6.6 Subtracting Integers Using Number Lines

YOU WILL NEED
- a number line

GOAL

Calculate the difference between integers using a number line.

LEARN ABOUT the Math

Matthew, Julie, and Sarah researched the record extreme temperatures of the capital cities in western and northern Canada.

Capital city	Lowest recorded temperature (°C)	Highest recorded temperature (°C)	Difference (°C)
Winnipeg	−45	+41	
Iqaluit	−46	+25	
Yellowknife	−51	+33	
Whitehorse	−52	+34	
Regina	−50	+43	
Edmonton	−48	+35	
Victoria	−16	+36	

They wanted to know how much higher the highest temperature was than the lowest temperature for each city.

What is the difference between the highest temperature and the lowest temperature for each city?

A. Suppose that the lowest Winnipeg temperature was +2. How would you express the temperature difference on a number line?

B. Express the difference between Winnipeg's actual temperatures as a subtraction.

C. Calculate the difference between Winnipeg's temperatures on a number line.

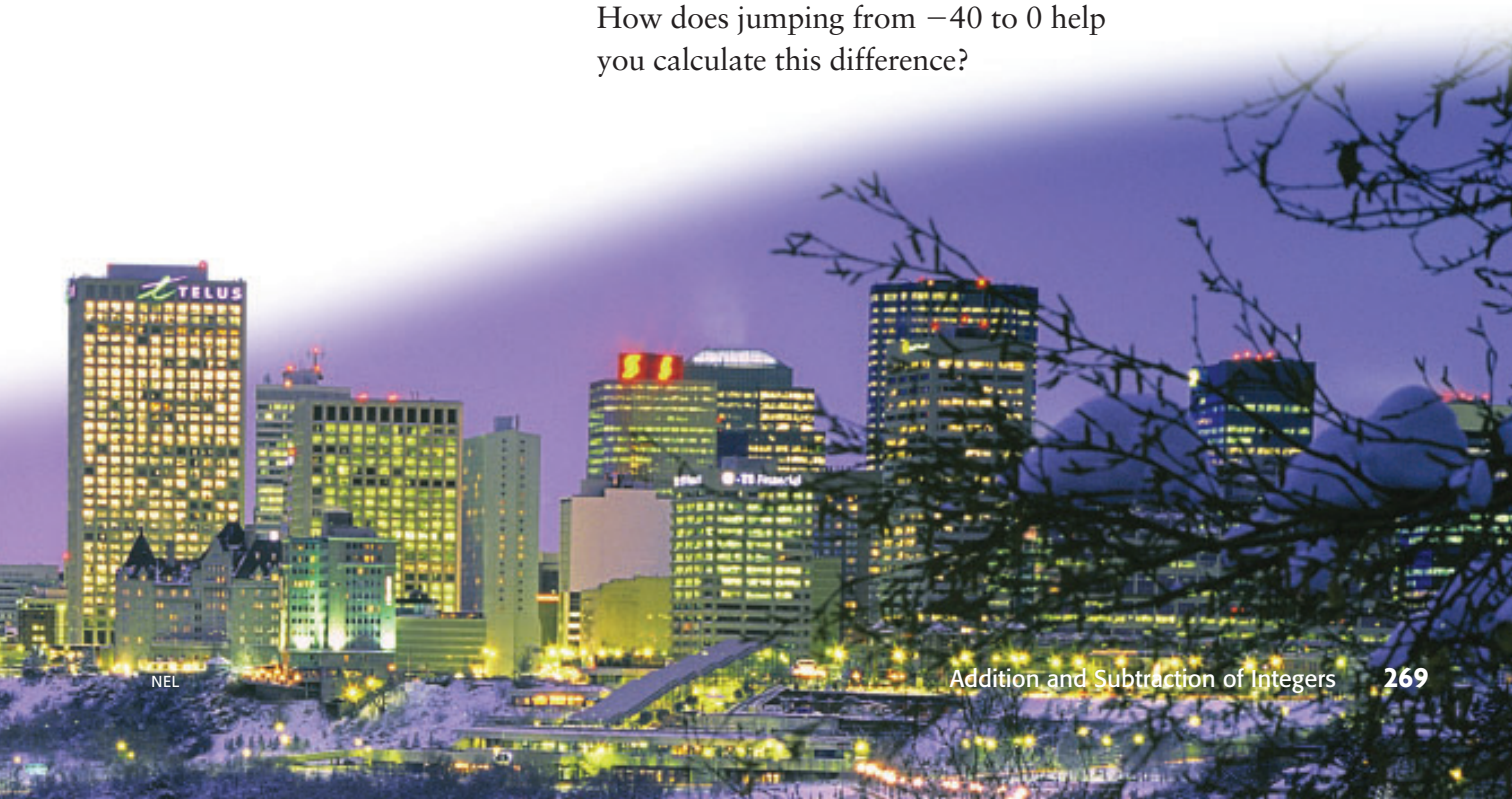
D. Calculate the difference between the highest and lowest temperatures for each of the other cities on a number line. Record your subtraction for each difference.

