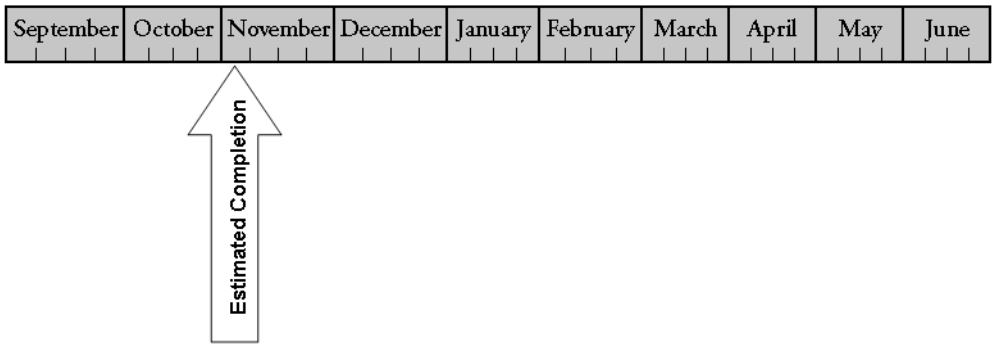
Integers

Suggested Time: 3 Weeks



Unit Overview

Focus and Context

In this unit, students will multiply and divide integers concretely, pictorially and symbolically. Integer multiplication can be thought of as repeated addition, and integer division can be thought of as the opposite of multiplication. Both operations will be modelled using integer tiles and number lines. As these models become internalized, students will perform these operations symbolically, without the use of manipulatives.

Students will generalize and apply rules for determining the signs of products and quotients. The product or quotient of two integers with the same sign is positive, and the product or quotient of two integers with opposite signs is negative. They will see that integers have the zero property, multiplicative identity, commutative property, and distributive property. The product of two-digit integers can be found using the distributive property.

Combining these new skills with the integer addition and subtraction they were exposed to in grade 7 will enable students to solve problems using all four arithmetic operations. Finally, they will apply the order of operations with integers.

Math Connects

Developing a good understanding of integers will permit students to represent real-life situations involving size and direction. Integers are important to science and engineering. They are needed to describe rates of change, and are used in situations involving time, position, elevation (e.g. above and below sea level), temperature, energy, and financial contexts such as net worth, balance sheets, or profit and loss.

Proficiency with integers is crucial to future work with algebra. It is necessary when evaluating algebraic expressions and solving equations. It allows students to graph relations using all four quadrants. Work with integers will be applied to future study of rational expressions, and extended to irrational and real numbers. It continues to build number sense, preparing students for a wide range of problem solving activities.

Process Standards Key

[**C**] Communication
[**CN**] Connections
[**ME**] Mental Mathematics and Estimation
[**PS**] Problem Solving
[**R**] Reasoning
[**T**] Technology
[**V**] Visualization

Curriculum Outcomes

STRAND	OUTCOME	PROCESS STANDARDS
Number	Demonstrate an understanding of multiplication and division of integers, concretely, pictorially and symbolically. [**8N7**]	C, CN, PS, R, V

Strand: Number

Outcomes

Students will be expected to

8N7 Demonstrate an understanding of multiplication and division of integers, concretely, pictorially and symbolically.

[C, CN, PS, R, V]

Achievement Indicators:

8N7.1 *Model the process of multiplying two integers using concrete materials or pictorial representations and record the process.*

Elaborations—Strategies for Learning and Teaching

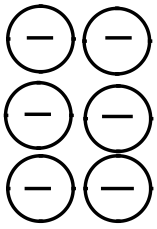
Students have been introduced to addition and subtraction of integers in previous grades. They have modelled integers concretely, pictorially and symbolically. It is assumed that students can compare and order integers, place integers on a number line, and add and subtract integers. Since order of operations is addressed later in this unit, some review of addition and subtraction rules may be required.

Research has shown that the use of concrete models is critical in mathematics because most mathematical ideas are abstract. Students must move from the concrete to the symbolic, and part of instructional planning involves making informed decisions about where students are on the continuum of concrete to symbolic thinking.

Addition of integers can help establish some of the initial groundwork for multiplication of integers. Students should see a connection between multiplication of integers and repeated addition. For example $(+3)\times(-5)$ can also be expressed as 3 sets of -5 or $(-5)+(-5)+(-5)$.

Although the rules for multiplying integers are easy for students to learn, explaining why those rules make sense is a greater challenge. Two models that can assist with this are integer counters and number lines.

Students should first be given the opportunity to explore repeated addition using integer counters.



This model represents (-2) + (-2) + (-2) as well as 3 groups of -2, or $(+3)\times(-2)$.

Continued

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Write each repeated addition as a multiplication.

  (i) (-6) + (-6) + (-6) + (-6) + (-6)
  (ii) (+4) + (+4) + (+4) + (+4) (8N7.1)

- Write each multiplication as repeated addition.

