloured tiles.

1. What sum does each set of tiles model?

Write the addition equation.



2. What sum does each set of tiles model?

How do you know you are correct?

- a) 3 yellow tiles and 2 red tiles
 b) 3 yellow tiles and 4 red tiles
 c) 2 red tiles and 2 yellow tiles

3. Use coloured tiles to represent each sum. Find each sum.

Sketch the tiles you used. What do you notice?

- a) $(+2) + (-2)$ b) $(-4) + (+4)$ c) $(+5) + (-5)$

4. Add. Sketch coloured tiles to show how you did it.

- a) $(+2) + (+3)$ b) $(-3) + (+4)$ c) $(-4) + (-1)$
 d) $(+1) + (-1)$ e) $(-3) + (-4)$ f) $(+5) + (-2)$

5. Add. Write the addition equations.

- a) $(+4) + (+3)$ b) $(-7) + (+5)$ c) $(-4) + (-5)$
 d) $(+8) + (-1)$ e) $(-10) + (-6)$ f) $(+4) + (-13)$

6. Represent each sentence with integers, then find each sum.

- a) The temperature drops 3°C and rises 4°C .
 b) Marie earned \$5 and spent \$3.
 c) A stock rises 15¢, then falls 7¢.
 d) Jerome moves his game piece 3 squares backward, then 8 squares forward.
 e) Duma deposits \$12, then withdraws \$5.



7. Use question 6 as a model.

Write 3 integer addition problems.

Trade problems with a classmate.

Solve your classmate's problems with coloured tiles.

8. Copy and complete.

a) $(+5) + \square = +8$

b) $\square + (-3) = -4$

c) $(+3) + \square = +1$

d) $(-5) + \square = -3$

e) $(+2) + \square = +1$

f) $\square + (-6) = 0$

9. **Assessment Focus**

a) Add: $(+3) + (-7)$

b) Suppose you add the integers in the opposite order:

$(-7) + (+3)$. Does the sum change?

Use coloured tile drawings and words to explain the result.

c) How is $(-3) + (+7)$ different from $(+3) + (-7)$? Explain.

d) Repeat parts a to c with a sum of integers of your choice.

What do you notice?

10. **Take It Further** Add. Sketch coloured tiles to show how you did it.

a) $(+1) + (+2) + (+3)$

b) $(+2) + (-1) + (+3)$

c) $(-3) + (-1) + (-1)$

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

11. **Take It Further** In a magic square, every row, column, and diagonal has the same sum. Copy and complete each magic square. How did you do it?

a)

+3		+1
	0	
-1		

b)

-1		+1
	-2	
		-3

12. **Take It Further** Copy each integer pattern.

What do you add each time to get the next term?

Write the next 4 terms.

a) $+8, +4, 0, -4, \dots$

b) $-12, -9, -6, -3, \dots$

Reflect

Talk to a partner. Tell how you used coloured tiles to add two integers when the integers have:

- the same signs
- opposite signs

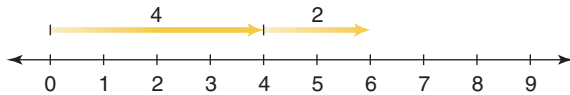
2.3

Adding Integers on a Number Line

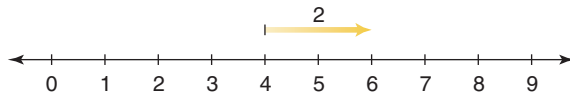
Focus Add integers using number lines.

We can show the addition of whole numbers on a number line: $4 + 2 = 6$

Draw 2 arrows.



Or, begin at 4, and draw 1 arrow.

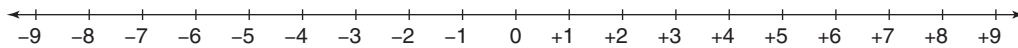


We can also show the addition of integers on a number line.

Explore



You will need copies of a number line.



- Choose two different positive integers. Use a number line to add them. Write the addition equation.
- Repeat the activity for a positive integer and a negative integer.
- Repeat the activity for two different negative integers.
- What happens when you add $+2$ and -2 ?



Reflect & Share

Compare your strategies for adding on a number line with those of your classmates.

Use coloured tiles to check the sums.

Why do you think integers such as $+2$ and -2 are called **opposite integers**?

Connect

- To add a positive integer, move right (in the positive direction).

$$(-2) + (+3)$$

Start at 0.

Draw an arrow 2 units long, pointing left.

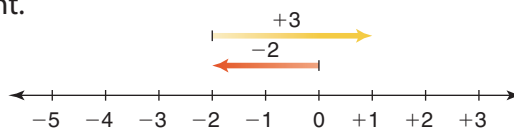
This arrow represents -2 .

From -2 , draw an arrow 3 units long, pointing right.

This arrow represents $+3$.

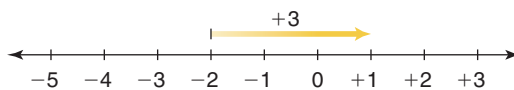
The arrow head is at $+1$.

$$\text{So, } (-2) + (+3) = +1$$



Notice that the first arrow ends at the first integer.

So, we could start at that integer, and use only 1 arrow to find the sum.



