

# **Grade 7 Mathematics**

## **Unit 2**

### **Integers**

*Estimated Time: 15 Hours*

|                                                  |                             |
|--------------------------------------------------|-----------------------------|
| <b>[C]</b> Communication                         | <b>[PS]</b> Problem Solving |
| <b>[CN]</b> Connections                          | <b>[R]</b> Reasoning        |
| <b>[ME]</b> Mental Mathematics<br>and Estimation | <b>[T]</b> Technology       |
|                                                  | <b>[V]</b> Visualization    |



# Unit 2 Overview

## Introduction

Students will focus on developing skills and understanding the addition and subtraction of integers, and completing simple number sentences. The big ideas in this unit are:

- Integers involve two concepts: size (magnitude) and sign (direction).
- Negative numbers and positive numbers that are the same distance from zero are opposites. Two opposites will combine to form a *zero pair*.
- Subtracting an integer is the same as adding the opposite integer.
- Integers are used to describe relative changes between two or more items.
- Integers are used to represent values like temperatures, altitudes, stock price changes, etc.

## Context

Students will draw upon their prior experiences with positive and negative numbers by using integers to represent real-life situations. Working with manipulatives and situational examples will deepen the students understanding of both size and direction as it pertains to integers. As students use integer counters and number lines they will develop an increasing awareness of how mathematics is used to solve a broad range of problems. They will learn *why* and *how* different strategies work and in turn this will enable investigation of objects and activities from a mathematical perspective.

## Why are these concepts important?

Developing a good understanding of integers will permit students to:

- Model real-life situations that have size and direction.
- Allow students to graph in all four quadrants.
- Understand integer operations which are crucial to working with algebraic expressions and equations.
- Build number sense for future problem solving activities

*"Can you do addition?" the White Queen asked. "What's one and one and one and one and one and one and one and one and one and one?"*

*"I don't know," said Alice, "I lost count."*

*Lewis Carroll [Charles Lutwidge Dodgson] (1832-1898)*

## General Outcome: Develop Number Sense

### Specific Outcome

*It is expected that students will:*

**7N6. Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially and symbolically.**

[C, CN, PS, R, V]

### Achievement Indicators

7N6.1 Explain, using concrete materials such as integer tiles and diagrams, that the sum of opposite integers is zero.

7N6.2 Solve a given problem involving the addition and subtraction of integers.

### Elaborations: Suggested Learning and Teaching Strategies

Students have been introduced to the concept of integers in previous grades. They have modelled integers concretely and pictorially. It is assumed that students can;

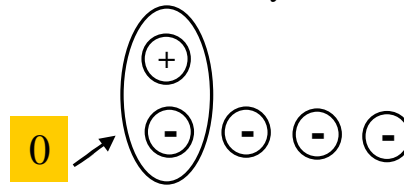
- Compare and order integers.
- Place integers on a number line.
- Add and subtract whole numbers.

In everyday life, there are many uses of integers. Using real life plays a major role in developing an understanding of integer operations. Students should see a connection between integers and the world around them through the use of problems couched in contexts such as the distance above or below sea level, temperature, and banking (deposits and withdrawals), etc.

The set of integers is an extension of the whole number system to include the **opposite** of every whole number. Operations with integers build on operations with whole numbers.

Students should be given an opportunity to explore the zero principle using integer tiles. The concept of a **zero pair** is demonstrated on page 52 of the text book. A yellow tile representing +1 and a red tile representing -1 form a zero pair. When combined they model the number zero.

