Content Overview

Dear Family,

The goal of this unit of *Math Expressions* is for your child to become fluent with dividing whole numbers and with comparing, adding, subtracting, multiplying, and dividing fractions and decimals. Below is a summary of the topics in this unit.

Addition and Subtraction of Fractions and Decimals

$$\frac{2}{3} + \frac{4}{5} = \frac{10}{15} + \frac{12}{15} = \frac{22}{15} = 1\frac{7}{15}$$

$$\begin{array}{r} {}^{3}1.{}^{10}\cancel{4}0 \\ -\ 0.25 \\ \hline 1.15 \end{array}$$

Equivalent Fractions

Multiply the numerator and denominator by the same number.

$$\frac{5}{6} = \frac{5 \bullet 2}{6 \bullet 2} = \frac{10}{12}$$

Divide the numerator and denominator by the same number.

$$\frac{10}{12} = \frac{10 \div 2}{12 \div 2} = \frac{5}{6}$$

Multiplication of Fractions and Decimals

Multiply numerators and denominators.

$$\frac{2}{3} \bullet \frac{4}{5} = \frac{2 \bullet 4}{3 \bullet 5} = \frac{8}{15}$$

Count decimal places in the factors to place the decimal point in the product.

$$0.12 \bullet 0.4 = 0.048$$

2 places 1 place 3 places

Division of Fractions and Decimals

Multiply by the reciprocal.

$$\frac{2}{5} \div \frac{3}{7} = \frac{2}{5} \bullet \frac{7}{3} = \frac{14}{15}$$

Sometimes you can divide numerators and denominators.

$$\frac{8}{15} \div \frac{2}{3} = \frac{8 \div 2}{15 \div 3} = \frac{4}{5}$$

Make the divisor a whole number by multiplying it and the dividend by the same number.

Here we multiply both by 10.

$$0.2\overline{)0.08} \quad 0.4$$

If you have any questions or comments, please call or write to me.

Sincerely,
Your child's teacher

CA CC

Unit 3 addresses the following standards from the *Common Core State Standards for Mathematics with California Additions*: **6.NS.1, 6.NS.2, 6.NS.3, 6.NS.4,** and all Mathematical Practices.

Un vistazo general al contenido

Estimada familia,

El objetivo de esta unidad de *Expresiones en matemáticas* es que su hijo domine la división de números enteros y que compare, sume, reste, multiplique y divida correctamente fracciones y decimales. Debajo hay un resumen de algunos de los temas de esta unidad.

Suma y resta de fracciones y decimales

$$\frac{2}{3} + \frac{4}{5} = \frac{10}{15} + \frac{12}{15} = \frac{22}{15} = 1\frac{7}{15}$$

$$\begin{array}{r} {}^{3}\not{1}.{}^{10}\not{4}0 \\ -\ 0.25 \\ \hline 1.15 \end{array}$$

Fracciones equivalentes

Multiplicar el numerador y el denominador por el mismo número.

$$\frac{5}{6} = \frac{5 \bullet 2}{6 \bullet 2} = \frac{10}{12}$$

Dividir el numerador y el denominador entre el mismo número.

$$\frac{10}{12} = \frac{10 \div 2}{12 \div 2} = \frac{5}{6}$$

Multiplicación de fracciones y decimales

Multiplicar los numeradores y denominadores.

$$\frac{2}{3} \bullet \frac{4}{5} = \frac{2 \bullet 4}{3 \bullet 5} = \frac{8}{15}$$

Contar los lugares decimales en los factores para colocar el punto decimal en la respuesta.

$$0.12 \bullet 0.4 = 0.048$$

2 lugares 1 lugar 3 lugares

División de fracciones y decimales

Multiplicar por el recíproco.

$$\frac{2}{5} \div \frac{3}{7} = \frac{2}{5} \bullet \frac{7}{3} = \frac{14}{15}$$

Algunas veces se pueden dividir los numeradores y denominadores.

$$\frac{8}{15} \div \frac{2}{3} = \frac{8 \div 2}{15 \div 3} = \frac{4}{5}$$

Dividir el divisor y el dividendo entre el mismo número para convertir el divisor en un número entero.

Aquí se multiplican ambos por 10.

$$0.2\overline{)0.08} \quad \text{(0.4 arriba)}$$

Si tiene preguntas, por favor comuníquese conmigo.