  (i) $(+7)\times(+2)$

  (ii) $(+7)\times(-2)$

  (8N7.1)

Performance

- Present students with an empty jar and a collection of marbles or counters.

  (i) Have students put 4 groups of -2 into the jar. Have them sketch the diagram to illustrate the situation and then write a number sentence to represent the situation.

  (ii) Ask students to remove 3 groups of -2 from the empty jar. Ask how many zero pairs would be needed in order to complete the task. Add enough zero pairs and then remove the groups. Have them sketch the diagram to illustrate the situation and then write a number sentence to represent the situation. (8N7.1)

Resources/Notes

Math Makes Sense 8

Lesson 2.1: Use Models to Multiply Integers

ProGuide: pp. 4-9

CD-ROM: Master 2.18

SB: pp. 64-69

Practice and HW Book: pp. 29-31

Strand: Number

Outcomes

Students will be expected to

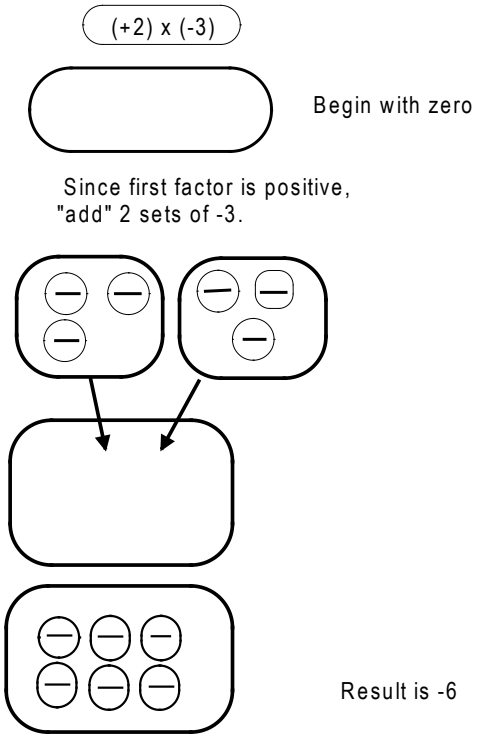
8N7 Continued

Achievement Indicator:

8N7.1 *Continued*

Elaborations—Strategies for Learning and Teaching

Students should be able to model multiplication of two positive integers or a positive and a negative integer with little difficulty. One way to model multiplication of a positive and a negative integer is shown below.



It is more difficult to model a situation where the first integer is negative since it is not clear what represents a negative number of groups. A model of multiplying two negative integers follows. Students may have difficulty determining the number of zero pairs to add when using a counter model. To help them make this decision, relate the number of zero pairs to the number of counters that have to be removed.

Continued

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Portfolio

- Kyle borrowed $6 from each of his two friends, Dillan and Jayden. Because it was Kyle's birthday his friends each forgave Kyle's debt. Ask students to explain using pictures and words how this affected Kyle's net worth. (8N7.1)

Journal

- Tell students that a friend missed class the day that multiplication of integers was first introduced. Ask them to write a detailed explanation to help the friend understand how to calculate $2\times(+5)$ and $-2\times(+5)$. (8N7.1)

Resources/Notes

Math Makes Sense 8

Lesson 2.1: Use Models to Multiply Integers

ProGuide: pp. 4-9

CD-ROM: Master 2.18

SB: pp. 64-69

Practice and HW Book: pp. 29-31

Strand: Number

Outcomes

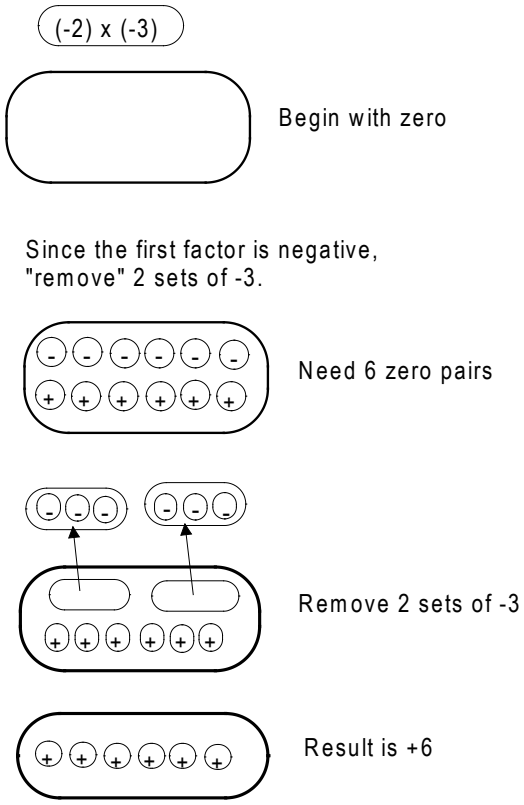
Students will be expected to

8N7 Continued

Achievement Indicator:

8N7.1 *Continued*

Elaborations—Strategies for Learning and Teaching



Patterning can then be used to justify the result for multiplying two negative integers.

$$(+2)\times(-3)=-6$$
$$(+1)\times(-3)=-3$$
$$0\times(-3)=0$$
$$(-1)\times(-3)=\ ?$$
$$(-2)\times(-3)=\ ?$$

Students should observe that as the first factor decreases by 1, the product increases by 3.