For example; model -3 using more than 3 integer tiles.  
There are an infinite number of ways to do this, such as



This achievement indicator will be repeatedly addressed throughout this unit, and aspects of it will be developed under each of the other achievement indicators.

| <b><i>General Outcome: Develop Number Sense</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                      |
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| <b>Suggested Assessment Strategies</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Resources/Notes</b>                                                                                                                                                                                                                                               |
| <p><u><i>Informal Observation</i></u></p> <ol style="list-style-type: none"> <li>1. Write various integers on cards and distribute them to small groups of students. Then have the students arrange themselves in order from least to greatest at the front of the room. You may wish to make this a competition by timing the students.</li> <li>2. Using a skipping rope as a model for a number line ask students to pin cards with integers written on them in the correct spot. You may elect to place benchmarks (i.e. 0) prior to the activity.</li> <li>3. Mix-up Match-up. Create cards with opposite integers written on them. Distribute these cards to the students and have them locate and sit with their opposite, in <u><i>zero pairs</i></u>.</li> </ol> <p><u><i>Paper and Pencil</i></u></p> <ol style="list-style-type: none"> <li>1. Have students create their own number line, label it, and keep it for reference.</li> <li>2. Using integer tiles have students demonstrate three ways to model integers such as -7, 8, -2 etc. An overhead or a Smartboard can be used to allow students to share their models with the class.</li> <li>3. Ask students to model as many integers as they can using exactly nine integer counters.</li> </ol> | <p><i>Math Makes Sense 7</i><br/> <b>Lesson 2.1</b><br/> Unit 2: Integers<br/> TR: ProGuide, pp. 4–7<br/> Master 2.10, 218<br/> CD-ROM Unit 2 Masters</p> <p>ST: pp. 52–55<br/> Practice and HW Book<br/> pp. 32–33</p> <p>Lessons 2.1–2.5<br/> Unit 2 pp. 82–83</p> |

## General Outcome: Develop Number Sense

### Specific Outcome

*It is expected that students will:*

**7N6. Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially and symbolically.**

[C, CN, PS, R, V]

(Cont'd)

### Achievement Indicators

7N6.3 Add two given integers, using concrete materials or pictorial representations, and record the process symbolically.

### Elaborations: Suggested Learning and Teaching Strategies

The two models most commonly used for solving **addition** of integers are:

1. Two coloured counters
2. Number lines.

Both models depict the concepts of **quantity** and **opposite**; students should be given experiences with each. Quantity is signified by the number of counters or length of the arrows. Opposite is represented as different colours or different directions.

In meeting this achievement indicator, have students come up with the *rules* listed below through their experiences with modeling situations. These should not be presented to students simply as rules.

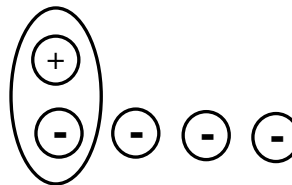
#### Adding Integers with the Same Sign

The sum of two positive integers is positive. The sum of two negative integers is negative.

#### Adding Integers with Opposite Signs

##### (Using Two Coloured Counters)

When adding two integers, it is necessary to first model each integer, and then match positive and negative values to make zero pairs.



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

This is an addition equation.

| <b><i>General Outcome: Develop Number Sense</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                    |
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| <b>Suggested Assessment Strategies</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Resources/Notes</b>                                                                                                                                                                                             |
| <p><u><i>Journal</i></u><br/>Ask students if the sum of a negative number and a positive number is always negative. Explain why or why not.</p> <p><u><i>Games</i></u><br/>1. <i>Integer War</i>. (Refer to Appendix 2–A.)<br/>2. <i>Connect Four: Adding Small Integers</i> (Refer to Appendix 2–B.)<br/>3. <i>Connect Four: Adding Big Integers</i> (Refer to Appendix 2–C.)<br/>4. <i>Magic Circle</i>. (Refer to Appendix 2–D.)</p> <p><u><i>Mental Math Team Activity</i></u><br/>Separate groups of students into teams. Each student will receive an individual whiteboard and the activity will begin with all team members standing. The teacher will write an addition equation on the board and ask students to write their answers on their whiteboards. Students with correct answers will remain standing and incorrect answers will sit. After three problems the team with the most people standing will receive 10 points. One member of the team will be selected to attempt a fun task, like shooting a foam basketball into a net etc, for an additional 5 points for their team. Then start a new round with everybody standing once again. The team that reached 100 points first will win.</p> | <p><i>Math Makes Sense 7</i><br/><b>Lesson 2.2</b><br/>Unit 2: Integers<br/>TR: ProGuide, pp. 8–11<br/>Master 2.11, 2.19<br/>CD-ROM Unit 2 Masters</p> <p>ST: pp. 56–59<br/>Practice and HW Book<br/>pp. 34–35</p> |

## General Outcome: Develop Number Sense

### Specific Outcome

*It is expected that students will:*

**7N6. Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially and symbolically.**

[C, CN, PS, R, V]

(Cont'd)

### Achievement Indicators

7N6.4 Illustrate, using a number line, the results of adding negative and positive integers.