- To add a negative integer, move left (in the negative direction).

$$(-2) + (-3)$$

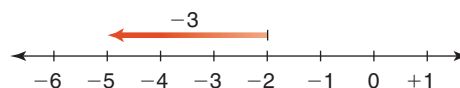
Start at -2 .

Draw an arrow 3 units long, pointing left.

This arrow represents -3 .

The arrow head is at -5 .

$$\text{So, } (-2) + (-3) = -5$$



We can use the same method to add integers on a vertical number line.

- The temperature is 12°C . It falls 5°C .

Find the final temperature.

$$(+12) + (-5)$$

Start at $+12$.

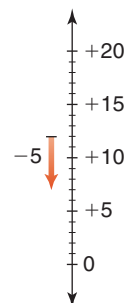
Draw an arrow 5 units long, pointing down.

This arrow represents -5 .

The arrow head is at $+7$.

$$\text{So, } (+12) + (-5) = +7$$

The final temperature is 7°C .



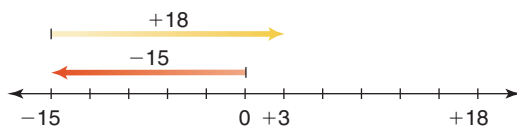
Example

Sandra and Joe buy and sell CDs at a flea market.
One day in August, they bought 3 CDs for \$5 each.
They sold 2 CDs for \$9 each.

- Write the expenses and income as integers.
- Did Sandra and Joe make money or lose money that day in August?
Explain.

A Solution

- Expenses: $(-5) + (-5) + (-5) = -15$; they spent \$15.
Income: $(+9) + (+9) = +18$; they made \$18.
- Draw a number line.
Add expenses and income.



$$(-15) + (+18) = +3$$

Since the sum of the expenses and income is positive,
Sandra and Joe made money. They made \$3.

Another Strategy

We could use coloured tiles.

Practice

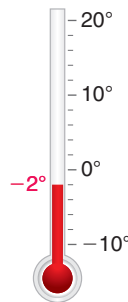
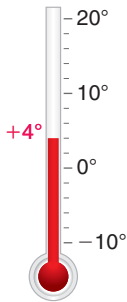
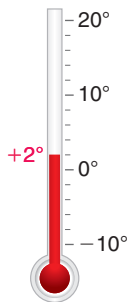
- Use a number line to represent each sum.
 - $(+1) + (+3)$
 - $(-1) + (+3)$
 - $(-3) + (+1)$
 - $(-1) + (-3)$
 - $(-3) + (-4)$
 - $(-3) + (+4)$
 - $(+3) + (-4)$
 - $(+3) + (+4)$
- Use a number line to add.
 - $(+4) + (+2)$
 - $(+5) + (-3)$
 - $(-4) + (-2)$
 - $(-8) + (+2)$
 - $(-6) + (-7)$
 - $(+1) + (-6)$
 - $(-5) + (+2)$
 - $(+8) + (+4)$
- Reverse the order of the integers in question 2, then add.
 - Compare your answers to the answers in question 2.
What do you notice?
 - Make a general statement about your observations.

4. Look at these thermometers. Find each temperature after:

a) it falls 4°C

b) it falls 7°C

c) it rises 6°C



5. a) The temperature rises 7°C , then drops 2°C .

What is the overall change in temperature?

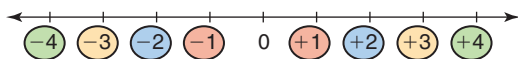
b) Adrian loses \$4, then earns \$8.

Did Adrian gain or lose overall?

c) The value of a stock went up \$3, then down \$2.

What was the final change in the value of the stock?

6. Opposite integers are the same distance from 0 but are on opposite sides of 0.



a) Write the opposite of each integer.

i) $+2$

ii) -5

iii) $+6$

iv) -8

b) Add each integer to its opposite in part a.

c) What do you notice about the sum of two opposite integers?

7. Use a number line. For each sentence below:

a) Write each number as an integer.

b) Write the addition equation.

Explain your answer in words.

i) You take 5 steps backward, then 10 steps backward.

ii) You withdraw \$5, then deposit \$8.

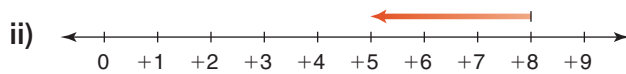
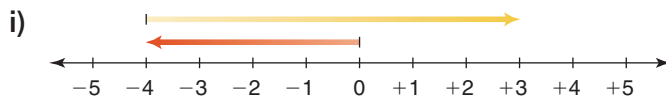
iii) A deep sea diver descends 8 m, then ascends 6 m.

iv) A person drives a snowmobile 4 km east, then 7 km west.

v) A person gains 6 kg, then loses 10 kg.



8. a) Write the addition equation modelled by each number line.
 b) Describe a situation that each number line could represent.



9. **Assessment Focus** Is each statement always true, sometimes true, or never true?

Use a number line to support your answers.

- a) The sum of two opposite integers is 0.
 b) The sum of two positive integers is negative.
 c) The sum of two negative integers is negative.
 d) The sum of a negative integer and a positive integer is negative.
10. **Take It Further** Add.
- a) $(+4) + (+3) + (-6)$ b) $(-2) + (-4) + (+1)$
 c) $(-5) + (+3) + (-4)$ d) $(+6) + (-8) + (+2)$
11. **Take It Further** The temperature in Calgary, Alberta, was -2°C . A Chinook came through and the temperature rose 15°C . At nightfall, it fell 7°C . What was the final temperature? Support your answer with a drawing.



