Scheme of Work

Week		TB	WB	Guide
1	**Chapter 1 Whole Numbers**			1–6
	Chapter Opener	1		7
	1 Numbers to One Billion	2–5	1–4	8–9
	2 Multiplying by 10, 100, and 1,000	6–9	5–7	10
	3 Dividing by 10, 100, and 1,000	10–13	8–10	11
	4 Multiplying by Tens, Hundreds, and Thousands	14–17	11–13	12
	5 Dividing by Tens, Hundreds, and Thousands	18–21	14–16	13
2	6 Practice	22	17–18	14
	Workbook Chapter 1 Answers			15–18
	Dimensions Math® Tests 5A, Chapter 1, pp. 1–12			
	Chapter 2 Writing and Evaluating Expressions			19–29
	Chapter Opener	23		30
	1 Expressions with Parentheses	24–27	19–21	31
	2 Order of Operations — Part 1	28–31	22–24	32
3	3 Order of Operations — Part 2	32–33	25–27	33
	4 Other Ways to Write and Evaluate Expressions	34–37	28–30	34–35
	5 Word Problems — Part 1	38–40	31–35	36–38
4	6 Word Problems — Part 2	41–43	36–40	39–40
	7 Practice	44–46	41–44	41–43
	Workbook Chapter 2 Answers			44–52
	Dimensions Math® Tests 5A, Chapter 2, pp. 13–24			

Materials

Materials

Optional

- Graph paper (to help with drawing neater bar models)
- Playing cards

Printouts

(singaporemath.com/higprintouts)

- Number Cards 1–12
- Shaded Dots

Mental Math

(singaporemath.com/higprintouts)

Mental Math		After Lesson
12	Subtract from 100, 1,000, or 10,000	Review
13	Subtract from 100, 1,000, or 10,000	Review
14	Subtract from hundreds, thousands, or ten thousands	Review
15	Subtract from hundreds, thousands, or ten thousands	Review
16	Various strategies	4

Notes

Order of Operations

Up until now, expressions that involve both addition or subtraction as well as multiplication and division have been presented in a way such that the answer is correct when the expression is evaluated by calculating from left to right. For example, they have seen equations such as $8 \times 6 = 8 \times 5 + 8$, and know that they should multiply 8 by 5 first.

In this chapter students will learn to apply "order of operation" rules to evaluate expressions with more than one operation (addition, subtraction, multiplication, or division). Students will learn that even if the above expression were written as $8 + 8 \times 5$, we still multiply 8 by 5 first. They will learn to use parentheses to change order of operations. $(8 + 8) \times 5$ indicates that 8 and 8 should be added first.

By convention, to solve an expression with multiple operations, we first multiply or divide from left to right, then add or subtract from left to right. Multiplication and division take precedence over addition and subtraction. In the following example, the underlining indicates which operation should be performed at each step.

$$
\begin{aligned}
& 10 - \underline{4 \div 2} \times 5 + 3 \\
= \; & 10 - \underline{2 \times 5} + 3 \\
= \; & \underline{10 - 10} + 3 \\
= \; & 0 + 3 \\
= \; & 3
\end{aligned}
$$

If an expression includes parentheses, we evaluate the expression within the parentheses first, following order of operations.

$$
\begin{aligned}
& 23 - (8 + \underline{2 \times 5}) \div 6 \\
= \; & 23 - (\underline{8 + 10}) \div 6 \\
= \; & 23 - \underline{18 \div 6} \\
= \; & 23 - 3 \\
= \; & 20
\end{aligned}
$$

The calculations for steps that do not affect each other can be recorded in one step and still follow order of operations. For example:

$$
\begin{aligned}
& 10 - \underline{4 \div 2} + \underline{6 \times 5} \\
= \; & \underline{10 - 2} + 30 \\
= \; & 8 + 30 \\
= \; & 38
\end{aligned}
$$

When students learn about exponents in Grade 6, they will learn that they need to evaluate the exponents before multiplying or dividing the rest of the expression.

Many elementary math school textbooks and websites offer a mnemonic to help students remember the order of operations, such as PEMDAS ("Please Excuse My Dear Aunt Sally" for Parentheses, Exponents, Multiplication, Division, Addition, Subtraction). Do not teach your student this type of mnemonic. The problem with this is that later, even as adults, they may remember the acronym, and not the lesson (or they may have been taught an incorrect order of operations by a teacher relying on this mnemonic) and think that multiplication must be done before division and addition before subtraction.