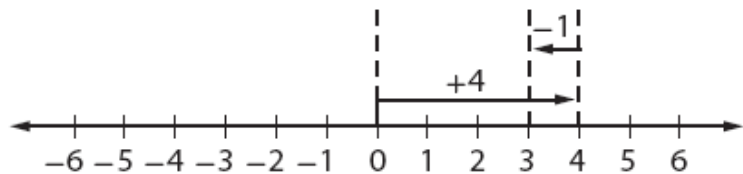
### Elaborations: Suggested Learning and Teaching Strategies

**Addition** of integers (*continued*):

2. Number lines.

### Adding Integers with Opposite Signs (Using a Number Line)

Start at 0. Move 4 units to the right to show +4. From there, move 1 unit to the left to show -1.



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

| <b>General Outcome: Develop Number Sense</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                              |
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| <b>Suggested Assessment Strategies</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Resources/Notes</b>                                                                                                                                                                                                                                                                       |
| <p><u>Paper and Pencil</u></p> <ol style="list-style-type: none"> <li>Write an addition equation to describe each situation. Then find each sum and explain its meaning.               <ol style="list-style-type: none"> <li><b>BOARD GAMES:</b> On your first turn, you move 10 spaces forward around the game board. On the second turn, you move 4 spaces backward. How many spaces are you from where you started?</li> <li><b>WEATHER:</b> Before you went to sleep last night, the temperature was <math>-3^{\circ}\text{C}</math>. During the night the temperature dropped by <math>5^{\circ}\text{C}</math>. What was the temperature in the morning?</li> <li><b>ELEVATOR:</b> Mrs. Brown parked in the parking garage 10 m below street level. She then got in an elevator and went up 27 m to her office. How far above the street is her office?</li> </ol> </li> <li>Find three pairs of integers with a sum of -29.</li> <li>Find integer pairs with the sum of -16 where:               <ol style="list-style-type: none"> <li>One number is less than -16</li> <li>One number is greater than +16</li> <li>One number is greater than 0 and less than +5.</li> </ol> </li> </ol> <div style="border: 1px solid black; padding: 10px; margin-top: 20px;"> <p><b>Note: <i>Math Makes Sense 7</i> limits its exercises to integers between -10 and +10. Teachers should take students beyond this range to explore their understanding.</b></p> </div> <p><u>Mental Math/Paper and Pencil</u></p> <ol style="list-style-type: none"> <li>Calculate.               <ol style="list-style-type: none"> <li><math>(-8) + (-15) =</math></li> <li><math>(+22) + (-14) =</math></li> <li><math>(-37) + (+24) =</math></li> <li><math>(-12) + (+17) + (-11) =</math></li> </ol> <p>Note: 1D is a limiting example.</p> </li> </ol> | <p><i>Math Makes Sense 7</i><br/> <b>Lesson 2.3</b><br/>           Unit 2: Integers<br/>           TR: ProGuide, pp. 12–16<br/>           Master 2.15, 2.12, 2.20<br/>           CD-ROM Unit 2 Masters</p> <p>ST: pp. 60–64<br/>           Practice and HW Book<br/>           pp. 36–38</p> |

## General Outcome: Develop Number Sense

### Specific Outcome

*It is expected that students will:*

**7N6. Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially and symbolically.**

[C, CN, PS, R, V]

(Cont'd)

### Achievement Indicators

7N6.5 Subtract two given integers, using concrete materials or pictorial representations, and record the process symbolically.