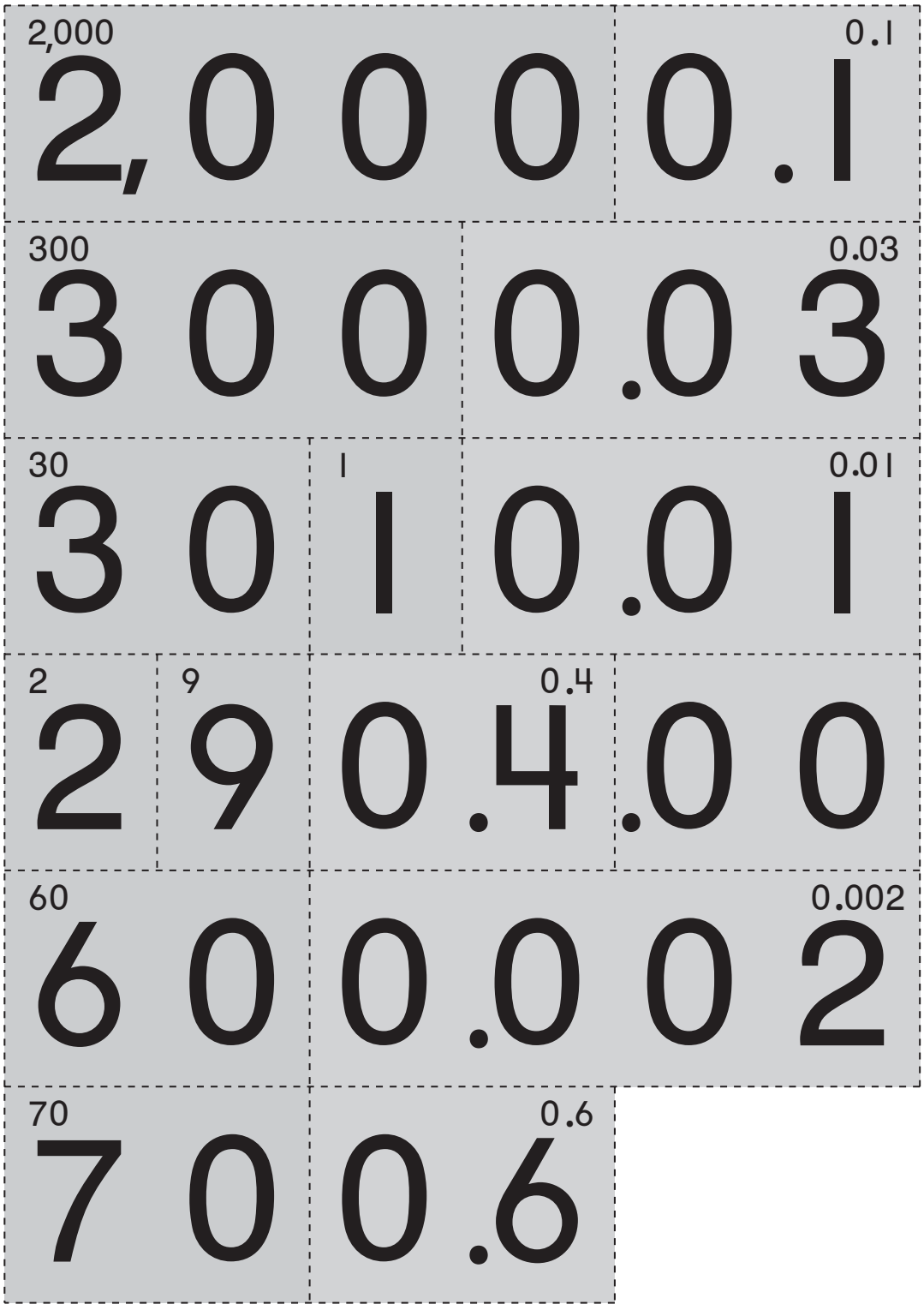
Atentamente,
El maestro de su hijo

CA CC

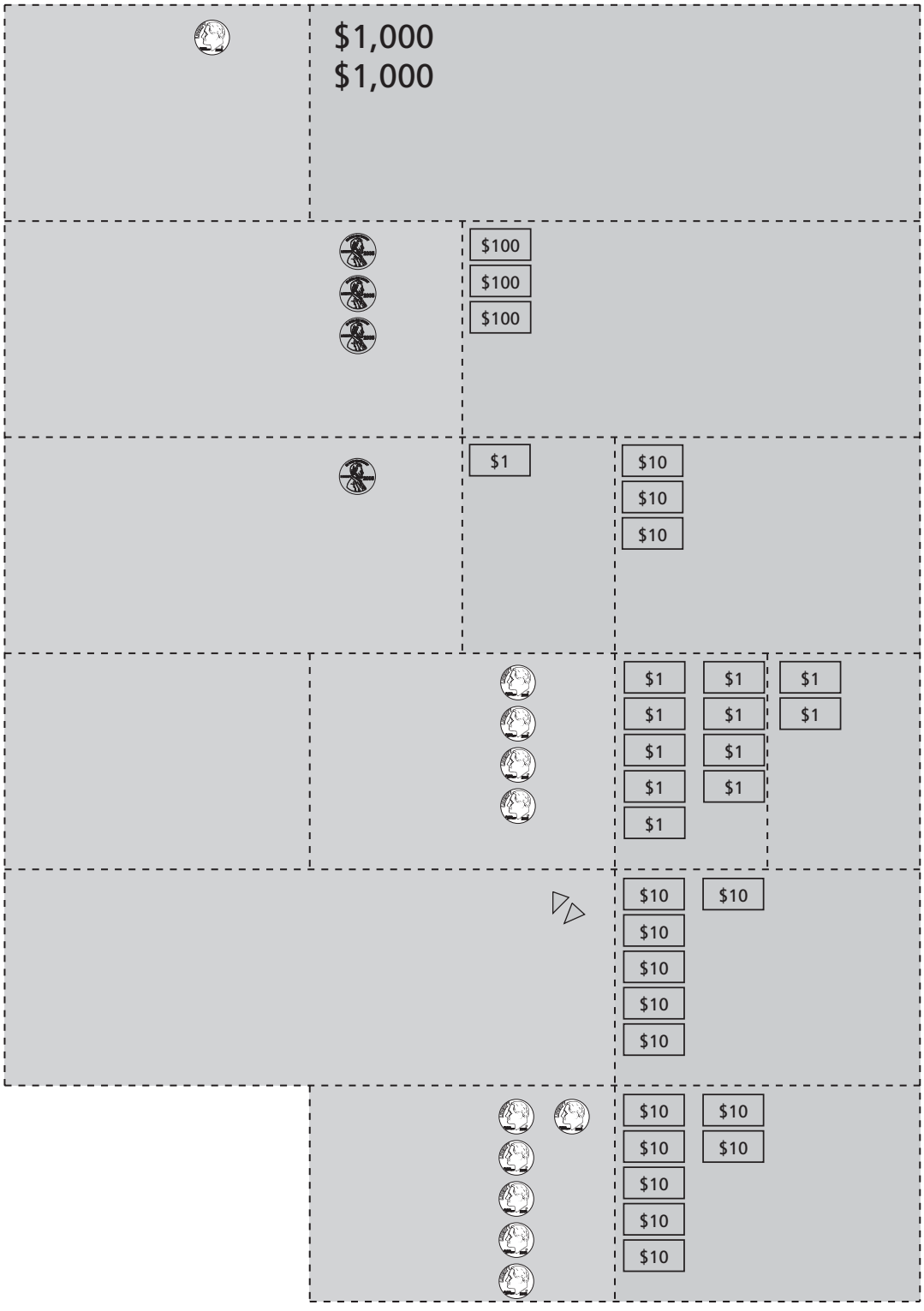
En la Unidad 3 se aplican los siguientes estándares auxiliares, contenidos en los *Estándares estatales comunes de matemáticas con adiciones para California*: **6.NS.1, 6.NS.2, 6.NS.3, 6.NS.4,** y todos los de prácticas matemáticas.

3–1
Class Activity

► Decimal and Whole Number Secret Code Cards



► Decimal and Whole Number Secret Code Cards



CA CC Content Standards **6.NS.2**
Mathematical Practices **MP.2, MP.3, MP.6, MP.7, MP.8**

▶ Discuss and Summarize

Fill in the blanks and discuss how the parts of each problem are related.

Place Value

× 10 (larger) ÷ 10 (smaller)

Thousands	Hundreds	Tens	ONES	Tenths	Hundredths	Thousandths
1,000.	100.	10.	1.	0.1	0.01	0.001
$\frac{1000}{1}$	$\frac{100}{1}$	$\frac{10}{1}$	$\frac{1}{1}$	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
$1,000.00	$100.00	$10.00	$1.00	$0.10	$0.01	$0.001

1 a.

2,000	300	60	1	0.6	0.03	0.002
2,	3	6	1	.6	3	2

b. $1,000 $1,000 | $100 $100 $100 | $10 $10 $10 $10 $10 | $10 | $1 | | | |

c. 2,361.632 = 2,000 + ____ + ____ + ____ + ____ + ____ + 0.002

2 a.

	0	.6	3	2

b. $+ \frac{\quad}{10} + \frac{\quad}{100} + \frac{\quad}{1,000}$

c. $+ \frac{\quad}{1,000} + \frac{\quad}{1,000} + \frac{\quad}{1,000}$

d.

	0	.6	0	0
+	0	.0	3	0
+	0	.0	0	2
	0	.6	3	2

Vocabulary

dividend
divisor
quotient
remainder

▶ Discuss Division Meanings

The 49 sixth graders raised $2,361 toward their class trip. How much is that for each student?

When $2,361 is split 49 ways, each student gets $40. Write 4 in the tens place. **divisor** ↓ 4 49)$2,361.00 ↑ **dividend**	Take away the $1,960 that has been shared out, leaving $401 to be shared next. 4 49)$2,361.00 − 1 96 401	Each student gets 8 more dollars. Take away the $392 shared out. 48 49)$2,361.00 − 1 96 401 − 392 9	There are 9 dollars left, which is 90 dimes. Each student gets 1 dime, so write 1 in the tenths place. 48.1 49)$2,361.00 − 1 96 401 − 392 9 0
Take away the 49 dimes shared out from the 90 dimes, leaving 41 dimes. 48.1 49)$2,361.00 1 96 401 − 392 9 0 − 4 9 4 1	Change the 41 dimes to 410 pennies. 48.1 49)$2,361.00 − 1 96 401 − 392 9 0 − 4 9 4 10	The multiplier 8, which was used before, works again. Each student gets 8 pennies. 48.18 49)$2,361.00 1 96 401 − 392 9 0 − 4 9 4 10	That makes 392 pennies shared out of the 410 pennies, leaving 18 pennies. **quotient** → 48.18 49)$2,361.00 − 1 96 401 − 392 9 0 − 4 9 4 10 − 3 92 **remainder** → 18

3. Each student gets $_____ and there are _____ cents left over.

3–1
Class Activity

▶ What's the Error?

