

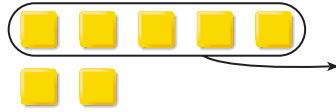
2.5

Subtracting Integers on a Number Line

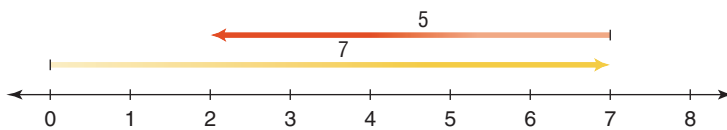
Focus Subtract integers using number lines.

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

$$7 - 5 = 2$$



We can model this subtraction on a number line.

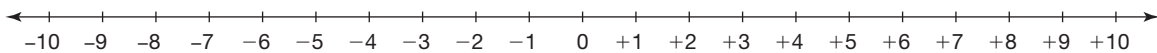


Subtraction is finding the difference. This number line shows how much more 7 is than 5.

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.

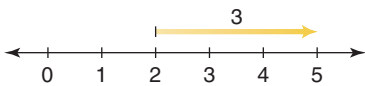


Reflect & Share

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

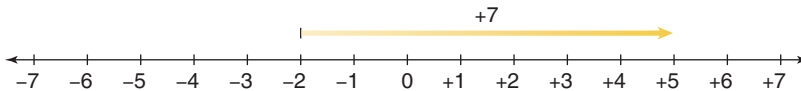
Connect

- ▶ 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 $+4$.

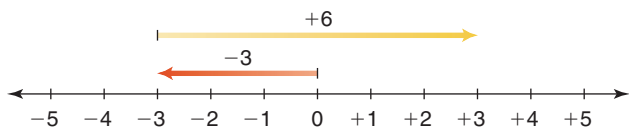
$$(-9) + (-4) = -13$$

Add -4 .

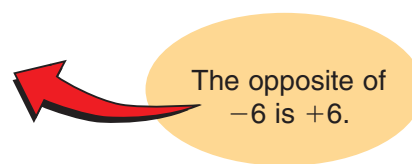
- To subtract an integer, we add the opposite integer.

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

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



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



Example

Subtract.

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

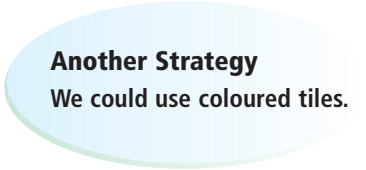
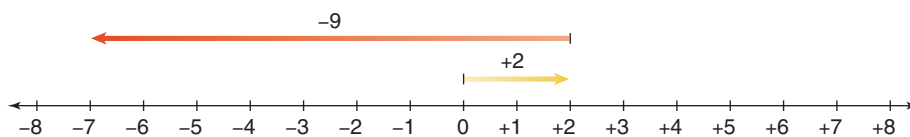
A Solution

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

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

Use a number line.

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

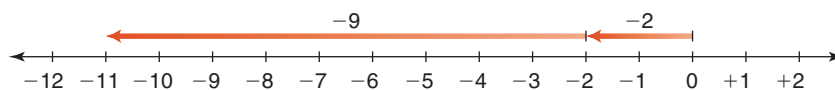


- b) To subtract: $(-2) - (+9)$

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.