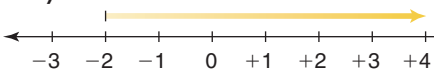
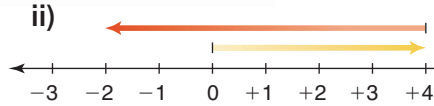
Reflect

Compare adding on a number line to adding with coloured tiles.
 Which method do you prefer?
 When might you need to use a different method?

Mid-Unit Review

LESSON

- 2.1** 1. Use coloured tiles to model each integer in two different ways. Draw the tiles.
- a) -5 b) 0
 c) $+8$ d) -1
 e) $+3$ f) -7
2. Suppose you have 8 red tiles. How many yellow tiles would you need to model $+3$? How do you know?
- 2.2** 3. What sum does each set of tiles model? How do you know you are correct? Write the addition equations.
- a) 6 yellow tiles and 1 red tile
 b) 5 yellow tiles and 7 red tiles
 c) 4 yellow tiles and 4 red tiles
4. Use coloured tiles to add. Draw pictures of the tiles you used.
- a) $(+4) + (-1)$ b) $(-3) + (-2)$
 c) $(-5) + (+1)$ d) $(+6) + (+3)$
 e) $(-4) + (-8)$ f) $(+4) + (+8)$
- 2.3** 5. Use a number line to add. Write the addition equations.
- a) $(+3) + (+2)$ b) $(-5) + (-1)$
 c) $(-10) + (+8)$ d) $(+6) + (-5)$
 e) $(-8) + (+8)$ f) $(-5) + (+12)$
6. a) Add. $(+4) + (-5)$
 b) Find 4 different pairs of integers that have the same sum as part a.

7. Write an addition equation for each situation.
- a) Puja earned \$50, and spent \$20. How much did Puja then have?
 b) The temperature is 5°C , then drops 10°C . What is the final temperature?
 c) The population of a city was 124 000, then it dropped by 4000 people. What was the population then?
 d) A plane was cruising at an altitude of 12 000 m, then dropped 1200 m. What was the cruising altitude then?
8. a) Write the addition equation modelled by each number line.
 b) Describe a situation that each number line could represent.
- i)
- 
- ii)
- 
9. Each integer below is written as the sum of consecutive integers.
- $(+5) = (+2) + (+3)$
 $(+6) = (+1) + (+2) + (+3)$
 Write each of these integers as the sum of consecutive integers.
- a) $+10$ b) 0 c) $+2$
 d) $+7$ e) $+4$ f) $+8$

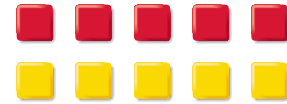
2.4

Subtracting Integers with Tiles

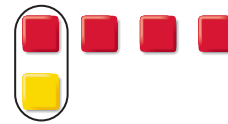
Focus Use coloured tiles to subtract integers.

To add integers, we combine groups of tiles.
To subtract integers, we do the reverse:
we remove tiles from a group.

Recall that equal numbers of red and yellow tiles model 0.
For example, $+5$ and -5 form 5 zero pairs,
and $(-5) + (+5) = 0$



Adding a zero pair to a set of tiles does not change its value.
For example, $(-3) + 0 = -3$



Explore



You will need coloured tiles.
Use tiles to subtract.
Add zero pairs when you need to.
Sketch the tiles you used in each case.

- $(+5) - (+3)$
- $(+5) - (-3)$
- $(-3) - (+5)$
- $(-3) - (-5)$



Reflect & Share

Compare your results with those of another pair of classmates.
Explain why you may have drawn different sets of tiles, yet both may be correct.
When you subtracted, how did you know how many tiles to use
to model each integer? How did adding zero pairs help you?

Connect

To use tiles to subtract integers, we model the first integer,
then take away the number of tiles indicated by the second integer.

We can use tiles to subtract: $(+5) - (+9)$

Model $+5$.



There are not enough tiles to take away $+9$.

To take away $+9$, we need 4 more yellow tiles.

We add zero pairs without changing the value.

Add 4 yellow tiles and 4 red tiles. They represent 0.



By adding 0, the integer the tiles represent has not changed.

Now take away the 9 yellow tiles.



Since 4 red tiles remain, we write: $(+5) - (+9) = -4$

This is a subtraction equation.

Example

Use tiles to subtract.

a) $(-2) - (-6)$

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

c) $(+2) - (-6)$

A Solution

a) $(-2) - (-6)$

Model -2 .

There are not enough tiles to take away -6 .

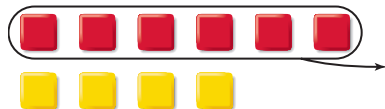
To take away -6 , we need 4 more red tiles.

We add zero pairs without changing the value.

Add 4 red tiles and 4 yellow tiles.



Now take away 6 red tiles.



Since 4 yellow tiles remain, we write: $(-2) - (-6) = +4$

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

Model -6 . 

There are no yellow tiles to take.

We need 2 yellow tiles to take away.