By comparing $(-3)\times(+2)$ and $(+2)\times(-3)$ using the counters, students should see that integers can be multiplied in any order without affecting the product. That is, just as with whole numbers, multiplication of integers is commutative. *Continued*

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Write a number sentence for each of the following problems and use a diagram to model each situation.

  (i) Brittany lost 3 points in each round (hand) of cards that was played. If she played 4 rounds, what was her score at the end of the game?

  (ii) Jeffrey owed $5 to each of 3 friends. What integer could be used to represent Jeffrey's total debt?

(8N7.1)

Resources/Notes

Math Makes Sense 8

Lesson 2.1: Use Models to Multiply Integers

ProGuide: pp. 4-9

CD-ROM: Master 2.18

SB: pp. 64-69

Practice and HW Book: pp. 29-31

Strand: Number

Outcomes

Students will be expected to

8N7 Continued

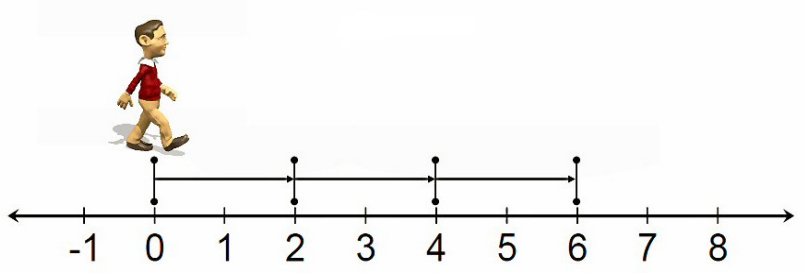
Achievement Indicator:

8N7.1 *Continued*

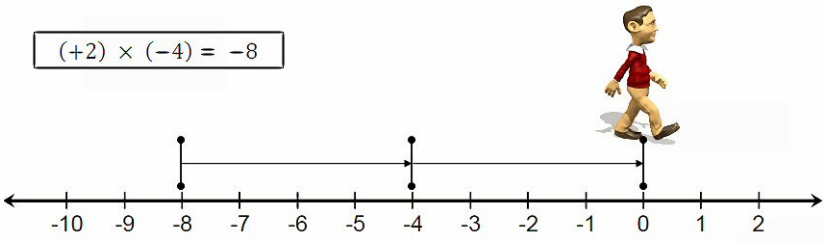
Elaborations—Strategies for Learning and Teaching

An alternative model is the number line. This provides a good method for visualizing integer multiplication if students have a solid understanding of the process. They will have to be made aware that the first integer indicates which direction to face and how many steps to take, while the second integer indicates which direction to move as well as the size of the steps.

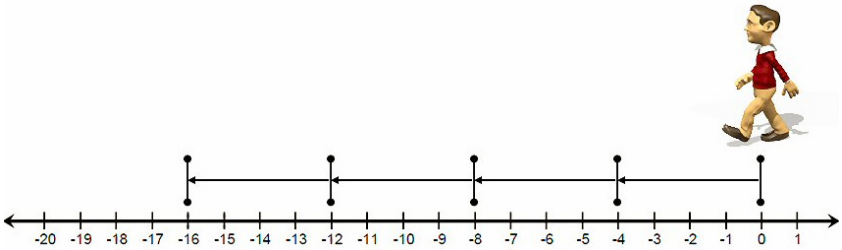
Consider $(+3)\times(+2)$. Starting at zero, face the positive end of the line. Take 3 steps of size 2 forward to stop at $+6$.



To multiply $(+2)\times(-4)$, face the positive end of the line and take 2 steps of size 4 backward to stop at -8.



To multiply $(-4)\times(+4)$, face the negative end of the line and take 4 steps of size 4 forward to stop at -16.



Continued

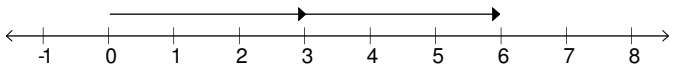
General Outcome: Develop Number Sense

Suggested Assessment Strategies

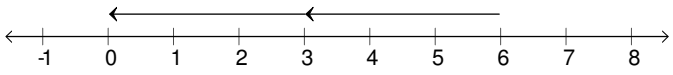
Performance

- What multiplication statement does each diagram represent?