The rules for order of operations apply if there are mixed operations in an expression. Students already know that if an expression has only addition or only multiplication, they do not have to solve it left to right (addition and multiplication can be done in any order). For example, in both of the examples below, students can see ways to make 100 or a multiple of ten in order to simplify calculations.

$$\begin{aligned} & 35 + 32 + 31 + 68 + 29 \\ = {} & 100 + 60 + 35 \\ = {} & 195 \end{aligned}$$

$$\begin{aligned} & 25 \times 36 \times 4 \\ = {} & 36 \times 100 \\ = {} & 3{,}600 \end{aligned}$$

Students should also know by now that if an expression has only subtraction or only division, they can subtract or divide in any order, as long as they subtract from the whole each time or divide the whole. For example, they know that if they see the expression $12 - 4 - 2$ they could subtract 2 from 12 first (but not from 4). They should also know from the previous chapter that they could solve $24{,}000 \div 6$ by dividing 24,000 by 1,000 or by 6 first, regardless of how the expression is written.

$$\begin{aligned} & 12 - 4 - 2 = 12 - 2 - 4 \\ \text{not } & 12 - \underline{4 - 2} = 12 - 2 \end{aligned}$$

$$\begin{aligned} & 25{,}000 \div 1{,}000 \div 5 \\ & = 25{,}000 \div 5 \div 1{,}000 \\ \text{not } & 25{,}000 \div \underline{1{,}000 \div 5} \\ & = 25{,}000 \div 200 \end{aligned}$$

Some students will intuitively understand when they can change the order from a strict left to right calculation, even when the expression has both addition and subtraction or both multiplication and division, and do so to facilitate mental calculation. For example, for $80 + 52 - 2$ we could subtract 2 from 52 first. (Because we are adding 52, it is part of the whole.) But for $100 - 15 + 20$ we can't add 20 to 15 first and then subtract 35 from 100. This gives an incorrect answer since we are subtracting more than we should. We can subtract 15 from 20 first and then add 5 to 100. If students do not have sufficient understanding of concepts, though, they should follow a left-to-right order in the calculations.

In later grades, students will learn to add negative numbers. To subtract we can add the opposite: $50 - 42 + 2 = 50 + (-42) + 2$. The addition can then be done in any order ($-42 + 2 = -40$). Later in this grade, students will learn both how to multiply by a fraction and that we can divide by multiplying by the inverse (e.g., $5 \times 10 \div 2 = 5 \times 10 \times \frac{1}{2}$). The multiplication can then be done in any order. (The conventions for order of operation are consistent with the way algebraic expressions are written, which often do not use multiplication or division symbols or parentheses. For example: $\frac{a}{ab - b^2} + \frac{b}{ab - a^2}$.)

The Distributive Property

According to the distributive property of multiplication, to multiply a number with the sum of two or more addends, we can multiply each addend separately by the number and then add. This is also true for subtraction. For example:

$$8 \times (6 + 4) = (8 \times 6) + (8 \times 4)$$
$$8 \times (6 - 4) = (8 \times 6) - (8 \times 4)$$

(Although parentheses are not needed for the right-hand expressions when following order of operations, using them helps with visualizing what operation is done first.)

Students have seen many examples of the distributive property already. For example, both the multiplication algorithm and many mental math strategies utilize this property, as do the two different methods for finding the perimeter of a rectangle. In earlier levels of this curriculum, they used number bonds to show the thought process. For example:

34 × 5 = 150 + 20 = 170
/ \\
30 4

Number bond diagrams, though, can't be easily used to illustrate situations involving subtraction, such as solving 49 × 4 by multiplying 50 by 4 and subtracting 4. In this chapter, students will be able to express this idea with equations and will apply the property to additional mental math strategies.

Bar Models

In this chapter, students will review the use of bar models as a tool for solving word problems and apply this tool to some complex word problems.

In Dimensions Math® 2, students learned to interpret bar models for simple one-step word problems. In Dimensions Math® 3 they learned to draw their own bar models for one-step and simple two-step word problems. In Dimensions Math® 4 they reviewed the use of bar models and used them to help them solve multi-step word problems.

Bar models are a way of representing an algebraic type of solution without the use of algebraic equations. Drawing bar models can lead to more creative solutions than an algebraic approach.

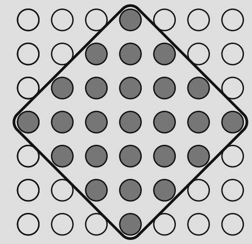
There are two basic types of bar models for addition and subtraction and for multiplication and division. These are illustrated on the next page.

Chapter Opener (p. 23)

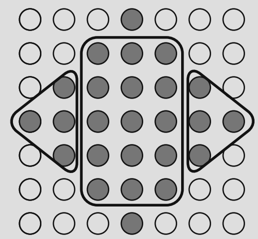
Show your student the **Shaded Dots** printout and have them tell you quickly (by not counting every single dot) how many unshaded dots there are. Ask them how they found their answer. They may have multiplied 4 by 6. Then ask them to tell you quickly how many shaded dots there are. Ask them how they found the answer. Presumably it will have more calculation steps than simply multiplying two numbers together. Do not ask them to write expressions.

Now have them look at the Chapter Opener, which shows two methods, one used by Dion and one by Mei. They can compare those methods to their own.

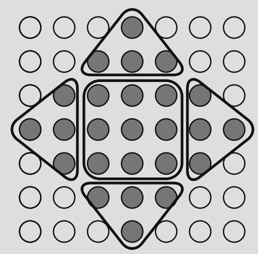
For future reference, Dion's method could be expressed as $2 \times 9 + 7$ and Mei's method as $4 \times 4 + 3 \times 3$. Other possible methods are shown here, along with equations, for when you return to this in Lesson 2.