We add zero pairs.

Add 2 yellow tiles and 2 red tiles.




Now take away 2 yellow tiles.



Since 8 red tiles remain, we write: $(-6) - (+2) = -8$

c) $(+2) - (-6)$

Model $+2$. 

There are no red tiles to take.

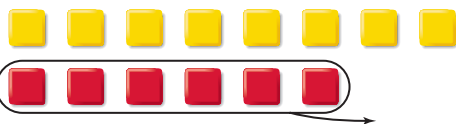
We need 6 red tiles to take away.

We add zero pairs.

Add 6 red tiles and 6 yellow tiles.



Now take away 6 red tiles.



Since 8 yellow tiles remain, we write: $(+2) - (-6) = +8$

Notice the results in the *Example*, parts b and c.

When we reverse the order in which we subtract two integers, the answer is the opposite integer.

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

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

Practice

1. Use tiles to subtract. Draw pictures of the tiles you used.

- a) $(+7) - (+4)$ b) $(-2) - (-2)$ c) $(-9) - (-6)$
d) $(+4) - (+2)$ e) $(-8) - (-1)$ f) $(+3) - (+3)$

2. Use tiles to subtract.

- a) $(-1) - (-4)$ b) $(+3) - (+8)$ c) $(-4) - (-11)$
d) $(+7) - (+8)$ e) $(-4) - (-6)$ f) $(+1) - (+10)$

3. Subtract.

- a) $(-4) - (-1)$ b) $(+8) - (+3)$ c) $(-11) - (-4)$
d) $(+8) - (+7)$ e) $(-6) - (-4)$ f) $(+10) - (+1)$

4. Subtract. Write the subtraction equations.

- a) $(+4) - (-7)$ b) $(-2) - (+8)$ c) $(-9) - (+5)$
d) $(+6) - (-8)$ e) $(-3) - (+6)$ f) $(-5) - (+7)$

5. Subtract.

- a) $(+4) - (+5)$ b) $(-3) - (+5)$ c) $(-4) - (+3)$
d) $(-1) - (-8)$ e) $(+8) - (-2)$ f) $(+4) - (-7)$

6. Use questions 1 to 5 as models.

Write 3 integer subtraction questions.

Trade questions with a classmate.

Solve your classmate's questions.

7. a) Use coloured tiles to subtract each pair of integers.

- i) $(+3) - (+1)$ and $(+1) - (+3)$
ii) $(-3) - (-2)$ and $(-2) - (-3)$
iii) $(+4) - (-3)$ and $(-3) - (+4)$

b) What do you notice about each pair of questions in part a)?

8. $(+5) - (-2) = +7$

Predict the value of $(-2) - (+5)$.

Explain your prediction, then check it.

9. **Assessment Focus** Use integers.

Write a subtraction question that would give each answer.

How many questions can you write each time?

- a) $+2$ b) -3 c) $+5$ d) -6



10. Which expression in each pair has the greater value?

Explain your reasoning.

a) i) $(+3) - (-1)$ ii) $(-3) - (+1)$

b) i) $(-4) - (-5)$ ii) $(+4) - (+5)$

11. Take It Further

a) Find two integers with a sum of -1 and a difference of $+5$.

b) Create and solve a similar integer question.

12. Take It Further Copy and complete.

a) $(+4) - \square = +3$

b) $(+3) - \square = -1$

c) $\square - (+1) = +4$

13. Take It Further Evaluate.

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

b) $(+1) - (+2) - (-1)$

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

d) $(-2) - (-4) + (-1)$

e) $(+2) - (+1) - (+4)$

f) $(+1) - (+2) + (+1)$

14. Take It Further Here is a magic square.

a) Subtract $+4$ from each entry.

Is it still a magic square? Why?

b) Subtract -1 from each entry.

Is it still a magic square? Why?

0	+5	-2
-1	+1	+3
+4	-3	+2

Reflect

Here are 4 types of subtraction questions:

- (negative integer) $-$ (negative integer)
- (negative integer) $-$ (positive integer)
- (positive integer) $-$ (positive integer)
- (positive integer) $-$ (negative integer)

Write a question for each type of subtraction.

Show how you use tiles to solve each question.

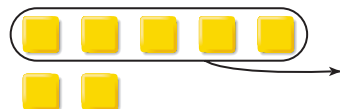
2.5

Subtracting Integers on a Number Line

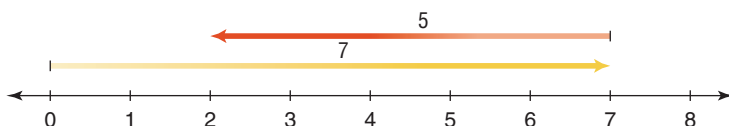
Focus Subtract integers using number lines.

Recall how to model the subtraction of whole numbers with coloured tiles.

$$7 - 5 = 2$$



We can model this subtraction on a number line.

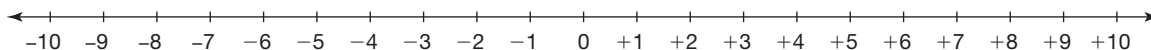


Subtraction is finding the difference.
This number line shows how much more 7 is than 5.

Explore



You will need coloured tiles and copies of this number line.