(i)



(ii)



(8N7.1)

Resources/Notes

Math Makes Sense 8

Lesson 2.1: Use Models to Multiply Integers

ProGuide: pp. 4-9

CD-ROM: Master 2.18

SB: pp. 64-69

Practice and HW Book: pp. 29-31

Strand: Number

Outcomes

Students will be expected to

8N7 Continued

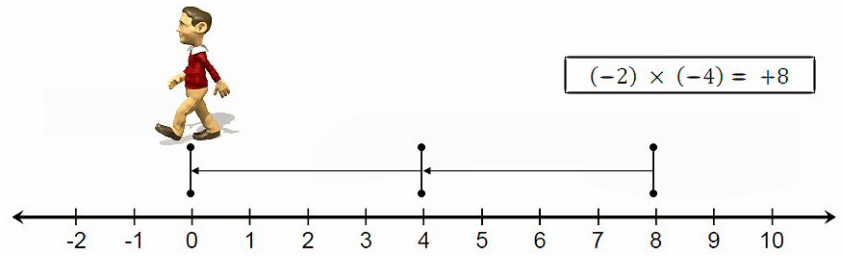
Achievement Indicators:

8N7.1 *Continued*

8N7.2 *Generalize and apply a rule for determining the sign of the product of integers.*

Elaborations—Strategies for Learning and Teaching

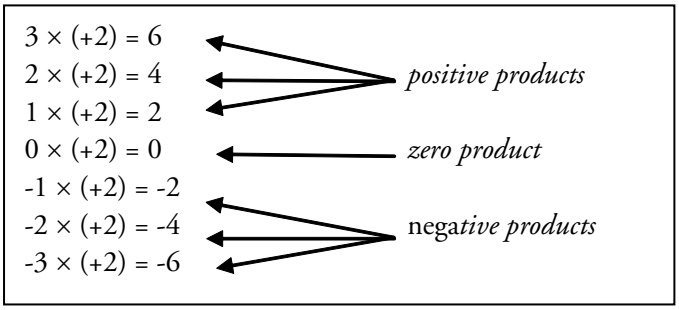
To multiply $(-2)\times(-4)$ face the negative end of the line and take 2 steps of size 4 backward to stop at 8.

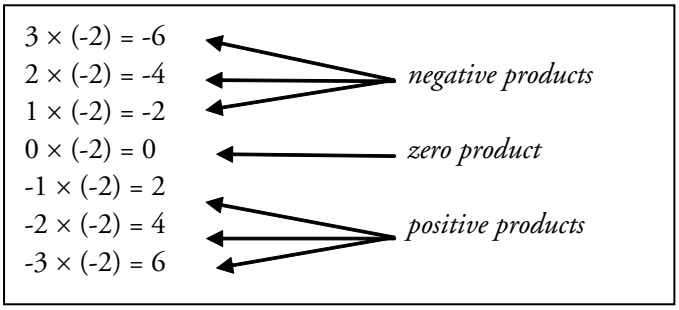


Building upon the models that have been used, students must develop the general "sign rules" for multiplication of integers:

- When two signs are the same, the product is positive.
- When two signs are different, the product is negative.

Patterning can be used to further illustrate integer product patterns:





The strategies used to multiply whole numbers with two or more digits can be employed to multiply integers with two or more digits. The "sign rules" are applied after the multiplication is completed.

Continued

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Find the products.

  (i) $(-4)\times(+3)$

  (ii) $(+5)\times(-2)$

  (iii) $(-4)\times(-3)$

  (iv) $(-4)\times(+22)$

  (v) $(-13)\times(-28)$ (8N7.2)

- Complete each multiplication statement. (8N7.2)

  (i) $(-4)\times \square = 28$

  (ii) $\square \times(-2)=24$

- Complete each statement in as many ways as possible using integers. (8N7.2)

  (i) $\square \times \square = -12$

  (ii) $\square \times \square = 16$

Presentation/Portfolio

- The sum of two integers is -2. The product of the same two integers is -24. What are the two integers? Explain your reasoning. (8N7.2)

- Without evaluating the products, identify the smallest product. Explain your reasoning. (8N7.2)

  $(-199)\times(+87)$

  $(-199)\times(-87)$

  $(+199)\times(+87)$

- Explain why the product of two negative integers has to be greater than their sum. (8N7.2)

Resources/Notes

Math Makes Sense 8

Lesson 2.2: Developing Rules to Multiply Integers

Game: What's My Product?

ProGuide: pp.10-15

CD-ROM: Master 2.19

SB: pp.70-76

Prcatice and HW Book: pp. 32-33

Strand: Number

Outcomes

Students will be expected to

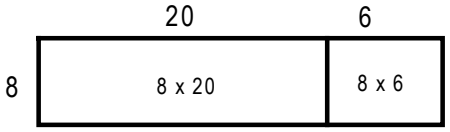
8N7 Continued

Achievement Indicators:

8N7.2 *Continued*

Elaborations—Strategies for Learning and Teaching

The area model, in combination with the distributive property, can be used to illustrate multiplication of integers. To find the product of -8×26 students can use the distributive property to represent the situation as below. Since a rectangle must have positive dimensions, first consider 8×26. This can be rewritten as $8\times(20+6)$ and represented by:



The area of this rectangle is $8(20+6)$. Using the distributive property, this gives:

$$8(20)+8(6)$$
$$=160+48$$
$$=208$$

Now recall that originally the integers had different signs, resulting in a negative product. Therefore, $-8\times 26=-208$.
The use of the area model is an important part of work with fractions and algebra.