Dear Math Students,

I solved the problem 5,619 ÷ 27 on my math homework. I got 28 R3. I know this can't be right because 27 × 28 is approximately equal to 30 • 30, which is 900. That's not even close to 5,619! Will you look at my work and help me figure out what I did wrong?

Your friend,
Puzzled Penguin

$$\begin{array}{r} 28 \\ 27\overline{)5{,}619} \\ \underline{54} \\ 219 \\ \underline{216} \\ 3 \end{array}$$

4. Write an answer to Puzzled Penguin.

PATH to FLUENCY Practice Division

Write each answer as a quotient with a remainder.

5. $23\overline{)3{,}272}$

6. $18\overline{)7{,}342}$

7. $19\overline{)3{,}812}$

Solve.

8. The engineering club won a $1,875 prize in a robot-building contest. The 16 club members want to share the prize equally. How much will each member get? How many cents will be left over?

3–1 Class Activity

▶ What's the Error?

Dear Math Students,

I am really having trouble with my math homework today. I had to solve 3,005 ÷ 15. I started, but I got stuck. I know the answer can't be 2, but I don't know what to do next. Can you help me finish the solution?

Your friend,
Puzzled Penguin

$$\begin{array}{r} 2 \\ 15\overline{)3{,}005} \\ \underline{30} \\ 0 \end{array}$$

9. Write an answer to Puzzled Penguin.

PATH to FLUENCY Practice Division

Write each answer as a quotient with a remainder.

10. $18\overline{)5{,}402}$ **11.** $14\overline{)7{,}019}$ **12.** $33\overline{)2{,}172}$

Solve.

13. Twelve friends earned $4,250 for painting a house. They want to split the money equally. How much will each friend get? How many cents will be left over?

CA CC Content Standards **6.NS.2**
Mathematical Practices **MP.1, MP.3, MP.6**

► Adjust the Multiplier by 1

Discuss each step of Nate's and Caity's solutions. Share how you would do that step.

Step 1

Nate	Caity
(90) 6 86) 6,123 3 − 5 16	(90) 7 86) 6,123 − 6 02
Nate Thinks: 7 • 90 = 630, which is more than 612, so 7 is too big for the multiplier. I will use 6. 6 • 6 ones = 36. I write the 6 ones under the 2 and the little 3 tens under the 1, so I remember to add them in. 6 × 8 tens = 48 tens, plus the 3 tens = 51 tens. I cross out the 3 because I already added it. So I get 516.	**Caity Thinks:** 7 • 90 = 630, which is more than 612, but 6 • 90 = 540, which is far from 612. 86 is near the middle between 80 and 90, so I think I will use 7. I know 7 • 6 ones = 42. I write the 2 and remember the 4 tens to add in. 7 times the 8 tens in 86 is 56 tens, plus the 4 tens = 60 tens. So I have 602, which is really 602 tens because the 7 is in the tens place.

Step 2

Nate	Caity
(90) 6 86) 6,123 5 10 12 3 − 5 16 96	(90) 7 86) 6,123 − 6 02 10
Nate Thinks: I need to ungroup to subtract 516 from 612. I think of 612 as 6 hundreds 1 ten and 2 ones. I ungroup 1 ten and get 10 ones and combine them with the 2 ones to make 12. I need more tens so I ungroup 1 hundred to make 10 tens. Now all the top numbers are greater, so I can subtract. 612 − 516 = 96. I see that 96 is greater than 86. So the multiplier is 7, not 6.	**Caity Writes:** 612 − 602 is 10. The multiplier 7 worked because 10 is less than 86.

▶ Adjust the Multiplier by 1 (continued)

Step 3 (Caity has no step to match Nate's Step 3.)

Nate	
(90) 7 86) 6,123 − 6 02 10	**Nate Thinks:** 7 • 6 ones is 42, which I write with a little 4 to add in later. 7 • 8 tens = 56 tens, plus the 4 tens I already had, equals 60 tens. So I have 602 (which is really 602 tens because the multiplier 7 is in the tens place). 612 − 602 = 10.

Step 4

Nate	Caity
(90) 71 86) 6,123 − 6 02 103 − 86 17 **Answer:** 71 R17	(90) 71 86) 6,123 − 6 02 103 − 86 17 **Answer:** 71 R17
Nate Thinks: I bring down the 3 to make 103. I can subtract only one group of 86 from 103. I write 1 in the ones place in the quotient. In 103, there are 10 tens, so I regroup 1 ten to make 13 ones. I subtract in each column. 103 − 86 = 17. So, 17 is the remainder.	**Caity Thinks:** I bring down the 3 to make 103. There is just 1 group of 86 in 103. I write 1 in the quotient. Then I subtract 1 • 86 from 103, and the answer is 17. So, the remainder is 17.

1. Write an equation to show Nate and Caity how to check their answers.

CA CC Content Standards **6.NS.3**
Mathematical Practices **MP.1, MP.2, MP.3, MP.6, MP.8**

▶ Summarize Multiplying by 0.1 and 0.01

Multiplying by 0.1 is the same as dividing by 10.

$0.1 \bullet 32.4 = 32.4 \div 10 = 3.24$

Multiplying a number by 0.1 divides it into 10 parts and takes 1 part. It gives a smaller number. Each digit moves one place right.

You can use this idea to multiply any number of tenths.

Fill in the blanks.

1. a. To find 0.2 • $32.40, divide $32.40 into 10 parts and take _____ of those parts.

   0.2 • $32.40 = ($32.40 ÷ 10) • _____

   b. To find 6.2 • $32.40, divide $32.40 into _____ parts and take _____ of those parts.

   6.2 • $32.40 = ($32.40 ÷ _____) • _____

Multiplying by 0.01 is the same as dividing by 100.

$0.01 \bullet 32.4 = 32.4 \div 100 = 0.324$

Multiplying a number by 0.01 divides it into 100 parts and takes 1 part. It gives an even smaller number. Each digit moves two places right.

You can use this idea to multiply any number of hundredths.

2. a. To find 0.02 • $32.40, divide $32.40 into _____ parts and take _____ of those parts.

   0.02 • $32.40 = ($32.40 ÷ 100) • _____

   b. To find 0.62 • $32.40, divide $32.40 into _____ parts and take _____ of those parts.

   0.62 • $32.40 = ($32.40 ÷ _____) • _____

▶ Rule About Multiplying Decimals

We can state a rule about multiplying with decimal numbers.

Rule: Ignore the decimal points and multiply. Then place the decimal point so the number of decimal places in the product is equal to the total number of decimal places in the factors.

Example
0.4 • 0.02
Ignore the decimal point and multiply: 4 • 2 = 8
Place decimal point so there are three decimal places:
0.4 • 0.02 = 0.008
1 place 2 places 3 places

3. Find each product in two ways: 1) Use the rule above; 2) Use the method of dividing into 10 or 100 parts and then multiplying by the number of tenths or hundredths. Show or explain your work. The first one is done for you.

	Use the Rule	Divide into Parts and Multiply
a. 0.2 • 0.3	0.06; two decimal places	(0.3 ÷ 10) • 2 = 0.03 • 2 = 0.06
b. 0.02 • 0.3		
c. 0.2 • 3		
d. 0.02 • 3		
e. 2 • 0.3		
f. 2 • 0.03		

4. Explain why the two methods give the same result.

Use either method to solve these problems.