- Step 1** Use tiles to subtract.
Sketch the tiles you used each time.
- | | |
|---------------|---------------|
| $(+7) - (+2)$ | $(-7) - (-2)$ |
| $(+7) - (-2)$ | $(-7) - (+2)$ |

Step 2 Model each subtraction done with tiles on a number line.

- Step 3** Use any method. Add.
- | | |
|---------------|---------------|
| $(+7) + (-2)$ | $(-7) + (+2)$ |
| $(+7) + (+2)$ | $(-7) + (-2)$ |



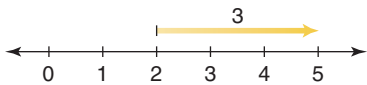
- Step 4** Each expression in *Step 3* has a corresponding expression in *Step 1*.
What do you notice about the answers to corresponding expressions?
What patterns do you see in each subtraction and addition?
Check your pattern using other integers.

Reflect & Share

Compare your answers with those of another pair of classmates.
How can you use addition to subtract two integers?

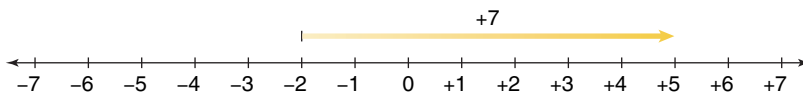
Connect

- To subtract two whole numbers, such as $5 - 2$, we can think, "What do we add to 2 to get 5?"
We add 3 to 2 to get 5; so, $5 - 2 = 3$



We could also think:
How much more is
5 than 2?

- We can do the same to subtract two integers.
For example, to subtract: $(+5) - (-2)$
Think: "What do we add to -2 to get $+5$?"



We add $+7$ to -2 to get $+5$; so, $(+5) - (-2) = +7$

We also know that $(+5) + (+2) = +7$.

We can look at other subtraction equations and related addition equations.

$(+9) - (+4) = +5$	$(+9) + (-4) = +5$
$(-9) - (-4) = -5$	$(-9) + (+4) = -5$
$(-9) - (+4) = -13$	$(-9) + (-4) = -13$
$(+9) - (-4) = +13$	$(+9) + (+4) = +13$



In each case, the result of subtracting an integer is the same as adding the opposite integer.

For example,

$$(-9) - (+4) = -13$$

Subtract $+4$.

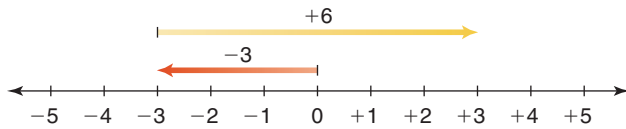
$$(-9) + (-4) = -13$$

Add -4 .

► To subtract an integer, we add the opposite integer.

For example, to subtract: $(-3) - (-6)$

Add the opposite: $(-3) + (+6)$



The opposite of -6 is $+6$.

So, $(-3) - (-6) = +3$

Example

Subtract.

- a) $(+2) - (+9)$ b) $(-2) - (+9)$

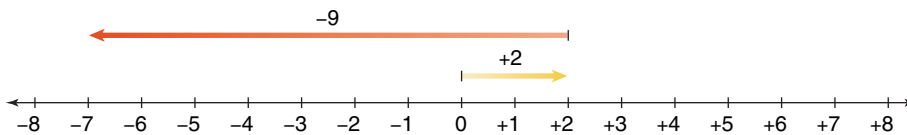
A Solution

- a) To subtract: $(+2) - (+9)$

Add the opposite: $(+2) + (-9)$

Use a number line.

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



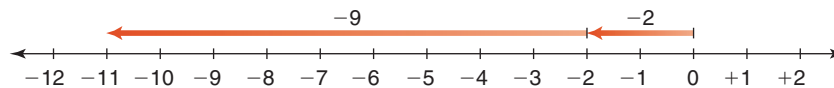
Another Strategy
We could use coloured tiles.

- b) To subtract: $(-2) - (+9)$

Add the opposite: $(-2) + (-9)$

Use a number line.

$$(-2) + (-9) = -11$$



Practice

1. Use a number line to subtract.
Use coloured tiles to check your answers.

- a) $(+2) - (+1)$ b) $(+4) - (-3)$ c) $(-4) - (-1)$
d) $(-5) - (+2)$ e) $(-2) - (-6)$ f) $(-3) - (-7)$

2. a) Reverse the order of the integers in question 1, then subtract.
 b) How are the answers different from those in question 1? Explain.

3. Use a number line to subtract. Write the subtraction equations.

- a) $(+10) - (+5)$ b) $(+7) - (-3)$ c) $(-8) - (+6)$
 d) $(-10) - (+5)$ e) $(-4) - (+4)$ f) $(-4) - (-4)$

4. Rewrite using addition to find each difference.

- a) $(+6) - (+4)$ b) $(-5) - (+4)$ c) $(-2) - (-3)$
 d) $(+4) - (-2)$ e) $(+1) - (+1)$ f) $(+1) - (-1)$

5. What is the difference in temperatures?

How can you subtract to find out?

- a) A temperature 7°C above zero and a temperature 5°C below zero
 b) A temperature 15°C below zero and a temperature 8°C below zero
 c) A temperature 4°C below zero and a temperature 9°C above zero

6. What is the difference in golf scores?

How can you subtract to find out?