The distributive property can also be applied without the area model.

$$-8\times 26$$
$$-8\times(20+6)$$
$$-8\times 20+-8\times 6$$
$$-160+-48$$
$$-208$$

Students should be provided with the opportunity to apply these rules in a variety of problem solving situations.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

- Use integers to give an example for each statement.

  (i) The product of two integers equals one of the integers.
  (ii) The product of two integers equals the opposite of one of the integers.
  (iii) The product of two integers is less than both integers.
  (iv) The product of two integers is greater than both integers.
  (8N7.2)

- Write a sign rule for the product of each of the following.

  (i) an even number of positive integers
  (ii) an odd number of positive integers
  (iii) an even number of negative integers
  (iv) an odd number of negative integers
  (8N7.2)

Journal

- Suppose a friend knows how to multiply positive integers but has never multiplied negative integers. (8N7.2)

  (i) How could you use the following pattern to show your friend how to calculate $(+6)\times(-4)$?

$$(+6)\times(+3)=+18$$
$$(+6)\times(+2)=+12$$
$$(+6)\times(+1)=+6$$
$$(+6)\times(0)=0$$
$$(+6)\times(-1)=-6$$
$$(+6)\times(-2)=?$$
$$(+6)\times(-3)=?$$
$$(+6)\times(-4)=?$$

  (ii) Make up a pattern to show your friend how to calculate $(+5)\times(-3)$.

Resources/Notes

Math Makes Sense 8

Lesson 2.2: Developing Rules to Multiply Integers

Game: What's My Product?

ProGuide: pp.10-15

CD-ROM: Master 2.19

SB: pp.70-76

Prcatice and HW Book: pp. 32-33

Strand: Number

Outcomes

Students will be expected to

8N7 Continued

Achievement Indicators:

8N7.3 *Provide a context that requires multiplying two integers.*

8N7.4 *Solve a given problem involving the multiplication of integers.*

Elaborations—Strategies for Learning and Teaching

Useful contexts for making work with integers meaningful for students include:

- temperature
- deposits or withdrawals
- golf scores that are below and above par
- floors that are above and below a main floor

To make meaningful connections between real-world contexts and integer multiplication, students must understand the use of positive and negative integers to represent the quantities that are multiplied. When solving problems, emphasize the importance of a summary statement to explain the meaning of the integer product.

Consider the following example.

Matthew has committed his support to a charity for 2 years. If he has $25/month deducted automatically from his bank account, what is the total of his deductions?

First, students must decide what integers to multiply.

−25 represents the monthly $25 deduction

+24 represents the number of months in two years

$$(-25)\times(+24)=-600$$

A complete solution requires an explanation of the negative sign in the context of the problem. In this case, Matthew's total deductions will be $600.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- You have no money and borrow $2 each day for three days. What is your total debt at the end of the third day? (8N7.2, 8N7.4)

- Explain your thinking with words or diagrams as you solve the following problem.

  Marcy has $16 and spends $3 per day. Johnny has $20 and spends $4 per day. Who will have more money or less debt at the end of 7 days? (8N7.1, 8N7.2, 8N7.4)

Performance

- **Game**: **"Operation Integers" (8N7.2, 8N7.6)**

  Players: 2 to 4

  Materials: A deck of cards (no face cards)

  Description:

  Deal all the cards face down on the table. Black suits are positive and red suits are negative. Each player turns over two cards and decides whether to add, subtract, multiply or divide the two numbers on the cards. The player who has the greatest result wins all the cards that are face up.

  Goal: The play continues until one person (the winner) has all the cards.

  Variations:

  - Use fewer cards or cards with only certain numbers.
  - Use fewer operations (limit to multiplication and division).
  - Turn over three or four cards instead of two cards for each player.
  - The player who has the least sum, difference, product or quotient wins all the cards that are face up.
  - Each player rolls two (or more) dice with integers on each face rather than using playing cards. The player with the greatest (or least) number resulting from the operations scores one point. The winner is the player with the most points.

Teachers may prefer to wait until division of integers is complete before using this activity with students.

Resources/Notes

Math Makes Sense 8

Lesson 2.2: Developing Rules to Multiply Integers

ProGuide: pp.10-15

SB; pp. 70-75

Strand: Number

Outcomes

Students will be expected to

8N7 Continued

Achievement Indicator:

8N7.5 *Model the process of dividing an integer by an integer using concrete materials or pictorial representations and record the process.*

Elaborations—Strategies for Learning and Teaching

A comparison of multiplication and division situations can be very useful in helping students understand division of integers. After multiplication has been fully developed, the fact that multiplication and division are inverse operations can be utilized. Students should be exposed to the connection between multiplication and division of integers, as well as division and grouping/sharing.