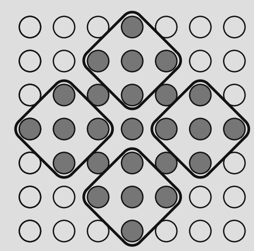
$7 \times 7 - 4 \times 6$



$3 \times 5 + 2 \times 3 - 2$



$3 \times 3 + 4 \times 3$



$4 \times 5 + 5$

Lesson 1 Expressions with Parentheses (pp. 24–27)

Think (p. 24)

Ask your student to find two ways to solve the problem in Think, one involving addition and one involving only subtraction, and to write the expressions. They should be writing two separate expressions for each of the two methods; do not have them combine them into one expression yet. They could add the amount for tickets and the bus rental and subtract that sum from the total, or subtract the tickets from the total and then subtract the bus tickets from that answer (or subtract the bus rental first). Then have them read Alex's statement.

Learn (p. 25)

This shows two methods and then shows both steps combined in a single expression. Emma explains how parentheses can be used to indicate which step should be calculated first. Up until now, students have learned to calculate left to right, and have already seen some expressions such as the multi-step expression in Method 1. They generally have not seen many expressions with parentheses.

Have your student solve Sofia's expression (700) and answer her question.

Point out that using parentheses allows us to write the steps for the second method in one expression. This is simply an easy way to show how a problem could be solved; finding the answer still involves two separate calculation steps.

Answers

$400

1. (a) 50
   52
   (b) 52
   48

2. (a) 28
   33
   (b) 7
   8

3. (a) 30 (b) 350
   (c) 990

4. (a) 630
   (b) 10
   (c) 125

5. $100 - (25 + 18) = 100 - 43 = 57$

6. $240 \div (33 + 7) = 240 \div 40 = 6$

Do (pp. 26–27)

2. In this lesson, the expressions without parentheses are all written so that students do follow order of operation when calculating from left to right.

5. 6. Point out that the use of multi-step expressions is simply to not have to give each step separately when showing the calculations needed to solve the problem. We still need to find the answers in more than one calculation step.

Lesson 2 Order of Operations — Part 1 (pp. 28–31)

Think (p. 28)

The poster shows the stars in a similar but simpler arrangement than the dots in the Chapter Opener. Make sure your student understands Emma's method, and then have them write a multi-step expression that shows all the steps in her solution.

Learn (p. 29)

Tell your student that calculating multiplication or division before addition or subtraction, when there are not parentheses to show which calculation to do first, is simply an agreed upon convention.

Point out that Sophia could just as easily have written 3 × 3 + 4. Writing it the way she did simply went along with the order in which she thought of a way to find the answer, that is, she may have written 4 down first for the 4 stars on the edges. You can have your student find a different method than the two already shown and write a multi-step expression.

Do (pp. 30–31)

❷ The sequence of problems in (a) through (d) is meant to emphasize that addition does not have precedence over subtraction, nor does multiplication have precedence over division, which are common misconceptions. The problems in (e) through (f) emphasize that multiplication and division do have precedence over addition and subtraction.

Answers

❶ (a) 150
148
(b) 50
52
(c) 50
25
(d) 2
4
(e) 100
0
(f) 25
125
(g) 40
16
28

❷ (a) $40 + \underline{3 \times 7}$
$= 40 + 21$
$= \mathbf{61}$

(b) $50 + \underline{20 \div 4}$
$= 50 + 5$
$= \mathbf{55}$

(c) $\underline{3 \times 50} + \underline{4 \times 30}$
$= 150 + 120$
$= \mathbf{270}$

(d) $\underline{60 \div 5} - \underline{15 \div 5}$
$= 12 - 3$
$= \mathbf{9}$

(e) $\underline{96 \div 8} - \underline{6 \times 2}$
$= 12 - 12$
$= \mathbf{0}$

(f) $22 + \underline{8 \div 2} - 2$
$= 22 + 4 - 2$
$= \mathbf{24}$

❸ Answers will vary.

❸ You may want to ask your student to find more than one method. See page 28 in this guide for some possible solutions.

Chapter 2 Workbook Answers

Exercise 1 pp. 19–21

1 = 500 ÷ (**75** + **25**)
= 500 ÷ **100**
= **5**

2 (a) 680
930

(b) 370
430

(c) 80
400

(d) 20
16

3 (a) 400 − 53 − 27
= 347 − 27
= **320**

(b) 400 − (53 − 27)
= 400 − 26
= **374**

(c) 81 ÷ 9 ÷ 3
= 9 ÷ 3
= **3**

(d) 81 ÷ (9 ÷ 3)
= 81 ÷ 3
= **27**

(e) 180 ÷ (2 × 3)
= 180 ÷ 6
= **30**

(f) 4 × (60 − 22)
= 4 × 38
= **152**

(g) 10,000 ÷ (48 ÷ 6)
= 10,000 ÷ 8
= **1,250**

(h) 640,000 ÷ (7,000 − 3,000)
= 640,000 ÷ 4,000
= **160**

4 200 − (3 × 35) = 95

5 Possible solutions:
(a) 9 × 3 ÷ 3 = 9
(b) 9 ÷ 3 − 3 = 0
(c) 9 × (3 − 3) = 9
(d) 3 × (9 ÷ 3) = 9
(e) 9 − 3 − 3 = 3
(f) 9 ÷ (3 × 3) = 1
(g) 9 + (3 − 3) = 9
(h) 3 − 3 + 9 = 9