- a) A golf score of 2 over par and a golf score of 6 under par
 b) A golf score of 3 under par and a golf score of 8 under par
 c) A golf score of 5 under par and a golf score of 4 over par

7. a) The table shows the average afternoon temperatures in January and April for four Canadian cities.

What is the rise in temperature from January to April for each city? Show your work.

b) Which city has the greatest difference in temperatures?

How do you know?

	City	January Temperature	April Temperature
i)	Calgary	-4°C	$+13^{\circ}\text{C}$
ii)	Iqaluit	-22°C	-10°C
iii)	Toronto	-3°C	$+12^{\circ}\text{C}$
iv)	Victoria	$+7^{\circ}\text{C}$	$+13^{\circ}\text{C}$



8. Assessment Focus

- a) Subtract: $(-6) - (+11)$
- b) Suppose we subtract the integers in the opposite order: $(+11) - (-6)$
How does the answer compare with the answer in part a?
Use number lines to explain.
- c) How is $(+6) - (-11)$ different from $(-6) - (+11)$? Explain.

9. Show three ways that $+4$ can be written as the difference of two integers.

10. Take It Further

 Use patterns to subtract.

- a) Subtract: $(+2) - (+5)$
Start the pattern with $(+6) - (+5) = +1$.
- b) Subtract: $(+7) - (-3)$
Start the pattern with $(+7) - (+4) = +3$.
- c) Subtract: $(-3) - (+7)$
Start the pattern with $(+8) - (+7) = +1$.

11. Take It Further

 Copy each integer pattern.

Write the next 4 terms.

What is the pattern rule?

- a) $+6, +2, -2, \dots$ b) $-3, -1, +1, \dots$
c) $+5, +12, +19, \dots$ d) $+1, 0, -1, \dots$

12. Take It Further

 Evaluate.

- a) $(+4) - (+2) - (+1)$ b) $(-2) - (+1) - (-4)$
c) $(-1) + (-2) - (+1)$ d) $(+5) - (+1) + (-2)$
e) $(+10) - (+3) - (-5)$ f) $(-7) - (+1) + (-3)$

Reflect

How is the subtraction of integers related to the addition of integers?

Use coloured tiles or a number line to show your thinking.

Writing to Reflect on Your Understanding

As you work through a math unit, you will come across many new ideas.

Sometimes it is hard to decide what you already know.

What you know can often help you understand the new ideas.

You can use a Homework Log to help you reflect on your understanding.



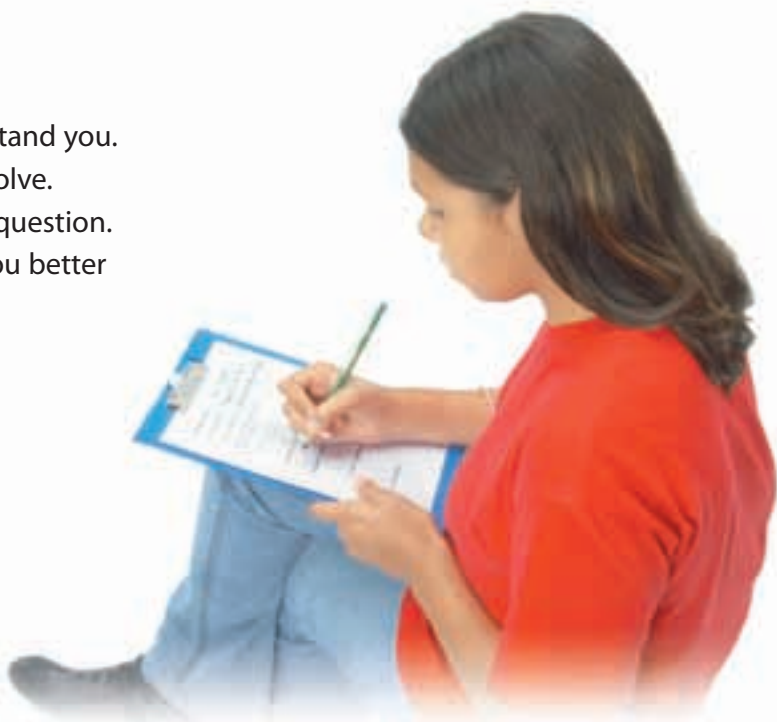
Using a Homework Log

As you work through your homework, ask yourself:

- What is the key idea?
- How difficult is the homework for me?
- Which questions am I able to do?
- Which questions do I need help with?
- What questions could I ask to help me with my homework?

Tips for Writing a Homework Log

- Write so that someone else can understand you.
- Write out a question that you cannot solve.
- Describe 3 ways you tried to solve the question.
- Write a question you can ask to help you better understand your homework.



Here is a sample Homework Log.

Name: Asad

Homework Log

The homework was ... P26 #5-12

The key concept was ... Subtracting integers on a number line

Overall, I'd rate the difficulty level of the homework as ...

Easy 0 1 2 3 4 5 6 7 8 9 10 Hard

One question I had difficulty with but solved was ...