### Elaborations: Suggested Learning and Teaching Strategies

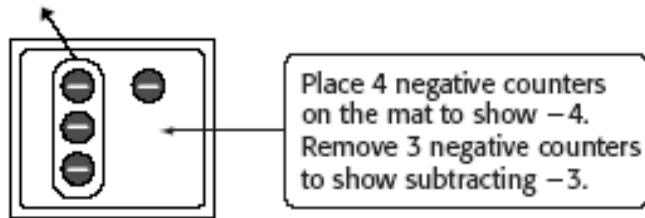
The two models most commonly used for solving **subtraction** of integers are:

1. Two coloured counters
2. Number lines.

Both models depict the concepts of **quantity** and **opposite**; students should be given experiences with each. Quantity is signified by the number of counters or length of the arrows. Opposite is represented as different colours or different directions.

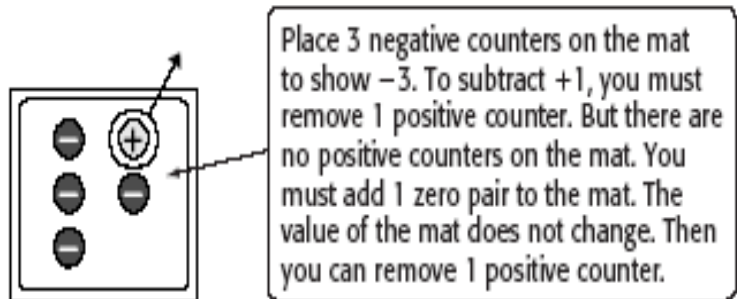
### Using Tiles

Find  $(-4) - (-3)$



So,  $-4 - (-3) = -1$ .

Find  $(-3) - (+1)$



The difference of  $-3$  and  $1$  is  $-4$ . So,  $(-3) - (+1) = (-4)$

## General Outcome: Develop Number Sense

### Suggested Assessment Strategies

#### Pencil and Paper

- Write a subtraction equation for each word problem and find the answer.
  - SOCCER:** The soccer ball was kicked 5 m in the forward direction on the first play of the game. The opposing team then kicked it back 6 m. Find the total change in distance.
  - TEMPERATURE:** The average temperature in Calgary, Canada, is  $22^{\circ}\text{C}$  in July and  $11^{\circ}\text{C}$  in January. Find the difference between the highest and lowest temperatures in Calgary.
  - BEACH:** Archie and Jughead were digging in the sand at the beach. Archie dug a hole that was 22 cm below the surface, and Jughead dug a hole that was 13 cm below the surface. Find the difference in the depths of their holes.
  - OTHER:** Ask students to solve and create their own problems using real-life situations such as: time zones, temperature, heights above and below sea level, profit/loss as it relates to, games, sports, shares of stocks, etc.

#### Journal

- Copy this table into your journal and complete.

|                                                   | In your own words | Example |
|---------------------------------------------------|-------------------|---------|
| How do you subtract integers using integer tiles? |                   |         |

- Can you model  $+2$  with an odd number of counters? Explain why or why not.
- Ask students if the difference between a negative number and a positive number is always negative. Explain why or why not.

#### Mental Math/Paper and Pencil

- Calculate. (See Note on previous page regarding integer range.)
  - $(+43) - (-6) =$
  - $(+15) - (-24) =$
  - $(-23) - (-12) =$
  - $(-14) - (+5) =$
  - $(+15) - (+34) - (-9) =$
 Note: 1E is a limiting example.

### Resources/Notes

*Math Makes Sense 7*

#### **Lesson 2.4**

Unit 2: Integers

TR: ProGuide, pp. 18–22

Master 2.13, 2.21

CD-ROM Unit 2 Masters

ST: pp. 66–70

Practice and HW Book  
pp. 39–40

## General Outcome: Develop Number Sense

### Specific Outcome

*It is expected that students will:*

**7N6. Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially and symbolically.**

[C, CN, PS, R, V]

(Cont'd)

### Achievement Indicators

7N6.6 Illustrate, using a number line, the results of subtracting negative and positive integers.