Exercise 2 pp. 22–24

1 = 250 + 225
= 475

2 (a) = 15 + **250**
= 265

(b) = 8 − 2
= 6

(c) = 54 − **40** + 10
= **14** + 10
= 24

(d) = 75 − **60** + **45**
= 15 + 45
= 60

3 (a) 64 − $\underline{3 \times 9}$
= 64 − 27
= **37**

(b) 200 − $\underline{125 \div 25}$
= 200 − 5
= **195**

Students have not formally learned to divide by a two-digit number using the division algorithm, but should by now have enough mathematical understanding to find 125 ÷ 25. They should know there are four 25s in 100 (25 × 4 = 100). They might know this by thinking in terms of how many quarters are in $1.25.

Chapter 2 Workbook Answers

(c) $200 + \underline{25 \times 4}$
$= 200 + 100$
$= \mathbf{300}$

(d) $\underline{75 \div 5} - \underline{4 \times 3}$
$= 15 - 12$
$= \mathbf{3}$

(e) $30 + \underline{24 \div 4} - 2$
$= 30 + 6 - 2$
$= \mathbf{34}$

(f) $88 + \underline{18 \div 3} - \underline{4 \times 6}$
$= 88 + 6 - 24$
$= \mathbf{70}$

(g) $10 + \underline{12 \times 8} - \underline{108 \div 9} + 6$
$= 10 + 96 - 12 + 6$
$= \mathbf{100}$

(h) $5{,}000 - \underline{360{,}000 \div 400} + 12{,}000$
$= 5{,}000 - 900 + 12{,}000$
$= \mathbf{16{,}100}$

4 $45 \times 6 + 82 \times 8 = 270 + 656 = 926$

5 (a) Possible solution:
$5 \times 5 \times 5 - 5 \times 5 = 100$
(b) $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 \times 9 = 100$

Exercise 3 pp. 25–27

1 (a) 5
30
2
75
77

(b) 5
100
10
1,000
500

(c) 90
2
8
30
240

(d) 5
10
50
25
80

2 (a) $\underline{80 \div 8} \times 2 - \underline{6 \div 2}$
$= \underline{10 \times 2} - 3$
$= 20 - 3$
$= \mathbf{17}$

(b) $80 \div (\underline{8 \times 2} - 6) \div 2$
$= 80 \div (16 - 6) \div 2$
$= 80 \div 10 \div 2$
$= \mathbf{4}$

(c) $25 + \underline{25 \div 5} \times 5 \div 25 - 5$
$= 25 + \underline{5 \times 5} \div 25 - 5$
$= 25 + \underline{25 \div 25} - 5$
$= 25 + 1 - 5$
$= \mathbf{21}$

(d) $\underline{4 \times 4} \times (4 + \underline{4 \div 4}) \div 4 - \underline{4 \times 4} + 4$
$= 16 \times (4 + 1) \div 4 - 16 + 4$
$= \underline{16 \times 5} \div 4 - 16 + 4$
$= \underline{80 \div 4} - 16 + 4$
$= 20 - 16 + 4$
$= \mathbf{8}$

(e) $9{,}000 \div (\underline{1{,}800 \div 30} \times 20 \div 4)$
$= 9{,}000 \div (\underline{60 \times 20} \div 4)$
$= 9{,}000 \div (1{,}200 \div 4)$
$= 9{,}000 \div 300$
$= \mathbf{30}$

3 $(1{,}000 - 250) \div (35 + 15)$
$= 750 \div 50$
$= 15$

4 (a) $12 - 8 \div 4 \times 3 = 6$

(b) $12 \div (8 + 4) + 4 = 5$

(c) $(12 - 8 - 4) \times 4 = 0$

(d) $12 \div (8 \div 4 \times 2) = 3$

Lesson 5 Divide a 2-Digit Number by a 2-Digit Number (pp. 60–62)

Think (p. 60)

Have your student read the problem, write an expression, and find the answer. You can give them place-value discs so that they can group the tens and ones.

Learn (p. 60)

To estimate the quotient to see what might work, we need to round both the dividend and the divisor. Dion rounded 21 to 20, and then rounded 86 to 80, since 8 is a multiple of 2. Then we try our estimated quotient to see if it works. 21 × 4 = 84, and if we subtract 84 from 86, the remainder (2) is less than the divisor (21), so 4 works as the quotient.

Do (pp. 61–62)

1. Emma rounded 31 to 30 and then 98 to 90 to get an estimated quotient of 3. This worked since 31 × 3 = 93, and 98 − 93 is less than 31.