What is the difference in temperatures?
A temperature 7°C above zero and a temperature 5°C below zero

$$\left. \begin{array}{l} \uparrow 7^{\circ}\text{C} \\ | \\ \uparrow 0^{\circ}\text{C} \\ | \\ \downarrow 5^{\circ}\text{C} \end{array} \right\} 12^{\circ}\text{C}$$

A question I couldn't solve was ...

Evaluate: $(+5) - (+1) + (-2)$

To solve it I tried these things ...

1. I used my calculator but I know I should be able to do it without one.
2. I tried to model it on a number line but I didn't know which way to draw the arrows.
3. I looked at the example in the book. It says to "add the opposite" but I don't know what that means.

Questions for experts ...

What does "add the opposite" mean?
How do you take away a negative integer?

✓ Check

- Complete a Homework Log for your next homework assignment.
- Share your Homework Log with a classmate.
- Try to help each other with questions that you were unable to solve.

Unit Review

What Do I Need to Know?

✓ Adding Integers

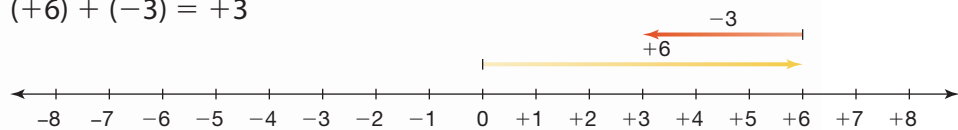
- You can use tiles to add integers.

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



- You can use a number line to add integers.

$$(+6) + (-3) = +3$$



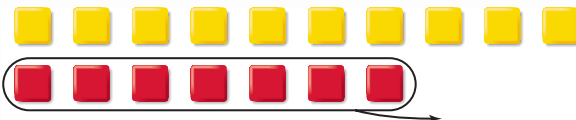
✓ Subtracting Integers

- You can use tiles to subtract integers: $(+3) - (-7)$

We need enough red tiles to take away 7 of them.

Model +3:

Since there are not enough tiles to take away -7 , add 7 yellow tiles and 7 red tiles. Now take away 7 red tiles. There are 10 yellow tiles left.



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

- You can also subtract by adding the opposite:

$$\begin{aligned} (-5) - (-8) &= (-5) + (+8) \\ &= +3 \end{aligned}$$

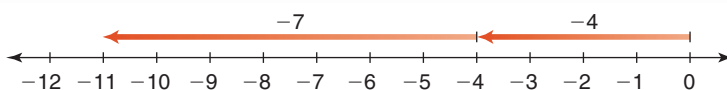
- You can use a number line to subtract integers.

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

Add the opposite: $(-4) + (-7)$

Use a number line.

$$(-4) - (+7) = -11$$



What Should I Be Able to Do?

LESSON

- 2.1** 1. Suppose you have 17 red tiles. How many yellow tiles would you need to model:

- a) -12 ? b) 0 ?
c) $+20$? d) -17 ?

How do you know?

2. Write the integer suggested by each of the following situations.

Draw yellow or red tiles to model each integer.

Explain your choice.

- a) The temperature rises 8°C .
b) The price of 1 L of gas falls 5¢ .
c) You deposit $\$12$ in your bank account.
d) You take 7 steps backward.
e) The time is 9 s before take-off.

- 2.2** 3. What sum does each set of tiles model?

- a) 5 red tiles and 2 yellow tiles
b) 6 yellow tiles and 5 red tiles
c) 6 yellow tiles and 7 red tiles
d) 8 yellow tiles and 8 red tiles

4. Represent each sentence with integers, then find each sum.

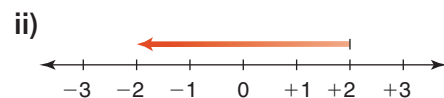
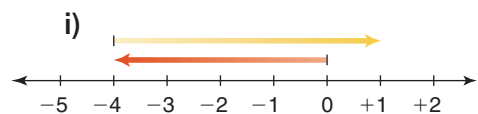
- a) The temperature was -6°C , then rose 4°C .
b) Surinder withdrew $\$25$, then deposited $\$13$.
c) A stock gained $\$15$, then lost $\$23$.
d) A submarine was 250 m below sea level, then ascended 80 m.

5. a) Find 4 pairs of integers that have the sum -5 .
b) Find 4 pairs of integers that have the sum $+4$.

- 2.3** 6. The temperature at 6 a.m. is -10°C . During the day, the temperature rises 17°C . What is the new temperature? Write an addition equation to represent this situation. Use a vertical number line to support your answer.



7. a) Write an addition equation modelled by each number line.
b) Describe a situation that each number line could represent.



- 2.2** 8. Use tiles to add or subtract.

2.4

- a) $(-1) + (+3)$
b) $(+3) + (-4)$
c) $(-2) - (+3)$
d) $(-1) - (-3)$

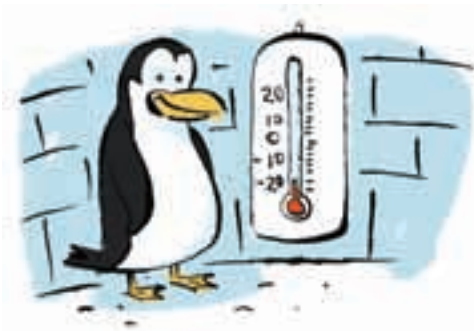
LESSON

- 2.3** **9.** Use a number line to add or subtract.
2.5

a) $(-1) + (+3)$ b) $(+6) + (-4)$
c) $(-4) - (+6)$ d) $(-5) - (-3)$

- 10.** When you add two positive integers, their sum is always a positive integer.
When you subtract two positive integers, is their difference always a positive integer? Explain.