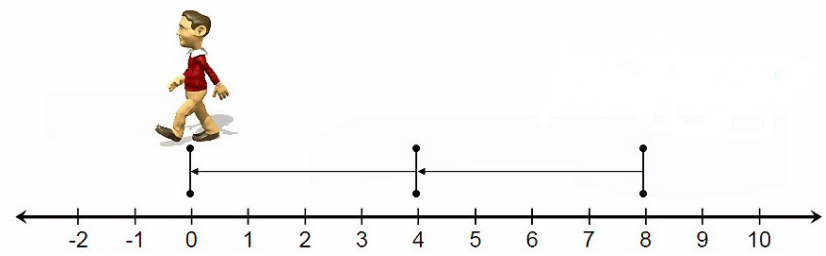
The use of the number line can be extended to model the division of integers. To make the connection, it may be beneficial to write a related multiplication statement.

For example,

Division Statement	Related Multiplication Statement
$(+8)\div(-4)=?$	$?\times(-4)=+8$

Refer back to the number line model used for multiplication where the first integer indicated the direction to face and how many steps to take and the second integer indicated the direction to move and the size of the steps. When dividing, the direction you end up facing determines the sign of the quotient.

Students must determine how many steps of -4 would bring them to $+8$.



The step size, -4, is negative; so walk backward. Starting at zero, take 2 steps to reach $+8$ and end up facing the negative direction.

$\therefore (+8)\div(-4)=-2$.

Continued

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Write a number sentence for each of the following problems and use a diagram to model each situation.
  (i) Chris and his three friends together owe $12. They agree to share the debt equally. What is each person's share of the debt?
  (ii) The temperature in Nain was falling 2°C each hour. How many hours did it take for the temperature to fall 10°C? (8N7.5)

- Present students with an empty jar and a collection of marbles or counters.
  (i) Have students put 10 red counters into the jar, using groups of 2 red counters. Have them sketch the diagram to illustrate the situation and then write a number sentence to represent the situation.
  (ii) Ask students to leave 6 red counters in the jar by removing groups of 3 yellow counters. Ask how many zero pairs would be needed in order to complete the task. Add enough zero pairs and then remove the groups. Have them sketch the diagram to illustrate the situation and then write a number sentence to represent the situation.
  (8N7.5)

Resources/Notes

Math Makes Sense 8

Lesson 2.3: Using Models to Divide Integers

ProGuide: pp. 17-22

CD-ROM: Master 2.20

SB: pp. 77-82

Practice and HW Book: pp. 34-36

Strand: Number

Outcomes

Students will be expected to

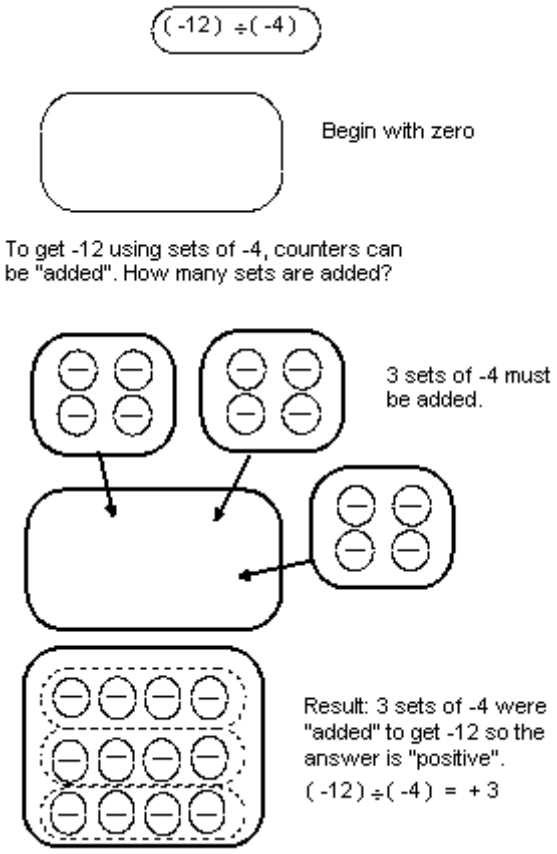
8N7 Continued

Achievement Indicator:

8N7.5 *Continued*

Elaborations—Strategies for Learning and Teaching

Integer counters can also be used when dividing integers. The following is one way to model $(-12)\div(-4)$.