5. 0.04 • 2 = _____ 6. 0.4 • 2 = _____ 7. 0.3 • 0.3 = _____ 8. 3 • 0.3 = _____

9. 0.04 • 6 = _____ 10. 0.5 • 7 = _____ 11. 0.3 • 0.8 = _____ 12. 7 • 0.6 = _____

CA CC Content Standards **6.NS.3**
Mathematical Practices **MP.2, MP.3, MP.6, MP.7, MP.8**

▶ Summarize Dividing by 0.1

Dividing by 0.1 gives a number ten times the original number.

$79.6 \div 0.1 = 10 \bullet 79.6 = 796$

Dividing by 0.1 is equivalent to multiplying by 10 because there are 10 small parts (tenths) in each whole.

Discuss and explain.

1. Dividing by 0.1 is the same as multiplying by 10. Discuss the reason for each numbered step.

$$\frac{79.6}{0.1} \overset{①}{=} \frac{79.6}{0.1} \bullet 1 \overset{②}{=} \frac{79.6}{0.1} \bullet \frac{10}{10} \overset{③}{=} \frac{79.6 \bullet 10}{0.1 \bullet 10} \overset{④}{=} \frac{796}{1} \overset{⑤}{=} 796$$

2. Multiplying a problem in long-division format by $1 = \frac{10}{10}$ gives an equivalent problem with a whole number divisor.

$0.1\overline{)79.6} \longrightarrow 0.1\overline{)79.6\bullet}$ OR $0.1\overline{)79.6\bullet}$

Complete.

3. The process in Exercise 2 can be used to change *any* decimal divisor to a whole number. Use the method to rewrite each problem with a whole number divisor.

   a. $0.4\overline{)2.7}$ b. $72.5\overline{)0.39}$ c. $2.7\overline{)9}$ d. $6.3\overline{)52}$

4. What makes Parts c and d of Exercise 3 trickier than the others?

_____

_____

PATH to FLUENCY **Divide.**

5. $0.3\overline{)9}$ 6. $0.7\overline{)2.1}$ 7. $1.2\overline{)480}$ 8. $2.2\overline{)0.88}$

9. $0.5\overline{)100}$ 10. $3.2\overline{)96}$ 11. $0.9\overline{)10.8}$ 12. $0.8\overline{)0.64}$

► Summarize Dividing by 0.01

Dividing by 0.01 gives a number 100 times the original number.

$79.6 \div 0.01 = 7{,}960 = 100 \bullet 79.6$

Dividing by 0.01 is equivalent to multiplying by 100 because there are 100 small parts (hundredths) in each whole.

Discuss and explain.

13. Dividing by 0.01 is the same as multiplying by 100. Discuss the reason for each numbered step.

$$\frac{79.6}{0.01} \underset{①}{=} \frac{79.6}{0.01} \bullet 1 \underset{②}{=} \frac{79.6}{0.01} \bullet \frac{100}{100} \underset{③}{=} \frac{79.6 \bullet 100}{0.1 \bullet 100} \underset{④}{=} \frac{7{,}960}{1} \underset{⑤}{=} 7{,}960$$

14. Multiplying a problem in long-division format by $1 = \frac{100}{100}$ gives an equivalent problem with a whole number divisor.

$0.01\overline{)79.6} \longrightarrow 0.01\overline{)79.60}$ OR $0.01\overline{)79.60}$

Complete.

15. The process in Exercise 14 can be used to change *any* decimal divisor to a whole number. Use the method to rewrite each problem with a whole number divisor.

a. $0.04\overline{)2.7}$ **b.** $7.25\overline{)0.39}$ **c.** $0.27\overline{)9}$ **d.** $0.63\overline{)52}$

16. What makes Parts a, c, and d of Exercise 15 tricky?

_____

_____

PATH to FLUENCY **Divide.**

17. $0.01\overline{)40}$ **18.** $0.03\overline{)0.9}$ **19.** $0.12\overline{)48}$ **20.** $0.07\overline{)0.49}$

21. $3.21\overline{)6.42}$ **22.** $0.25\overline{)7.5}$ **23.** $0.11\overline{)990}$ **24.** $0.04\overline{)0.16}$

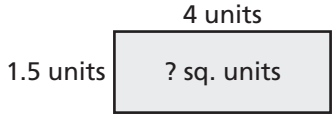
CA CC Content Standards **6.NS.3**
Mathematical Practices **MP.1, MP.2, MP.6, MP.8**

▶ Greater, Equal, or Less

1. Explore what happens when you multiply 4 by different numbers.

Case 1: Multiply 4 by a number greater than 1.

$4 \bullet \mathbf{1.5} =$ _____

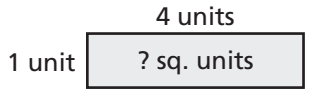


Is the product less than, greater than, or equal to 4?

_____

Case 2: Multiply 4 by 1.

$4 \bullet \mathbf{1} =$ _____

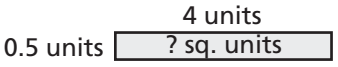


Is the product less than, greater than, or equal to 4?

_____

Case 3: Multiply 4 by a number less than 1.

$4 \bullet \mathbf{0.5} =$ _____



Is the product less than, greater than, or equal to 4?

_____

2. Multiply 10 by 1, a number greater than 1, and a number less than 1. Tell how each product compares to 10.

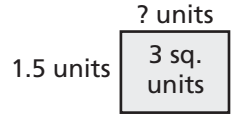
_____

_____

3. Explore what happens when you divide 3 by different numbers.

Case 1: Divide 3 by a number greater than 1.

$3 \div \mathbf{1.5} =$ _____

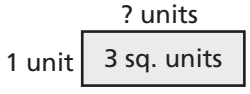


Is the quotient less than, greater than, or equal to 3?

_____

Case 2: Divide 3 by 1.

$3 \div \mathbf{1} =$ _____

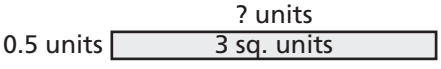


Is the quotient less than, greater than, or equal to 3?

_____

Case 3: Divide 3 by a number less than 1.

$3 \div \mathbf{0.5} =$ _____



Is the quotient less than, greater than, or equal to 3?

_____

4. Divide 12 by 1, a number greater than 1, and a number less than 1. Tell how each quotient compares to 12.

_____

_____

► Multiply or Divide

For each problem, decide whether you need to multiply or divide. Then solve.

Show your work.

5. A wallet size photo measures 2.5 inches by 3.5 inches. What is the area of a wallet-size photo?

_____

6. Mr. Diaz paid $5.96 for 4 pounds of broccoli. What was the price per pound?

_____

7. The Washingtons' backyard has an area of 55.48 square meters. If the length of the yard is 7.6 meters, what is the width?

_____

8. In 1976, gas cost about $0.36 per gallon. The gas tank of the car Mr. Renzi drove in that year held 22 gallons. How much did it cost him to fill his gas tank?

_____

9. The area of a king size bed is about 42.2 square feet. A queen size bed is about 0.8 times that size. What is the approximate area of a queen size bed? Round to the nearest tenth of a square foot.

_____

10. A rectangular office has an area of 125 square feet. If the length of the office is 9.5 feet, what is the width? Round to the nearest tenth of a foot.

_____

▶ Greater or Less

Solve.

11. Amber earns $8.50 per hour bagging groceries. Josie, a cashier, earns 1.3 times as much as Amber.

Does Josie earn more or less than Amber?

_____

How much does Josie earn?

_____

12. On movie night, the student council sold popcorn in 0.75-ounce bags. They sold 180 ounces in all.

Did they sell more or fewer than 180 bags?

_____

How many bags did they sell?

_____

13. Stickers with the school mascot cost $1.15 each. Manuel bought 9 stickers.

Did Manuel spend more or less than $9?

_____

How much did Manuel spend?