- 11.** a) What temperature is 7°C warmer than 2°C ?
b) What temperature is 5°C warmer than -5°C ?
c) What temperature is 8°C cooler than 2°C ?
d) What temperature is 4°C cooler than -3°C ?



- 2.4** **12.** Use tiles or a number line to subtract.
2.5 Write the subtraction equations.

a) $(+4) - (+1)$ b) $(+5) - (-1)$
c) $(+2) - (-2)$ d) $(-4) - (+1)$
e) $(-6) - (-2)$ f) $(-10) - (-5)$
g) $(-4) - (-2)$ h) $(-5) - (-10)$

- 13.** Subtract.
a) $(+7) - (+2)$ b) $(-7) - (+3)$
c) $(-4) - (-5)$ d) $(+3) - (+3)$
e) $(+3) - (-3)$ f) $(-3) - (-2)$

- 14.** Use tiles or a number line.
Find the difference between:
a) a temperature of $+5^{\circ}\text{C}$ and -7°C
b) an elevation of -100 m and $+50\text{ m}$
- 15.** What is the difference in heights?
How can you subtract to find out?
a) A water level of 2 m below sea level and a water level of 7 m above sea level
b) A balloon 25 m above ground and a balloon 11 m above ground
- 16.** What is the difference in masses?
How can you subtract to find out?
a) A gain of 9 kg and a loss of 3 kg
b) A loss of 6 kg and a loss of 5 kg
- 17.** We measure time in hours.
Suppose 12 noon is represented by the integer 0 .
a) Which integer represents 1 p.m. the same day?
b) Which integer represents 10 a.m. the same day?
c) Find the difference between these times in 2 ways.
Show your work.
- 18.** a) Find 5 pairs of integers with a difference of $+6$.
b) Find 5 pairs of integers with a difference of -3 .

Practice Test

1. Evaluate. Use coloured tiles.

Record your work.

a) $(+5) + (-8)$

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

c) $(-9) + (-1)$

d) $(-4) + (+10)$

e) $(-6) - (-2)$

f) $(+12) - (-11)$

2. Evaluate. Use a number line.

Record your work.

a) $(+9) + (-1)$

b) $(-4) - (+11)$

c) $(-8) + (-3)$

d) $(+13) - (+6)$

e) $(-7) + (+9)$

f) $(-1) - (-5)$

3. Without calculating the sum, how can you tell if the sum of two integers will be:

a) zero?

b) negative?

c) positive?

Include examples in your explanations.

4. Here is a different type of dartboard.

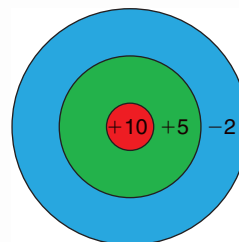
A player throws 2 darts at the board.

His score is the sum of the integers in the areas his darts land.

Assume both darts hit the board.

a) How many different scores are possible?

b) Find each score.



5. The lowest temperature possible is approximately -273°C .

The temperature at which water boils is 100°C .

What is the difference in these temperatures?

6. Place 3 integers in a row as shown.

$(+6)$

$(+4)$

(-3)

How many different answers can you get by putting addition and/or subtraction signs between the integers?

How do you know you have found all possible answers?

For example: $(+6) + (+4) - (-3)$

What if there were 4 integers in a row?

TIME ZONES



The map shows the world's time zones.

Greenwich, in London, England, is the reference point, or the zero for the time zones. Its time is called UTC, or Coordinated Universal Time. London, England, is also in this time zone.

The positive and negative integers on the map show the changes in time from UTC.

The 2008 Summer Olympics will be held in Beijing, China.

1. The local start times of some Olympic events are given. Family members want to watch these events live, in Brandon (the same time zone as Dallas). What time should they "tune in"? How do you know?
 - a) 200-m backstroke at 2:00 p.m.
 - b) 100-m dash at 7:00 p.m.
 - c) gymnastics at 11:00 p.m.
 - d) middleweight boxing at 8:00 a.m.

- An event is broadcast live in Montreal at 9:00 p.m.
What time is it taking place in Beijing?
Show your work.
- Two pen pals plan to meet in Beijing for the Olympics.
Atsuko lives in Tokyo, Japan.
She can get a direct flight to Beijing that takes 4 h.
Paula lives in Sydney, Australia, and her direct flight takes 13 h.
What time does each girl leave her country to arrive in Beijing at 6 p.m., Beijing time?

Check List

Your work should show:

- ✓ how you used integers to solve each problem
- ✓ the strategies you used to add and subtract integers
- ✓ correct calculations
- ✓ a clear explanation of how integers relate to time zones



- Olympic funding depends on money from North American television networks. What problems will the organizers of the Beijing Olympics encounter when they plan the times for events?
- Make up your own problem about the time zone map.
Solve your problem. Show your work.

Show how you can use integers to solve each problem.

Reflect on Your Learning

Suppose there were no negative integers.
Could we survive in a world without negative integers?
Explain.