Patterning is also useful in division. For example,

$9\div 3=3$	$-9\div(-3)=3$
$6\div 3=2$	$-6\div(-3)=2$
$3\div 3=1$	$-3\div(-3)=1$
$0\div 3=0$	$0\div(-3)=0$
$-3\div 3=?$	$3\div(-3)=?$
$-6\div 3=?$	$6\div(-3)=?$

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Portfolio

- Tyler modelled $(+18)\div(+6)$ by separating 18 positive chips into groups of 6. Dillan modelled the same division by separating 18 positive chips into 6 equal groups. Explain how they each determined the correct quotient. (8N7.5)

- Your teacher asks you to evaluate $(-2000)\div(-500)$. You only have 20 integer counters. Explain, with diagrams, how you would model this situation. (8N7.5)

- The sum of two integers is +15. Dividing the larger integer by the smaller integer gives a quotient of -4. What are the two integers? Explain your reasoning. (8N7.5, 8N7.6)

- Without evaluating the quotients, which one will have the least value? Explain your reasoning. (8N7.5, 8N7.6)

  $(-1428)\div(+84)$

  $(+1428)\div(+84)$

  $(-1428)\div(-84)$

Resources/Notes

Math Makes Sense 8

Lesson 2.3: Using Models to Divide Integers

ProGuide: pp. 17-22

CD-ROM: Master 2.20

SB: pp. 77-82

Practice and HW Book: pp. 34-36

Strand: Number

Outcomes

Students will be expected to

8N7 Continued

Achievement Indicators:

8N7.6 *Generalize and apply a rule for determining the sign of the quotient of integers.*

8N7.7 *Provide a context that requires dividing two integers.*

8N7.8 *Solve a given problem involving the division of integers (2-digit by 1-digit) without the use of technology.*

8N7.9 *Solve a given problem involving the division of integers (2-digit by 2-digit) with the use of technology.*

Elaborations—Strategies for Learning and Teaching

As with multiplication, the models that have been used would lead to the general "sign rules" for division of integers. This provides another opportunity to explore inverse operations. Comparison of multiplication and division can be useful in helping students understand division. For example, since $-2\times 3=-6$, it must be true that the product divided by either factor should equal the other factor. Therefore, $(-6)\div(-2)=3$ and $(-6)\div 3=-2$. Students should conclude that when two signs are the same, the quotient is positive, and when two signs are different, the quotient is negative.

Students should be provided with the opportunity to apply these rules in a variety of problem solving situations. The use of appropriate terminology, such as dividend, divisor and quotient, is important. Students should be exposed to different forms of division notation. For example, a division statement can be written as $(-6)\div(-3)$, $-3\sqrt{-6}$ or $\frac{-6}{-3}$. To solve 2-digit by 1-digit division problems students can apply the long division algorithm used in elementary grades, and then apply the "sign rules" appropriately.

The division of integers can occur in many contexts. One example is provided here.

The diving depths in feet of 7 scuba divers studying schools of fish were $-12,-9,-15,-8,-20,-17,\text{and}-10$. *What is the mean diving depth?*

$$\frac{(-12)+(-9)+(-15)+(-8)+(-20)+(-17)+(-10)}{7}=\frac{-91}{7}=-13$$

The mean diving depth is 13 *feet* below the surface of the water.

Questions such as this one provide an opportunity for discussion to ensure students understand the meaning of the negative quotient.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Find the quotients.

  (i) $9 \div (+3)$

  (ii) $(+14) \div (-7)$

  (iii) $\frac{-16}{2}$

  (iv) $\frac{-42}{-7}$

  (v) $\frac{90}{-15}$

  (8N7.6)

- Complete each division statement.

  (i) $(-44) \div \square = (+11)$

  (ii) $\square \div (-2) = (-8)$

  (8N7.6)

- Complete each statement in as many ways as possible using integers.

  (i) $+18 \div \square = \square$

  (ii) $-24 \div \square = \square$

  (8N7.6)

- If 14 times an integer is -84, what is the integer? (8N7.6)

- A football team was penalized 30 points in 3 plays. Suppose the team was penalized an equal number of yards on each play. Write a division statement using integers and solve it to find the number of yards in each penalty. (8N7.7, 8N7.8)

- Anna and Sarah ran 5 laps of a race. When Anna finished, Sara was 15 meters behind her. Suppose Sara fell behind the same number of meters during each lap. Write a division statement using integers, and solve it to determine how far Sara fell behind in each lap.

  (8N7.7, 8N7.8)

Game

- "Operation Integers"

  The description can be found on page 69

  (8N7.2, 8N7.6)

Resources/Notes

Math Makes Sense 8

Lesson 2.4: Developing Rules to Divide Integers

ProGuide: pp. 24-29

CD-ROM: Master 2.21

SB: pp. 84-89

Practice and HW Book: pp. 37-38

Strand: Number

Outcomes

Students will be expected to

8N7 Continued

Achievement Indicator:

8N7.10 *Identify the operation required to solve a given problem involving integers.*

Elaborations—Strategies for Learning and Teaching

Students should be able to identify the operations necessary to solve problems involving data such as, but not limited to, temperature, height above and below sea level, net worth, and score keeping games. Prior to actually solving problems, students should be given the opportunity to identify the operation required to solve a problem. The focus here is not on solving the problems, but using key words, or ideas, to identify which operation would be used. Key words include, but are not limited to, those shown in the table.