### Elaborations: Suggested Learning and Teaching Strategies

**Subtraction** of integers (*continued*):

2. Number lines.

#### Using a Number Line

There are two methods that we must expose the students to when subtracting integers. Each is equally valuable and needs to be fully developed. The first is not a common approach but as the following explanation shows is used more often in real world applications.

This first method, called the **Comparison Model** of subtracting integers is analogous to how cashiers determine the amount of change a customer will receive when they make a purchase.

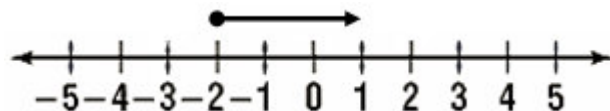
For instance, a customer's bill comes to \$9.65 and they pay with a \$20 bill. A cashier will determine the change by finding how much makes \$10 (adding on) and then adding the remaining \$10. In effect, the cashier will say 35¢ makes \$10, and another \$10 makes \$20. So the change is \$10.35.

So we have turned  $(20 - 9.65)$  into "how far away from 9.65 is 20?"

On page 72 of the text there is an explanation of how to subtract integers using the Comparison Model.

Consider the problem  $1 - (-2)$ .

We will ask the question "how far away from -2 is 1?" Or "what do we add to -2 to get 1?" Starting at -2 draw a line towards +1 until you get there. Then notice that you have drawn a line with a length of 3 towards the right. So the answer is +3.



So,  $(+1) - (-2) = (+3)$

## General Outcome: Develop Number Sense

### Suggested Assessment Strategies

#### Journal

1. Assign the Reflect activity on page 75 to the students.
2. List as many words or phrases as you can, that mean “subtract or subtraction.”

#### Individual/Group Activity

(Refer to Appendix 2–E for the *Integer Angel* worksheet.)

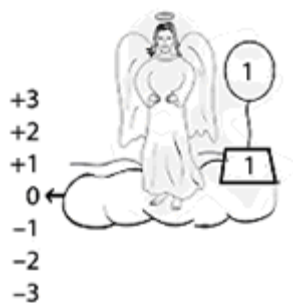
Integer Angel is floating on a cloud at zero. One balloon supports one weight. If we gave her 100 balloons and 100 weights, what would happen to her? Explain why.

Now that Integer Angel has 100 balloons and 100 weights, let's make her move. We want her to go **up 4** spaces but we do not have any balloons to give her. How can we still make her move up 4 spaces?

Again, Integer Angel is at zero with 100 balloons and 100 weights. If you want to make her drop **down 28** steps but do not have any weights to give her, how can you still get the end result of 28 down?

TAKING AWAY BALLOONS makes Integer Angel move \_\_\_\_\_.

TAKING AWAY WEIGHTS makes Integer Angel move \_\_\_\_\_.



### Resources/Notes

*Math Makes Sense 7*

#### **Lesson 2.5**

Unit 2: Integers

TR: ProGuide, pp. 23–27

Master 2.15, 2.14, 2.22

CD-ROM Unit 2 Masters

ST: pp. 71–75

Practice and HW Book

pp. 41–43

## General Outcome: Develop Number Sense

### Specific Outcome

*It is expected that students will:*

**7N6. Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially and symbolically.**

[C, CN, PS, R, V]

(Cont'd)

### Achievement Indicators

7N6.6 Illustrate, using a number line, the results of subtracting negative and positive integers.  
(continued)

### Elaborations: Suggested Learning and Teaching Strategies

As a prelude to the second method, called **Adding the Opposite**, you may decide to use these exercises with the students.

Exercise 1:

On the board display equations similar to these examples;

$$(+4) - (+2) = ( \quad )$$

$$(+7) - (-3) = ( \quad )$$

$$(-3) - (-2) = ( \quad )$$

**Ask the students to determine these answers using the comparison method.**

Then display these equations on the board;

$$(+4) + (-2) = ( \quad )$$

$$(+7) + (+3) = ( \quad )$$

$$(-3) + (+2) = ( \quad )$$

**Ask the students to determine these answers using whatever integer addition method they prefer.**

Exercise 2:

Patterning can be used to develop this as well. Have students compare each column:

$$(+4) - (+2) = 2$$

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

$$(+4) - (+0) = 4$$

$$(+4) - (-1) = 5$$

$$(+4) - (-2) = 6$$

$$(+4) - (-3) = 7$$

$$(+4) + (-2) = 2$$

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

$$(+4) + (-2) = 4$$

$$(+4) + (+1) = 5$$

$$(+4) + (+2) = 6$$

$$(+4) + (+3) = 7$$

After these answers are completed ask the students what they have noticed. Hopefully, they will respond that they noticed the answers were the same when the opposites were added.