_____

14. A tabletop is 1.7 meters long and 0.8 meters wide.

Is the area more or less than 1.7 square meters?

_____

What is the area?

_____

15. Caleb is using thin strips of wood to build a picture frame. One of the strips has a width of 1.2 centimeters and an area of 24.96 square centimeters.

Is the length of the strip more or less than 24.96 centimeters?

_____

What is the length of the strip?

_____

▶ Which Is Greater?

Solve without doing any calculations.

16. Which is greater, 18 • 76 or 76 ÷ 18? How do you know?

17. Which is greater, 0.37 • 45 or 45 ÷ 0.37? How do you know?

18. Which is greater, 81 ÷ 12 or 81 ÷ 0.12? How do you know?

19. Which is greater, 23 • 67 or 0.23 • 67? How do you know?

▶ How Many Decimal Places?

Use the fact that 39 • 74 = 2,886 to solve each problem.

20. 0.39 • 7,400 = _____

21. 0.39 • 740 = _____

22. 0.39 • 74 = _____

23. 39 • 7.4 = _____

24. $0.74\overline{)2{,}886}$

25. $0.74\overline{)288.6}$

26. $0.74\overline{)28.86}$

27. $74\overline{)288.6}$

28. 3.9 • 740 = _____

29. 3.9 • 74 = _____

30. 3.9 • 7.4 = _____

31. 39 • 0.74 = _____

32. $7.4\overline{)2{,}886}$

33. $7.4\overline{)288.6}$

34. $7.4\overline{)28.86}$

35. $74\overline{)28.86}$

PATH to FLUENCY **Solve.**

36. 0.7 • 0.3 = _____

37. 0.06 • 7 = _____

38. 8 • 0.4 = _____

39. $0.12\overline{)42}$

40. $3.2\overline{)2.4}$

41. $0.06\overline{)54}$

42. $0.27\overline{)1.35}$

43. $\begin{array}{r} 0.09 \\ \times\ \ 52 \\ \hline \end{array}$

44. $\begin{array}{r} 8.5 \\ \times\ 4.2 \\ \hline \end{array}$

45. $\begin{array}{r} 7.2 \\ \times\ 0.25 \\ \hline \end{array}$

46. $\begin{array}{r} 18 \\ \times\ 0.6 \\ \hline \end{array}$

47. $3.02\overline{)90.6}$

48. $7.5\overline{)0.06}$

49. $0.8\overline{)6.8}$

50. $0.2\overline{)0.95}$

PATH to FLUENCY How Many Decimal Places? (continued)

Solve.

51. $0.09 \bullet 0.7 =$ _____

52. $50 \bullet 0.5 =$ _____

53. $1.2 \bullet 1.2 =$ _____

54. $0.8\overline{)25.6}$

55. $0.07\overline{)2.45}$

56. $1.2\overline{)0.9}$

57. $0.9\overline{)0.63}$

58. $\begin{array}{r} 0.8 \\ \times\ 6.1 \\ \hline \end{array}$

59. $\begin{array}{r} 0.33 \\ \times\ 29 \\ \hline \end{array}$

60. $\begin{array}{r} 0.46 \\ \times\ 56 \\ \hline \end{array}$

61. $\begin{array}{r} 7.5 \\ \times\ 1.9 \\ \hline \end{array}$

62. $2.08\overline{)8.32}$

63. $0.2\overline{)0.01}$

64. $0.24\overline{)36}$

65. $1.2\overline{)1.08}$

▶ The Meaning of the Remainder

Solve. *Show your work.*

66. Zola has 575 beads. She needs 32 beads to make a necklace. How many necklaces can she make?

_____

67. At a concert, a band earned $495 for selling 36 CDs. How much did they earn per CD?

_____

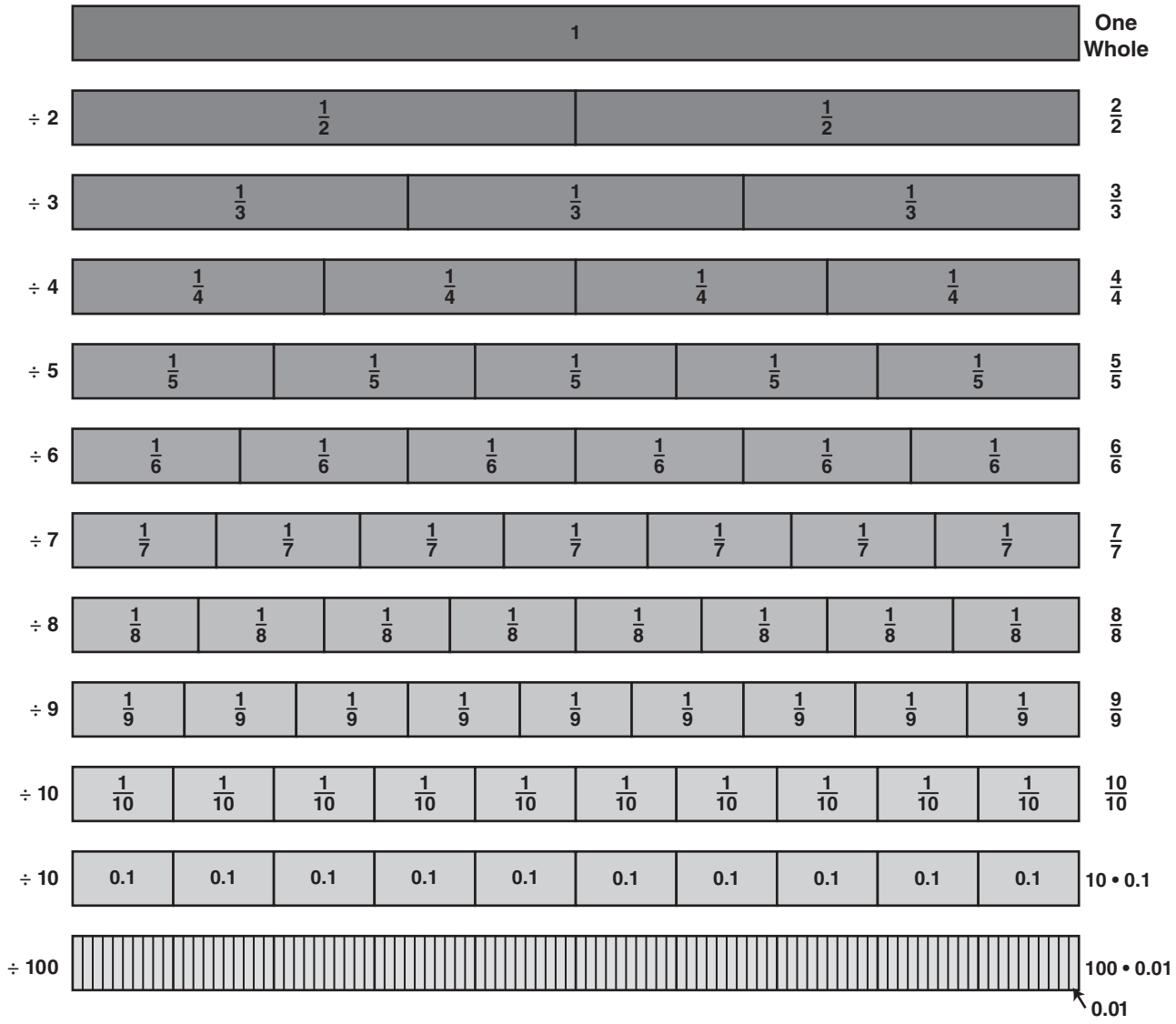
68. Mr. Perelli made 500 ounces of raspberry jam. He filled as many 32-ounce jars with jam as he could. How much jam did he have left over?