2. Sofia rounded 16 to 20 and then 81 to 80 (since 8 is a multiple of 2) to get an estimated quotient of 4. However, in this case, 16 × 4 is 64, and the remainder is greater than 16. So then she tried 5 (one more than 4) for the quotient. Students should generally start by rounding the divisor to the nearest ten, then the dividend to a multiple of the divisor, to get the first quotient to try. They may have to adjust the quotient up or down.

   You can point out, if you want, that if we then try 5 as the quotient, the remainder will be 16 less than the remainder for 4, so we don't really have to then multiply 5 by 16 to get the remainder. We can just subtract 16 from the remainder we got when we tried 4 as the quotient.

Answers

86
4 bags, **2** apples left over

1.
$$\begin{array}{r} \mathbf{4} \\ 31\overline{)98} \\ \underline{\mathbf{93}} \\ \mathbf{5} \end{array}$$

2.
$$\begin{array}{r} \mathbf{5} \\ 16\overline{)81} \\ \underline{\mathbf{80}} \\ \mathbf{1} \end{array}$$

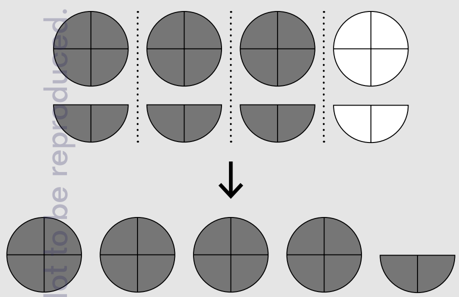
3. (a) 3
   (b) 7
   (c) 5
   (d) 2 R 3
   (e) 4 R 2
   (f) 7 R 4
   (g) 2 R 9
   (h) 3 R 4
   (i) 5 R 15
   (j) 3 R 17

4. **7 horses**
   91 ÷ 13 = 7

5. (a) **5 bags**
   86 ÷ 15 is 5 R 11
   (b) **4 more hay cubes**
   15 − 11 = 4

We can follow the same reasoning used for finding a fraction of a set when the answer is a whole number in order to find the fraction of a set when the answer is a fraction or mixed number.

For example: “There are 6 pizzas. $\frac{3}{4}$ of the pizzas were eaten. How many pizzas were eaten?”



$\frac{1}{4}$ of 6 $\longrightarrow \frac{6}{4}$

$\frac{3}{4}$ of 6 $\longrightarrow 3 \times \frac{6}{4} = \frac{18}{4} = \frac{9}{2} = 4\frac{1}{2}$

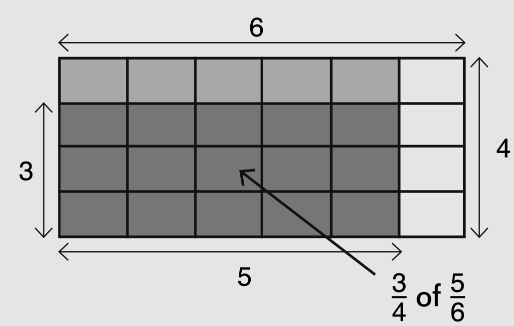
Or:

$3 \times \frac{6}{4} = \frac{3 \times \cancel{6}^{3}}{\cancel{4}_{2}} = \frac{9}{2} = 4\frac{1}{2}$

In the first method, we could simplify the value for $\frac{1}{4}$ of 6 as $\frac{3}{2}$ before multiplying by 3, but it is not necessary to express it as a mixed number. The picture shows all the wholes divided into fourths, which helps students understand that 3 times 6 fourths, or 18 fourths, of the pizzas were eaten.

Multiplying a Fraction by a Fraction

Being able to interpret multiplication of a whole number by a fraction, i.e., finding a fraction of a set, where the set is the quantity in the whole number, will help students understand the process for multiplying a fraction by a fraction. They still need to find a fraction of a set, but this time the “set” is a fraction. This is a lot easier than trying to figure out how to do repeated addition of a fraction a fractional number of times. Multiplication of a fraction by a fraction is usually illustrated with a rectangle, which makes it easy to count rows and columns and relate that to the calculation process. This is sometimes called an area model. For example, we can interpret $\frac{3}{4} \times \frac{5}{6}$ as $\frac{3}{4}$ of $\frac{5}{6}$. To illustrate this pictorially, divide a rectangle into sixths either horizontally or vertically, and then into fourths in the other direction. Since each sixth is divided into fourths, there are a total of 4 × 6 = 24 parts. $\frac{5}{6}$ is 20 of those parts. If we shade $\frac{3}{4}$ of the 20 parts, we can easily see that we shade 3 × 5 = 15 parts.



$\frac{3}{4} \times \frac{5}{6} = \frac{3 \times 5}{4 \times 6} = \frac{15}{24} = \frac{5}{8}$

What we are really doing is creating an equivalent fraction for $\frac{5}{6}$ with a numerator (number of parts) that is a multiple of 4. We can find $\frac{1}{4}$ of those 20 parts and then multiply that by 3. $\frac{1}{4}$ of 20 twenty fourths is 5 twenty-fourths. 3 × 5 twenty-fourths is 15 twenty-fourths.

$$\frac{3}{4} \times \frac{5}{6} = 3 \times \left(\frac{1}{4} \times \frac{20}{24}\right) = 3 \times \frac{5}{24} = \frac{15}{24} = \frac{5}{8}$$

However, the end result is the same as when we multiply the numerators and the denominators, which is well-illustrated with the model.