Reflecting

E. What temperature problem would you be solving if you calculated (−45) − (+41)? Use a number line to help you explain.

F. How can you tell, without calculating, that the answer for part C is a positive integer?

G. Suppose that you use a number line to calculate (+35) − (−40). How does jumping from −40 to 0 help you calculate this difference?

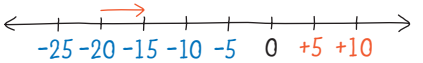


WORK WITH the Math

Example 1 | Subtracting integers on a number line

Calculate (−15) − (−20) on a number line.

Julie's Solution



I wanted to calculate the difference between −20 and −15.

I started at −20 and went to −15.

The arrow is 5 units long.

The arrow points to the right, so I recorded the difference as a positive integer.

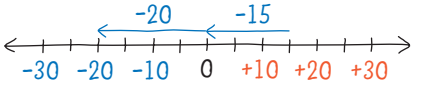
(−15) − (−20) = (+5)

The difference is +5.
This makes sense, because (−20) + (+5) = (−15).

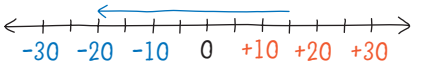
Example 2 | Subtracting integers on a number line

Calculate (−20) − (+15) on a number line.

Matthew's Solution



I wanted to calculate the difference between +15 and −20.
I started at +15.
It was 15 units from +15 to 0
and 20 more units to −20.



The arrow is 35 units long.

The arrow points to the left, so I recorded the difference as a negative integer.

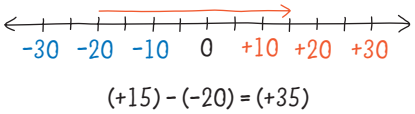
(−20) − (+15) = (−35)

The difference is −35.
This makes sense, because (+15) + (−35) = (−20).

Example 3 | Subtracting integers on a number line

Calculate (+15) − (−20) on a number line.

Sarah's Solution



I wanted to calculate the difference between −20 and +15.

I started at −20 and went to +15. It was 20 units from −20 to 0, and 15 more units to +15. The arrow is 35 units long. The arrow points to the right, so I recorded the difference as a positive integer.

The difference is +35.
This makes sense, because (−20) + (+35) = (+15).

A Checking

1. **a)** Calculate (−35) − (+40) on a number line.
   b) What is the starting point of the arrow?
   c) What is the end point of the arrow?

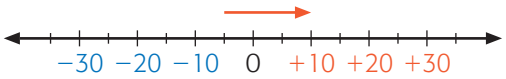
2. Calculate.
   a) (−12) − (−20)
   b) (+31) − (+32)

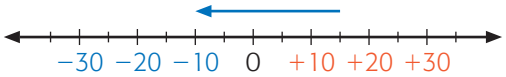
B Practising

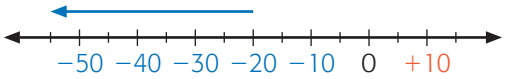
3. **a)** Calculate (+36) − (−34) = ■ and (−34) − (+36) = ▲ on a number line.
   b) Explain why ■ and ▲ are opposite integers.

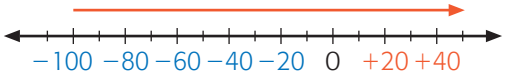
4. Calculate.
   a) (−20) − (−40)
   b) (+30) − (+70)
   c) (−23) − (−21)
   d) (+35) − (+32)
   e) (+10) − (−10)
   f) (−20) − (−20)

5. Record the subtraction that each model represents.

a)


b)


c)


d)


6. The difference between two integers is -5. What does this tell you about the positions of the integers on a number line?

7. Determine the unknown value.

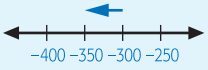
a) ■ $- (-4) = -30$

b) $(-12) -$ ■ $= -19$

c) ■ $- (+7) = -32$

d) $(+8) -$ ■ $= -15$

8. The following table shows the changing balances in some bank accounts. Copy and complete the table.

	Starting balance ($)	Final balance ($)	Model	Change in value ($)
a)	−300	−350		$(-350) - (-300)$ $= (-50)$
b)	+200	−150		
c)	+150	+20		
d)	−595	+105		
e)	−1005	−950		
f)	+537	−111		

9. Which of these expressions has the greatest result?

A. $(+40) + (+20) - (+30)$

B. $(+37) - (-85) + (-10)$

C. $(-100) - (-510) + (-520)$

D. $(+25) + (-40) - (-135)$

10. a) Explain why $(+15) - (-9) = (+15) + (+9)$.

b) Can you always add the opposite to subtract an integer? Use an example to help you explain.