_____

CA CC Content Standards **6.NS.3**
Mathematical Practices **MP.2, MP.3, MP.6, MP.8**

► Comparing Unit Fractions and Decimals

The bar at the top represents a whole watermelon. Below are unit fractions and unit decimals made by dividing the watermelon into equal parts.



The greater the dividing number is, the smaller the unit fraction or decimal will be. The fraction denominator and the decimal place show the dividing number. So, a greater denominator or decimal place means the whole is divided into smaller parts.

1. $4 > 3$, but $\frac{1}{4} \bigcirc \frac{1}{3}$

2. $100 > 10$, but $0.01 \bigcirc 0.1$

3. $1{,}000 > 100$, but $0.001 \bigcirc 0.01$

Vocabulary

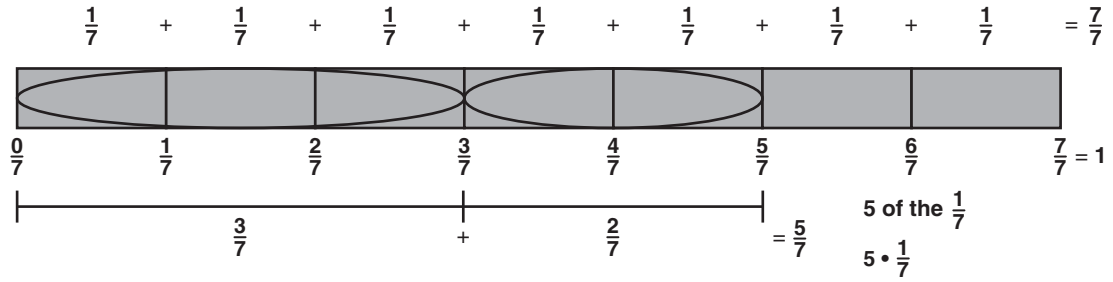
numerator
denominator

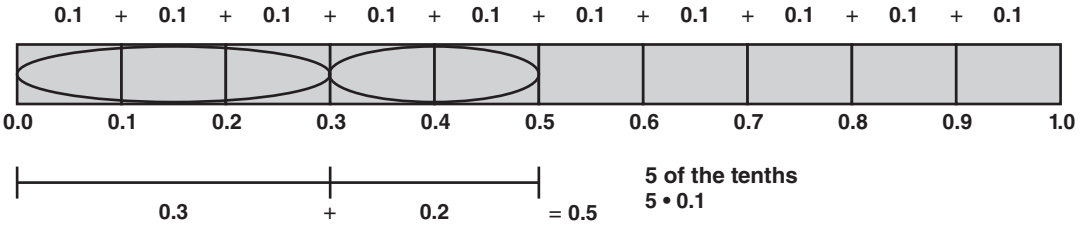
PATH to FLUENCY

Adding and Subtracting Unit Fractions and Decimals

The **denominator** of a fraction tells the number of equal parts the whole is divided into, and, therefore, the number of unit fractions that are made. The **numerator** tells how many of these unit fractions the fraction represents.

numerator → $\frac{n}{d}$ ← denominator





Add.

4. $\frac{3}{9} + \frac{2}{9} =$ _____

5. $\frac{3}{6} + \frac{2}{6} =$ _____

6. $0.03 + 0.02 =$ _____

Subtract.

7. $\frac{5}{7} - \frac{3}{7} =$ _____

8. $\frac{5}{7} - \frac{2}{7} =$ _____

9. $\frac{5}{9} - \frac{3}{9} =$ _____

10. $\frac{5}{6} - \frac{2}{6} =$ _____

11. $0.5 - 0.3 =$ _____

12. $0.5 - 0.2 =$ _____

13. $0.05 - 0.03 =$ _____

14. $0.05 - 0.02 =$ _____

To add or subtract fractions with like denominators, add or subtract the numerators.

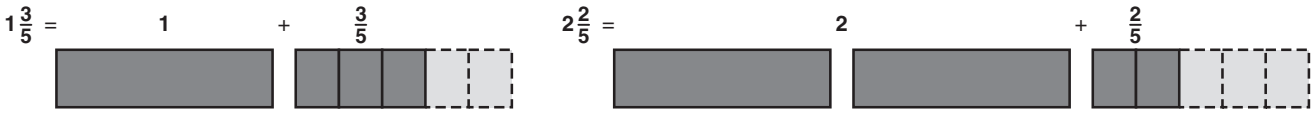
To add or subtract decimals with like places, add or subtract the numbers in the places.

3–6
Class Activity

► Discuss Adding and Subtracting Mixed Numbers

Add mixed numbers by adding whole numbers and adding fractions. You may need to make a new group after adding.

Example 1 $1\frac{3}{5} + 2\frac{2}{5}$

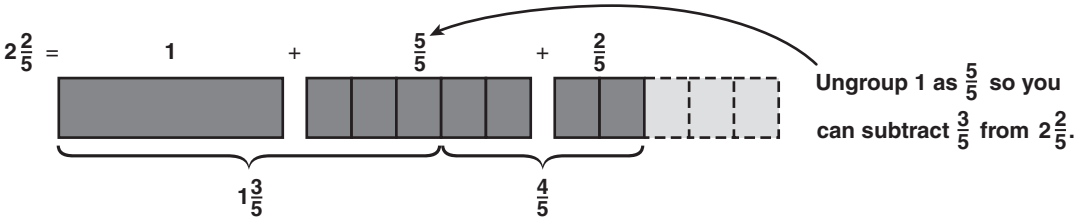


A. $1\frac{3}{5} + 2\frac{2}{5} = 1 + \frac{3}{5} + 2 + \frac{2}{5} = 1 + 2 + \frac{3}{5} + \frac{2}{5} = 3 + \frac{5}{5} = 3 + 1 = 4$

B.
$$\begin{array}{r} 1\frac{3}{5} \\ +\ 2\frac{2}{5} \\ \hline 3\frac{5}{5} \end{array} = 3 + 1 = 4$$

Subtract mixed numbers by ungrouping a 1 if needed. Then subtract whole numbers and subtract fractions.

Example 2 $2\frac{2}{5} - 1\frac{3}{5}$



Suzy's Method

$\frac{3}{5}$ to $\frac{5}{5}$ is $\frac{2}{5}$ plus $\frac{2}{5} = \frac{4}{5}$.

$2\frac{2}{5} = 1 + \frac{5}{5} + \frac{2}{5}$

$-\ 1\frac{3}{5} = 1 + \frac{3}{5}$

$\frac{2}{5} + \frac{2}{5} = \frac{4}{5}$

Ian's Method

$2\frac{2}{5}$

$-\ 1\frac{3}{5}$

$\frac{4}{5}$

Youngshim's Method

$2 + \frac{2}{5} = 1 + \frac{7}{5}$

$-\ 1 + \frac{3}{5} = 1 + \frac{3}{5}$

$0 + \frac{4}{5} = \frac{4}{5}$

PATH to FLUENCY Practice with Fractions and Decimals

Complete each statement with < or >.

15. $\frac{1}{5}$ ◯ $\frac{1}{4}$

16. $\frac{1}{8}$ ◯ $\frac{1}{9}$

17. $\frac{2}{5}$ ◯ $\frac{2}{7}$

18. 0.6 ◯ 0.06

19. $\frac{3}{5}$ ◯ $\frac{3}{4}$

20. $\frac{5}{8}$ ◯ $\frac{5}{9}$

21. $\frac{8}{9}$ ◯ $\frac{8}{10}$

22. 0.08 ◯ 0.8

If the numerators are the same, the fraction with the *lesser denominator* is *greater* because its unit fractions are greater.

Complete each statement with < or >.