In this example, the product was simplified after multiplying. Since simplifying a fraction involves dividing the numerator and denominator by common factors, we can simplify before multiplying. The process can be recorded by crossing out factors in the numerator and denominator of the fractions being multiplied together and writing the quotient next to the crossed out number, similar to what we could do when multiplying a whole number by a fraction. Since we know that multiplying fractions involves multiplying the numerators and denominators together, the common factor we divide the numerator and denominator by in simplifying the fraction does not have to come from the same fraction. Therefore, the process can be recorded immediately, as in the second example below. Encourage your student to always write the quotient, even if it is 1, to help them remember they are not simply "throwing away" numbers.

$$\frac{3}{4} \times \frac{5}{6} = \frac{\overset{1}{\cancel{3}} \times 5}{4 \times \underset{2}{\cancel{6}}} = \frac{5}{8}$$

Or:

$$\frac{\overset{1}{\cancel{3}}}{4} \times \frac{5}{\underset{2}{\cancel{6}}} = \frac{5}{8}$$

Students will multiply improper fractions, or mixed numbers. The easiest method for multiplying mixed numbers is to convert them to improper fractions, and then simplify as much as possible before multiplying. For example:

$$2\frac{2}{3} \times 4\frac{1}{5} = \frac{8}{\underset{1}{\cancel{3}}} \times \frac{\overset{7}{\cancel{21}}}{5}) = \frac{56}{5} = 11\frac{1}{5}$$

Although the numbers can be split into a whole number part and a fraction part and the distributive property applied twice, that is unnecessarily complicated at this level. However, it can make sense when using mental math to apply the distributive property once when multiplying a whole number by a mixed number. For example:

$$\begin{aligned} 12 \times 4\tfrac{1}{4} &= (12 \times 4) + (12 \times \tfrac{1}{4}) \\ &= 48 + 3 \\ &= 51 \end{aligned}$$

Lesson 5 Multiplying a Fraction by a Unit Fraction (pp. 126–128)

Think (p. 126)

Have your student follow these directions to find $\frac{1}{2}$ of $\frac{1}{4}$ (without seeing Learn.) You could give the directions out loud. To find the answer, they should notice that there are now 8 equal parts, and one of them gets shaded with both colors. That part is $\frac{1}{2}$ of $\frac{1}{4}$.

Learn (p. 126)

Students should notice that folding the paper created 2 columns and 4 rows of parts, which is the same as the denominators of the two fractions. The total number of parts is 2 × 4. So to multiply $\frac{1}{2}$ by $\frac{1}{4}$, we multiply the denominators to get the denominator for the product. The equation above the number line indicates that we multiply the numerators to get the numerator of the product, which will become more apparent in Do. The number line shows another way to visualize the answer.

Do (pp. 127–128)

1. The product is the same even when we multiply in a different order. One third of a group of one fourth is the same fraction as one fourth of a group of one third.

2. 1 column of 3 rows, or 1 × 3 parts, is shaded darker to represent $\frac{1}{3}$ of $\frac{3}{4}$. We multiply the numerators of the fractions to get the numerator of the products. There are a total of 3 columns of 4 rows, or 3 × 4 parts. We multiply the denominators to get the total number of parts. When using rectangles to illustrate multiplication of fractions, there is no rule for which fraction is represented by horizontal lines and which by vertical lines, which is the point of Mei's comment. The product is still 3 out of 12 equal parts.

3. This problem illustrates the calculation with bar models. To find $\frac{1}{2}$ of $\frac{1}{3}$ or of $\frac{2}{3}$, we first divide the bar into three equal units, and then each of those units into 2 smaller units. The total number of equal units is 2 × 3.

4. This problem shows a number line to verify the calculations. To divide three fifths into 6 equal parts, we need to divide each of the fifths into half. There will then be 10 equal intervals between 0 and 1, so one of those is $\frac{1}{10}$.

Answers

1. (a) $= \mathbf{\frac{1}{12}}$ (b) $= \mathbf{\frac{1}{12}}$

2. $= \frac{\mathbf{3}}{12}$
   $= \mathbf{\frac{1}{4}}$

3. (a) $= \mathbf{\frac{1}{6}}$
   (b) $= \frac{\mathbf{2}}{6} = \frac{\mathbf{1}}{3}$

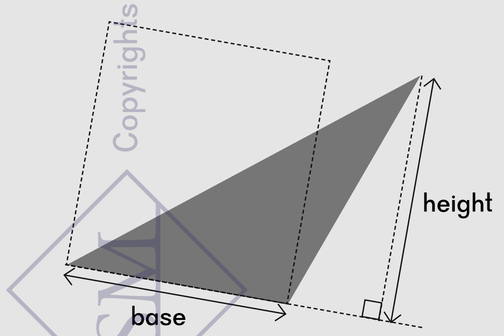
4. $= \frac{\mathbf{3}}{30} = \mathbf{\frac{1}{10}}$; $\frac{1}{10}$ L