Addition	*Subtraction*	*Multiplication*	*Division*
increase	decrease	double	share
more	less	triple	group
sum	difference	product	quotient

This list could be generated by exposing students to a variety of word problems and identifying the operations necessary to solve them.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Presentation/Portfolio

- Explain why the quotient of two negative integers has to be greater than their sum. (8N7.6)

- Without doing any calculations, Chantal said that the quotients $(-468)\div(-26)$ and $(+468)\div(+26)$ must be the same. How did she know? (8N7.6)

Journal

- Michael said, "When I divide +12 by +4, +3, +2, or +1, the quotient is less than or equal to +12. If I divide -12 by +4, +3, +2, or +1, I think the quotient should be less than or equal to -12." Do you agree with him? Explain. (8N7.6, 8N7.8)

Performance

- Provide students with sample word problems. These word samples can be written on individual slips of paper, or using an overhead. In groups, or individually, have students identify which operation they would use and explain how they know. Have them record a list of the key words or phrases that helped them identify the operation. Compile a master list by having them share the individual or group lists. (8N7.10)

Paper and Pencil

- Write the integer sentence that can be used to solve the following problems:

  (i) An oil rig is drilling a well at 2 m per minute. How deep is the well after the first 8 minutes?

  (ii) The temperature decreased 16°C over a 4 hour period. Assuming that the temperature decreased at a constant rate, how much did the temperature decrease each hour? (8N7.10)

Resources/Notes

Math Makes Sense 8

Lesson 2.5: Order of Operations with Integers

ProGuide: pp. 30-35

SB: pp. 90-93

Strand: Number

Outcomes

Students will be expected to

8N7 Continued

Achievement Indicator:

8N7.11 *Solve a given problem involving integers taking into consideration order of operations.*

Elaborations—Strategies for Learning and Teaching

Students will have already used the order of operations, excluding exponents, but limited to whole numbers and decimals. This will now be extended to calculations with integers. It is important to note that work with exponents is not a specific outcome until grade 9. For this unit of work, students will complete calculations based on the following order of operations:

- Brackets
- Division/Multiplication (in the order they appear)
- Addition/Subtraction (in the order they appear)

Rules for order of operations are necessary in order to maintain consistency of results. It is important to provide students with situations in which they can recognize the need for the order of operations.

Technology is useful for situations involving more than 1-digit divisors or 2-digit multipliers. Students should understand how to use the key on the calculator and how negatives are dealt with differently on certain calculators. Specific instruction should be given on calculator use with regard to the order of operations. Students should recognize the necessity of preparing problems for calculator entry. They should also be aware that different calculators process the order of operations in different ways. Some calculators are programmed to address the order of operations automatically, and others are not.

The appropriate use of brackets should be discussed.

- Brackets can be used to show integers as positive or negative such as (-3) or (+4). These brackets require no operation.
- There is a need for brackets around (-4) in the expression -5 – (-4), however brackets are not necessary for (-5).
- For positive integers the positive sign is often “understood”. For example, 4 is understood to be the same as (+4), so brackets are not necessary in this case.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Calculate.

  (i) $(-4)-(+8)\times(-2)-(+15)$

  (ii) $(+3)\times\left[(+14)+(-18)\right]-(+8)\div(-4)$

  (iii) $\dfrac{[6+(-38)]\div 4(-2)}{(-2+4)(5-6)}$ (8N7.11)

- Using brackets, group the terms in the expression $40\times 6-3\times 4-5$ to get the least possible result. (8N7.11)

- Identify the missing operation sign in each equation.

  (i) 36 ☐ (4 ☐ 1) ☐ 2 = 24

  (ii) -12 ☐ 4 ☐ (-3) = -24

  (8N7.11)

- The formula for converting temperatures from Fahrenheit (F) to Celsius (C) is $C=(F-32)\times 5\div 9$. Use the formula to convert -49°F to degrees Celsius. (8N7.11)

- The daily low temperatures in La Scie for 5 days for November were -4°C, +1°C, -2°C, +1°C and -6°C. What is the mean of these temperatures? (8N7.11)

Portfolio

- There are errors in this solution.

$$\begin{aligned}&3\times(-8)\div(-2-4)\\&=-24\div(-2-4)\\&=12-4\\&=8\end{aligned}$$

  Find the errors and make the necessary corrections. (8N7.11)

Journal

- To win a free trip, you must answer the following skill-testing question correctly: $-3\times -4+(-18)\div 6-(-5)$.

  The contest organizers say that the answer is +4. Write a letter to the organizers explaining why there is a problem with their solution.

  (8N7.11)

Resources/Notes

Math Makes Sense 8

Lesson 2.5: Order of Operations with Integers

Understanding the Problem: pp. 94-95

ProGuide: pp. 30-35

CD-ROM: Master 2.22

SB: pp. 90-93

Practice and HW Book: pp. 39-40