23. $2\frac{4}{5}$ ◯ $3\frac{1}{5}$

24. $6\frac{1}{3}$ ◯ $7\frac{1}{2}$

25. 2.9 ◯ 3.01

26. $4\frac{3}{7}$ ◯ $4\frac{6}{7}$

For mixed numbers, if the whole numbers are different, the number with the greater whole number is greater. If the whole numbers are the same, the number with the greater fraction or decimal part is greater.

Complete each statement with < or >.

27. $\frac{5}{8}$ ◯ $\frac{3}{8}$

28. $\frac{20}{3}$ ◯ $\frac{21}{3}$

29. 0.4 ◯ 0.5

30. 0.04 ◯ 0.05

If the denominators are the same, the fraction with the *greater numerator* is *greater* because it represents more unit fractions.

Add or subtract.

31. $\frac{3}{5} + \frac{4}{5} =$ _____

32. $\frac{7}{8} - \frac{6}{8} =$ _____

33. $3\frac{2}{6} + 4\frac{5}{6} =$ _____

34. $\begin{array}{r} 6.1 \\ -\ 2.2 \\ \hline \end{array}$

35. $\begin{array}{r} 6\frac{1}{3} \\ -\ 2\frac{2}{3} \\ \hline \end{array}$

36. $\begin{array}{r} 14.32 \\ -\ 9.56 \\ \hline \end{array}$

37. $\begin{array}{r} 6\frac{2}{7} \\ -\ 3\frac{5}{7} \\ \hline \end{array}$

38. Jacob used $2\frac{7}{8}$ yards of fabric to make a banner. He added another $\frac{5}{8}$ yard of fabric to decorate the banner. How much fabric did he use?

_____

3–7 Class Activity

CA CC Content Standards **6.NS.3, 6.NS.4**
Mathematical Practices **MP.1, MP.3, MP.4, MP.5. MP.6**

Vocabulary

equivalent fractions

▶ What Are Equivalent Fractions?

Each fraction bar shows a fraction equivalent to $\frac{5}{6}$.

A. Split each sixth into two equal parts to make 10 twelfths.

Numerically: $\frac{5 \bullet 2}{6 \bullet 2} = \frac{10}{12}$. We have more, but smaller, parts.

B. Split each sixth into three equal parts to make 15 eighteenths.

Numerically: $\frac{5 \bullet 3}{6 \bullet 3} = \frac{15}{18}$. We have more, but smaller, parts.

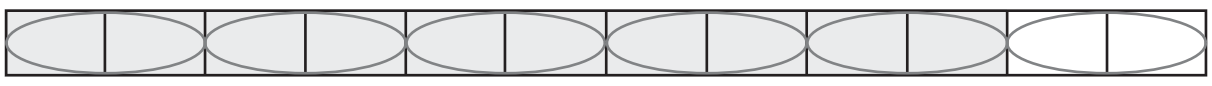
C. Split each sixth into four equal parts to make 20 twenty-fourths.

Numerically: $\frac{5 \bullet 4}{6 \bullet 4} = \frac{20}{24}$. We have more, but smaller, parts.

You can make equivalent fractions by

- Multiplying to make more, but smaller, parts, as in the examples above.
- Dividing to make fewer, but larger, parts.

  For example, to simplify $\frac{10}{12}$, form groups of two twelfths to get 5 sixths.



Numerically: $\frac{10 \div 2}{12 \div 2} = \frac{5}{6}$ Think: $\frac{2}{2} \bullet \boxed{\frac{5}{6}} = \frac{10}{12}$

► Seeing Equivalent Fractions in the Multiplication Table

You can use the multiplication table to find equivalent fractions.

•	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9
2	2	4	6	8	10	12	14	16	18
3	3	6	9	12	15	18	21	24	27
4	4	8	12	16	20	24	28	32	36
5	5	10	15	20	25	30	35	40	45
6	6	12	18	24	30	36	42	48	54
7	7	14	21	28	35	42	49	56	63
8	8	16	24	32	40	48	56	64	72
9	9	18	27	36	45	54	63	72	81

	· 2	· 3	· 4	· 5	· 6	· 7	· 8	· 9
$\frac{5}{6}$	$\frac{10}{12}$	$\frac{15}{18}$	$\frac{20}{24}$	$\frac{25}{30}$	$\frac{30}{36}$	$\frac{35}{42}$	$\frac{40}{48}$	$\frac{45}{54}$
	· 2	· 3	· 4	· 5	· 6	· 7	· 8	· 9

Use the multiplication table to write fractions equivalent to the given fraction.

1. $\frac{3}{5} = \_\_\_\_ = \_\_\_\_ = \_\_\_\_ = \_\_\_\_ = \_\_\_\_ = \_\_\_\_ = \_\_\_\_ = \_\_\_\_ = \_\_\_\_$

2. $\frac{4}{7} = \_\_\_\_ = \_\_\_\_ = \_\_\_\_ = \_\_\_\_ = \_\_\_\_ = \_\_\_\_ = \_\_\_\_ = \_\_\_\_ = \_\_\_\_$

3–7
Class Activity

▶ Finding a Common Denominator

Example 1 $\frac{4}{5} + \frac{3}{10}$

Jo Anne's Solution

I look at the denominators to see what I need to multiply by.

$\frac{4}{5} + \frac{3}{10} = \frac{4 \bullet 2}{5 \bullet 2} + \frac{3}{10} = \frac{8}{10} + \frac{3}{10} = \frac{11}{10} = 1\frac{1}{10}$

$\bullet 2$

Mark's Solution

I see $5 \bullet 2 = 10$.	So, I multiply 4 and 5 by 2.	I find how many tenths.	Now I can add.
$\frac{4 \bullet}{5 \bullet 2} = \frac{}{10}$	$\frac{4 \bullet 2}{5 \bullet 2} = \frac{}{10}$	$\frac{4 \bullet 2}{5 \bullet 2} = \frac{8}{10}$	$\frac{4}{5} + \frac{3}{10} = \frac{8}{10} + \frac{3}{10} = \frac{11}{10} = 1\frac{1}{10}$

> To compare, add, or subtract two fractions when the denominator of one is a factor of the denominator of the other, change the fraction with the lesser denominator to an equivalent fraction that uses the greater denominator.

Example 2 $0.2 + 0.03$

Shauna's Solution

0.2 is two dimes. That is 20 pennies, so $0.2 = 0.20$.
I add like places.

$$\begin{array}{r} 0.20 \\ +\ 0.03 \\ \hline 0.23 \end{array}$$

> To compare, add, or subtract decimals with different numbers of places, put zeros on the end of the decimal with fewer places to make the number of decimal places in the two numbers equal.

Compare, add, or subtract.

3. $0.07 \bigcirc 0.4$

4. $0.1 \bigcirc 0.06$

5. $\frac{2}{5} \bigcirc \frac{8}{15}$

6. $\frac{3}{4} \bigcirc \frac{8}{12}$

7. $\frac{5}{6} - \frac{11}{24} =$ _____

8. $0.4 - 0.08 =$ _____

9. $0.3 - 0.02 =$ _____

10. $\frac{4}{5} + \frac{17}{30} =$ _____

▶ What's the Error?