5. (a) $\frac{1}{10}$ (b) $\frac{2}{5}$ (c) $\frac{1}{18}$
   (d) $\frac{1}{9}$ (e) $\frac{1}{30}$ (f) $\frac{3}{10}$
   (g) $\frac{1}{7}$ (h) $\frac{1}{8}$ (i) $\frac{5}{36}$

Area of a Triangle

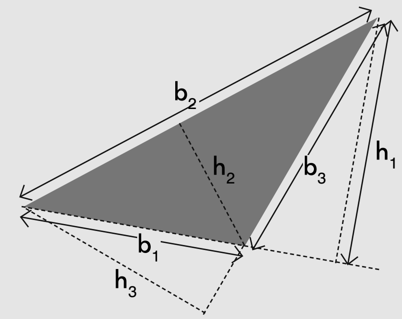
In this chapter, students will use their understanding of the area of a rectangle, their experience finding the area of rectilinear figures, and their understanding of the distributive property of multiplication to find the area of all three types of triangles (right, acute, and obtuse). They will understand how to find the "height" of a triangle relative to any of the sides of the triangle (the "base") and derive a formula for the area of a triangle: $\frac{1}{2}$ × base × height. They will see that the same formula applies to all triangles, and that they can use the formula whichever side of the triangle is considered the base.

The area of a triangle is the same as half the area of a corresponding rectangle with one side the same length as one side of the triangle, and the adjacent side the same length as the perpendicular distance from the base to the opposite vertex.



Area of the shaded triangle:
$\frac{1}{2}$ × base × height

It does not matter which side is the base.



Area of the shaded triangle:
$\frac{1}{2} \times b_1 \times h_1 = \frac{1}{2} \times b_2 \times h_2 = \frac{1}{2} \times b_3 \times h_3$

Students will not, however, need to measure any sides in this chapter. They will either be given a base and height or be able to calculate them from given measurements. Or, the triangles will be drawn on a square grid where all the each vertex of the triangle is on an intersection of the grid, such that if they need to find a base, one side of the triangle will lie along a line on the grid.

Students will then find the area of figures composed of triangles and rectangles, and solve other problems involving the area of triangles.

Lesson 4 Area of a Triangle — Part 1 (pp. 178–183)

Think (p. 178)

Before looking at the textbook, give your student the first page of the **Lesson 7-4** printout and ask them to find the area of the triangle in square units. They can use any method.

Learn (pp. 178–180)

This shows three methods we could use to show that the area of a triangle is half of the area of the given rectangle. Your student can compare their method with these. Each of these methods should be easy to visualize, but your student can verify any they did not use with the triangles on the printout.

Page 180 emphasizes that any side of the triangle can be the base; the base does not have to be parallel to the bottom of the page. A formula for the area of a triangle is given in the box. (Students know we can multiply in any order. They can find half of an even number first, even if it is the height.)

Do (pp. 181–183)

1. Before looking at Do, give your student the second page of the **Lesson 7-4** printout to answer Alex's question at the bottom of page 180. They should identify an appropriate base and height for each (using the background grid) and can use any method to find the area. They should find that they can use the same formula for each of the triangles. They can then compare their methods to the ones in the textbook.

Answers

12 cm^2

1. (a) = **30** cm^2
   = **15** cm^2
   (b) = **5** × **6** = **30** cm^2
   = $\frac{1}{2}$ × **5** × **6** = **15** cm^2
   (c) = **5** × **6** = **30** cm^2
   = $\frac{1}{2}$ × **5** × **6** = **15** cm^2
   There is a base and height that is the same for all three triangles.

2. **15** $\mathbf{cm^2}$
   = $\frac{1}{2} \times 10 \times 3 = 15$ cm^2

3. (a) DE
   (b) JL
   KM
   (c) QS
   PR

4. (a) 60 cm^2 ($\frac{1}{2} \times 12 \times 10$)
   (b) 3 in^2 ($\frac{1}{2} \times 3 \times 2$)
   (c) 24 m^2 ($\frac{1}{2} \times 8 \times 6$)
   (d) 96 cm^2 ($\frac{1}{2} \times 12 \times 16$)
   (e) $17\frac{1}{2}$ ft^2 ($\frac{1}{2} \times 7 \times 5$)
   (f) 57 cm^2 ($\frac{1}{2} \times 19 \times 6$)

The textbook uses Method 3 for the triangles in (b) and (c), since they are not isosceles triangles. Students should, however, be able to see that if they "cut" the triangle along the height, each half triangle is a right triangle, with an area that is half of its corresponding rectangle.