(This elaboration is **continued** on the next two page spread...)

| <b>General Outcome: Develop Number Sense</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                 |
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| <b>Suggested Assessment Strategies</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Resources/Notes</b>                                                          |
| <p><u>Technology/Web Activities</u></p> <ol style="list-style-type: none"> <li>1. Play the game called Line Jumper at this link:<br/> <a href="http://www.funbrain.com/cgi-bin/nl.cgi?A1=s&amp;A2=4">http://www.funbrain.com/cgi-bin/nl.cgi?A1=s&amp;A2=4</a><br/> This game would be particularly effective if played on a SmartBoard.<br/> This website was found at: www.funbrain.com</li> <li>2. Also, investigate the activities at this link:<br/> <a href="http://learnalberta.ca/content/mejhm/html/video_interactives/integers/integersInteractive.html">http://learnalberta.ca/content/mejhm/html/video_interactives/integers/integersInteractive.html</a><br/> This website was found at: www.learnalberta .ca</li> <li>3. Also, investigate the activities at this link:<br/> <a href="http://nlvm.usu.edu/en/nav/frames_asid_162_g_3_t_1.html?from=category_g_3_t_1.html">http://nlvm.usu.edu/en/nav/frames_asid_162_g_3_t_1.html?from=category_g_3_t_1.html</a><br/> This website was found at: <a href="http://www.nlvm.usu.edu">www.nlvm.usu.edu</a><br/> (National Library of Virtual Manipulatives)</li> </ol> <p><u>Paper and Pencil</u></p> <p>When you add two negative integers, you always get a negative sum. When you subtract two negative integers, do you always get a negative difference? Explain with the aid of examples.</p> <p><u>Extension</u></p> <p>Without actually calculating the difference between two integers, how can you tell whether the answer will be positive, negative or zero? Explain with the aid of examples.</p> | <p><i>Math Makes Sense 7</i><br/> <b>Lesson 2.5</b><br/> <b>(continued)</b></p> |

## General Outcome: Develop Number Sense

### Specific Outcome

*It is expected that students will:*

**7N6. Demonstrate an understanding of addition and subtraction of integers, concretely, pictorially and symbolically.**

[C, CN, PS, R, V]

(Cont'd)

### Achievement Indicators

7N6.6 Illustrate, using a number line, the results of subtracting negative and positive integers.  
(continued)

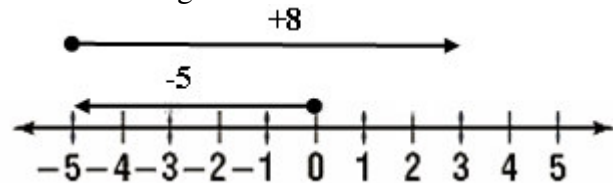
### Elaborations: Suggested Learning and Teaching Strategies

This leads into developing the second method of subtracting integers which, as previously noted, is called **Adding the Opposite**.

All subtraction statements have an equivalent addition statement.

i.e.  $(-5) - (-8)$  is the same as  $(-5) + (+8)$

So, on a number line we get



Thus  $(-5) - (-8) = (-5) + (+8) = (+3)$

| <b><i>General Outcome: Develop Number Sense</i></b> |                                                                      |
|-----------------------------------------------------|----------------------------------------------------------------------|
| <b>Suggested Assessment Strategies</b>              | <b>Resources/Notes</b>                                               |
|                                                     | <i>Math Makes Sense 7</i><br><b>Lesson 2.5</b><br><b>(continued)</b> |

*Strand: Number*