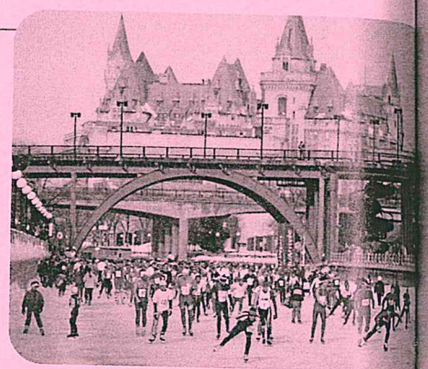
6.7 Using Number Lines to Subtract Integers

You will need
- a number line

▶ **GOAL**
Calculate the difference between integers using a number line.

Learn about the Math



Miguel, Romona, and Bonnie found these data.

City	Lowest recorded temperature (°C)	Highest recorded temperature (°C)
Ottawa	−37	+39
Toronto	−32	+41
Montreal	−38	+38
Calgary	−36	+34
Vancouver	−17	+35
Winnipeg	−44	+42
Churchill	−49	+37

They wanted to determine which city had the greatest difference between lowest and highest recorded temperatures.

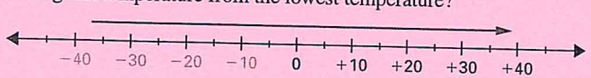
Bonnie said, "It's easy to find the difference between positive temperatures, such as +42 and +4. All you have to do is subtract: (+42) − (+4) = (+38)."

Miguel commented, "But all the lowest temperatures are negative. For Ottawa, we have to calculate (+39) − (−37). We could use counters, but we need too many counters."

Bonnie replied, "We used number lines to add integers that were far from zero. Maybe we can use number lines to subtract, too."

? How can you use a number line to calculate temperature differences?

A. Mark the lowest and highest temperatures for Ottawa on a number line. Draw an arrow from the lowest temperature to the highest temperature. Write the subtraction question the arrow represents. How far away is the highest temperature from the lowest temperature?



B. Why does the arrow in step A show (+39) − (−37)?

C. On the same number line, draw an arrow from the highest temperature to the lowest temperature. What does this arrow represent? Write the subtraction question this arrow represents.

D. Use the method you used in steps A to C to calculate the temperature range for the other cities in the table.

E. Use your calculations to identify the city with the greatest range of extreme temperatures.

F. Use the same method to calculate how much lower the −49°C low for Churchill is than the −17°C low for Vancouver.

Reflecting

1. When you want to calculate (+39) − (−37), why do you start at (−37) on the number line?

2. a) How is the arrow going from the highest temperature to the lowest temperature like the arrow going from the lowest temperature to the highest temperature?

b) How is it different?

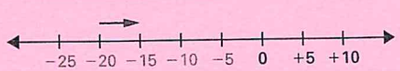
3. How does a number line model show whether the result of an integer subtraction will be positive or negative?

Work with the Math

Example 1: Modelling integer subtraction on a number line

Use a number line model to show that (−15) − (−20) = (+5).

Romona's Solution



I marked −20 and −15 on the number line.

The order of the subtraction told me to start the arrow at (−20) and end it at (−15).
The arrow is 5 units long and goes right.

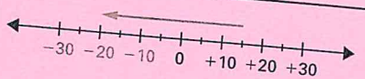
(−15) − (−20) = (+5)

The difference is (+5).

Example 2: Modelling integer subtraction on a number line

Use a number line model to show that $(-20) - (+15) = (-35)$.

Miguel's Solution



I marked −20 and +15 on the number line.

The order of the subtraction told me to start the arrow at (+15) and end it at (−20). The arrow is 35 units long and goes left.

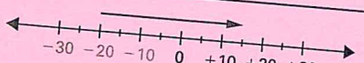
$(-20) - (+15) = (-35)$

The difference is (−35).

Example 3: Modelling integer subtraction on a number line

Use a number line model to calculate $(+15) - (-20)$.

Bonnie's Solution



I marked −20 and +15 on the number line.

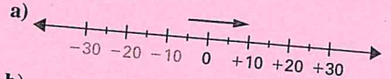
The order of the subtraction told me to start the arrow at (−20) and end it at (+15). The arrow is 35 units long and goes right.

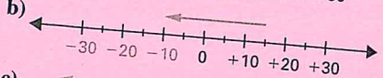
$(+15) - (-20) = (+35)$

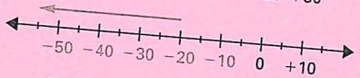
The difference is (+35).

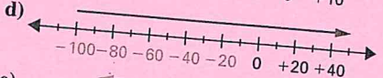
A Checking

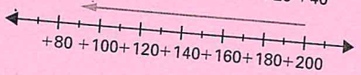
4. Write the subtraction question that each model represents.

a)


b)


c)


d)


e)


5. Calculate each difference in question 4.

6. An arrow is used on a number line model to represent $(-35) - (+40)$.

a) Identify the starting point for the arrow.

b) Identify the ending point for the arrow.

c) Calculate the difference.

B Practising

7. On a number line, how do the distance and direction from −2 to −4 compare with the distance and direction from −4 to −2?

8. The difference between two integers is −5. What does this tell you about their positions on a number line?

9. Use a number line to show that $(-30) - (+40) = (-30) + (-40)$. Explain why this is true.

10. Use a number line to explain why $(+36) - (-34)$ and $(-34) - (+36)$ have different integer values.

11. Mark the starting and ending points for each subtraction on a number line. Calculate the difference.

a) $(-20) - (-40)$

b) $(+30) - (+70)$

c) $(-23) - (-21)$

d) $(+35) - (+32)$

e) $(+10) - (-10)$

f) $(-20) - (-20)$

g) $(-20) - (+20)$

h) $(+100) - (-100)$

12. Imagine that an arrow on a number line is used to represent each difference in the following table. Copy and complete the table. Part (a) is done for you.

	Start of arrow	End of arrow	Subtraction statement
a)	−5	−1	(−1) − (−5)
b)	+15	+10	
c)	−10	−16	
d)	0	+8	
e)	−8	0	
f)			(−80) − (+20)
g)			(+15) − (−15)
h)			(−85) − (−15)

13. Use a number line to calculate each difference in question 12.

14. The subtraction $6 - 4$ represents the difference between 6 and 4. Use a number line to explain why $(+6) - (-4)$ and $(-4) - (+6)$ do not represent the same difference.

15. Ravi tracked the performance of several investments. Copy and complete Ravi's chart. Use a number line to model each difference.

	Last year's gain/loss ($)	Current gain/loss ($)	Change in value this year ($)
a)	−300	−350	(−350) − (−300) = (−50)
b)	+200	−150	
c)	+150	+20	
d)	−595	+105	
e)	−1005	−950	
f)	+537	−111	
g)	−97	−121	
h)	−32	+128	

C Extending

16. Copy and complete the table.

	a	b	a − b
a)	−2150	+205	
b)	−1510		+103
c)		+237	−150

17. Use a number line to calculate each answer.

a) $(+40) + (+20) - (+30)$

b) $(-45) + (-35) - (-20)$

c) $(+37) - (-85) + (-10)$

d) $(+120) - (-90) + (-10)$

e) $(-100) - (-510) + (-520)$

f) $(+301) - (-205) + (-153)$

18. a) Use a number line to show why $(+15) - (-9) = (+15) + (+9)$.

b) Use a number line to show why $(+15) - (-20) = (+15) + (+20)$.

c) Predict the difference $(+15) - (-35)$. Explain your prediction.