Chapter 7 Workbook Answers

3 **30 s**

$\frac{5}{6} \times \frac{3}{5} \times 60 = 30$

4 **32 in**

$2 \text{ ft} \div \frac{3}{4} = \frac{8}{3} \text{ ft}$

$\frac{8}{3} \times 12 \text{ in} = 32 \text{ in}$

5 $\mathbf{5\frac{1}{3}}$ **oz**

1 stick of butter is $\frac{1}{4}$ lb

$2 \times \frac{2}{3} \times \frac{1}{4} \text{ lb} = \frac{1}{3} \text{ lb}$

$\frac{1}{3} \times 16 \text{ oz} = 5\frac{1}{3} \text{ oz}$

6 (a) $\mathbf{3\frac{11}{18}}$ **ft²**

$2\frac{1}{6} \times 1\frac{2}{3} = \frac{13}{6} \times \frac{5}{3} = \frac{65}{18} = 3\frac{11}{18}$

(b) **520 in²**

$(2\frac{1}{6} \times 12) \times (1\frac{2}{3} \times 12)$

$= 26 \times 20$

$= 520$

Or:

$3\frac{11}{18} \times 144 = 432 + 8 = 520$

7 $\mathbf{2\frac{2}{3}}$ **in²**

$(2\frac{1}{3} \times 2\frac{1}{3}) - (1\frac{2}{3} \times 1\frac{2}{3}) = \frac{49}{9} - \frac{25}{9} = \frac{8}{3} = 2\frac{2}{3}$

You may want to revisit this problem after Lesson 4. Then the solution is simply:

$4 \times \frac{1}{2} \times 1\frac{1}{3} = \frac{8}{3} = 2\frac{2}{3}$

8 (a) $\mathbf{1\frac{1}{2}}$ **min**

$\frac{1}{10} \times 15 \text{ min} = 1\frac{1}{2} \text{ min}$

(b) **90 s**

$1\frac{1}{2} \times 60 \text{ s} = 90 \text{ s}$

Exercise 4 pp. 166–170

1 (a) = **24** cm²

(b) = $\mathbf{\frac{35}{2}}$

= $\mathbf{17\frac{1}{2}}$ cm²

(c) **21 cm²**

$\frac{1}{2} \times 6 \times 7 = 21$

(d) $\mathbf{31\frac{1}{2}}$ **cm²**

$\frac{1}{2} \times 9 \times 7 = 31\frac{1}{2}$

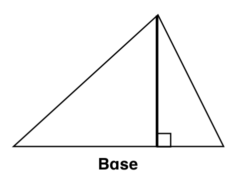
2 (a) Height = **FH**

(b) Height = **KL**

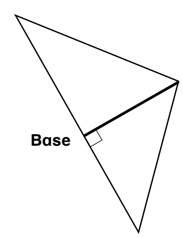
(c) Base = **QS**, Height = **PR**

(d) Base = **WY**, Height = **XZ**

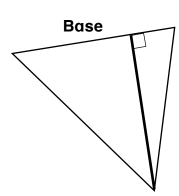
3 (a)



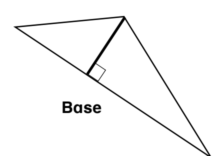
(b)



(c)



(d)



Chapter 7 Workbook Answers

4 **A: 48 cm²**
B: 24 cm²
C: 96 cm²

A: $\frac{1}{2} \times 8 \times 12 = 48$

B: $\frac{1}{2} \times 48 = 24$ (The base of B is half the base of A.)

C: $2 \times 48 = 96$ (The base of C is twice base of A.)

Or:

B: $\frac{1}{2} \times 4 \times 12 = 24$

C: $\frac{1}{2} \times 16 \times 12 = 96$

5 (a) **80 cm²**
$\frac{1}{2} \times 16 \times 10 = 80$

(b) **147 cm²**
$\frac{1}{2} \times 14 \times 21 = 147$

(c) **72 cm²**
$\frac{1}{2} \times 12 \times 12 = 72$

(d) **$45\frac{1}{2}$ cm²**
$\frac{1}{2} \times 13 \times 7 = 45\frac{1}{2}$

6 (a) **48 cm²**
$\frac{1}{2} \times 6 \times 16 = 48$

(b) **$59\frac{1}{2}$ cm²**
$\frac{1}{2} \times 17 \times 7 = 59\frac{1}{2}$

7 (a) **8 cm**
$20 \div (\frac{1}{2} \times 5) = 20 \div \frac{5}{2} = 20 \times \frac{2}{5} = 8$

Or:

The area of the triangle is half of the area of a rectangle with the same base and height.

$2 \times 20 = 40$

$40 \div 5 = 8$

(b) **5 cm**
Students will have to use the second method above, unless they know how to divide a fraction by a fraction.

$2 \times 7\frac{1}{2} = 15$

$15 \div 3 = 5$

Exercise 5 pp. 171–174

1 (a) = **21** cm²

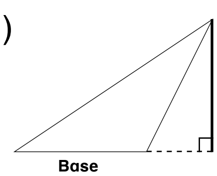
(b) = $\frac{\mathbf{25}}{\mathbf{2}}$

= **$12\frac{1}{2}$** cm²

(c) **12 cm²**
$\frac{1}{2} \times 3 \times 8 = 12$

2 (a) DE (b) KL

3 (a)



(b)