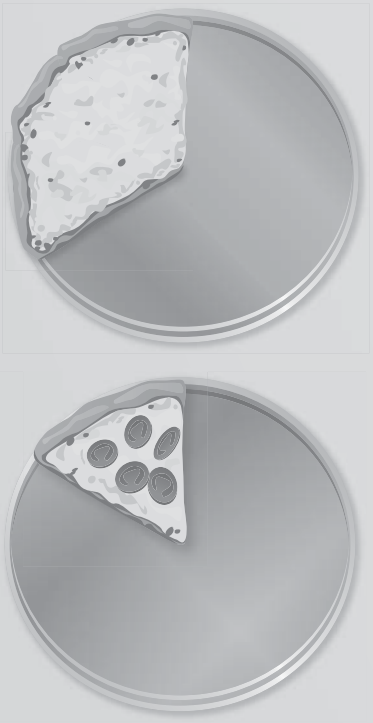
Dear Math Students,

My friend Wendy had a pizza party. After the party, she had $\frac{1}{3}$ of a cheese pizza left. She also had $\frac{1}{6}$ of a pepperoni pizza. I told Wendy that together she has $\frac{2}{9}$ of a whole pizza left. She says that can't be right.

Can you help me figure out my mistake? How much of a whole pizza does Wendy have?

Your friend,

Puzzled Penguin



11. Write an answer to Puzzled Penguin.

CA CC Content Standards **6.NS.4**
Mathematical Practices **MP.3, MP.6**

Vocabulary

common factor
common denominator

▶ Common Denominators for Other Cases

Case 1: Denominators with no common factor except 1

$\frac{2}{3} + \frac{5}{4}$

Virginia's Solution: I need to find a common denominator. 3 • 4 is 12. So, if I multiply the numerator and denominator of each fraction by the other factor, they'll both have the denominator 12.

$$\frac{2 \bullet 4}{3 \bullet 4} + \frac{5 \bullet 3}{4 \bullet 3} = \frac{8}{12} + \frac{15}{12}$$
$$= \frac{23}{12} = 1\frac{11}{12}$$

Add or subtract.

1. $\frac{4}{5} + \frac{2}{3} =$ _____

2. $\frac{3}{5} - \frac{1}{6} =$ _____

Case 2: Denominators with a common factor that is not one of the numbers

$\frac{3}{4} + \frac{5}{6}$

Roger's Solution: I think of a number that is a multiple of both denominators. 12 is a multiple of 4 and 6. Then I think of what to multiply the denominator of each fraction by to get 12. I multiply the numerator and denominator by that number.

$$\frac{3}{4} + \frac{5}{6} = \frac{3 \bullet 3}{4 \bullet 3} + \frac{5 \bullet 2}{6 \bullet 2}$$
$$= \frac{9}{12} + \frac{10}{12}$$
$$= \frac{19}{12} = 1\frac{7}{12}$$

Serena's Solution: If I can't think of a common multiple, I just use Virginia's method and multiply the numerator and denominator of each fraction by the other factor.

$$\frac{3}{4} + \frac{5}{6} = \frac{18}{24} + \frac{20}{24}$$
$$= \frac{38}{24} = 1\frac{14}{24} = 1\frac{7}{12}$$

Add or subtract.

3. $\frac{5}{6} + \frac{3}{8} =$ _____

4. $\frac{5}{9} - \frac{1}{6} =$ _____

▶ Practice With Common Denominators

Complete each statement with < or >.

5. $\frac{5}{6} \bigcirc \frac{7}{9}$

6. $\frac{5}{8} \bigcirc \frac{4}{6}$

7. $\frac{5}{7} \bigcirc \frac{3}{4}$

8. $\frac{3}{5} \bigcirc \frac{2}{3}$

Add or subtract.

9. $\frac{5}{6} + \frac{1}{4} =$ _____

10. $\frac{2}{5} + \frac{4}{7} =$ _____

11. $3\frac{4}{5} + 6\frac{2}{3} =$ _____

12. $4\frac{1}{2} + 2\frac{5}{9} =$ _____

13. $6\frac{7}{10} - 5\frac{7}{8} =$ _____

14. $3\frac{4}{5} - 1\frac{5}{6} =$ _____

15. $7\frac{2}{3} - 1\frac{3}{4} =$ _____

16. $6\frac{4}{7} - 2\frac{2}{3} =$ _____

17. A recipe calls for $\frac{1}{3}$ cup of flour. Another recipe calls for $\frac{3}{4}$ cup of flour. How much flour do you need to make both recipes? _____

CA CC Content Standards **6.NS.3, 6.NS.4**
Mathematical Practices **MP.1, MP.2, MP.3, MP.6**

Vocabulary
least common multiple

▶ Strategies for Common Denominators

1. The denominators of several pairs of fractions are shown below.

   4, 8 4, 3 4, 6 5, 10 5, 7 8, 12 6, 8 6, 12 6, 7

   List each pair of denominators beside the case that best describes it. Think about the strategy you would use to find a common denominator for the pair.

   Case A One denominator is a factor of the other. _____

   Case B The denominators have no common factors other than 1. _____

   Case C The denominators have a common factor that is not one of the numbers and is not 1. _____

▶ Least Common Multiple

2. The **least common multiple (LCM)** of two numbers is the least number that is a multiple of both numbers. Find the LCM of each pair of numbers.

   a. 4, 6 _____ b. 4, 10 _____ c. 6, 8 _____ d. 6, 9 _____

   e. 6, 10 _____ f. 8, 10 _____ g. 8, 12 _____ h. 9, 12 _____

   i. 10, 12 _____ j. 4, 8 _____ k. 3, 9 _____ l. 5, 9 _____

3. Pairs a through i represent which case? What strategy can you use to find the LCM?

   _____

4. Pairs j and k represent which case? How do you know the answer you found is the LCM?

   _____

5. Pair l represents which case? How do you know the answer you found is the LCM?

   _____

The LCM can be one of the denominators (Case A) or the product of the denominators (Case B) or a multiple of both denominators (Case C). We can always use the product of the denominators as a common denominator.

► Solve Real World Problems

Write an equation and use it to solve the problem.

Show your work.

6. In a frog-hopping contest, the frog that hops farthest in two hops wins. On the second hop, your frog hops $\frac{3}{8}$ yard. He hopped a total of $\frac{15}{16}$ yard. How long was his first hop?

7. The planning committee for a class party bought 6.5 liters of juice. After the party, they had 2.75 liters left. How much juice did the class drink at the party?

8. Diana and James are painting a room together. Diana paints $\frac{1}{3}$ of the room and James paints $\frac{1}{4}$ of the room. How much of the room have they painted?

9. A carpenter cuts a piece 0.75 meters long from a board. The remaining board is 1.5 meters long. How long was the board before the carpenter cut it?

10. A teacher brought some colored beads to class. During class, her students used $1\frac{2}{9}$ bags of beads. The teacher was left with $1\frac{5}{6}$ bags. How many bags of beads did she bring to class?

11. Pedro wrote a math riddle for his friends.

Guess my number, I'll tell you more:
Subtract me from $6\frac{5}{8}$, and you'll get four!

What is Pedro's number?

PATH to FLUENCY Mixed Practice

Add.

12. $0.04 + 0.1 =$ _____

13. $\frac{2}{3} + 1\frac{2}{9} =$ _____

14. $\frac{3}{7} + \frac{1}{7} =$ _____

15. $\frac{1}{5} + \frac{1}{6} =$ _____

16. $1.2 + 2.03 =$ _____

17. $4\frac{5}{9} + 1\frac{5}{6} =$ _____

18. $2\frac{3}{10} + 3\frac{1}{4} =$ _____

19. $5.2 + 2.15 =$ _____

Subtract.

20. $\frac{2}{3} - \frac{1}{4} =$ _____

21. $1.4 - 0.25 =$ _____

22. $4\frac{2}{5} - 1\frac{3}{10} =$ _____

23. $1\frac{5}{6} - \frac{1}{3} =$ _____

24. $1.37 - 0.4 =$ _____

25. $3\frac{3}{10} - 2\frac{5}{8} =$ _____

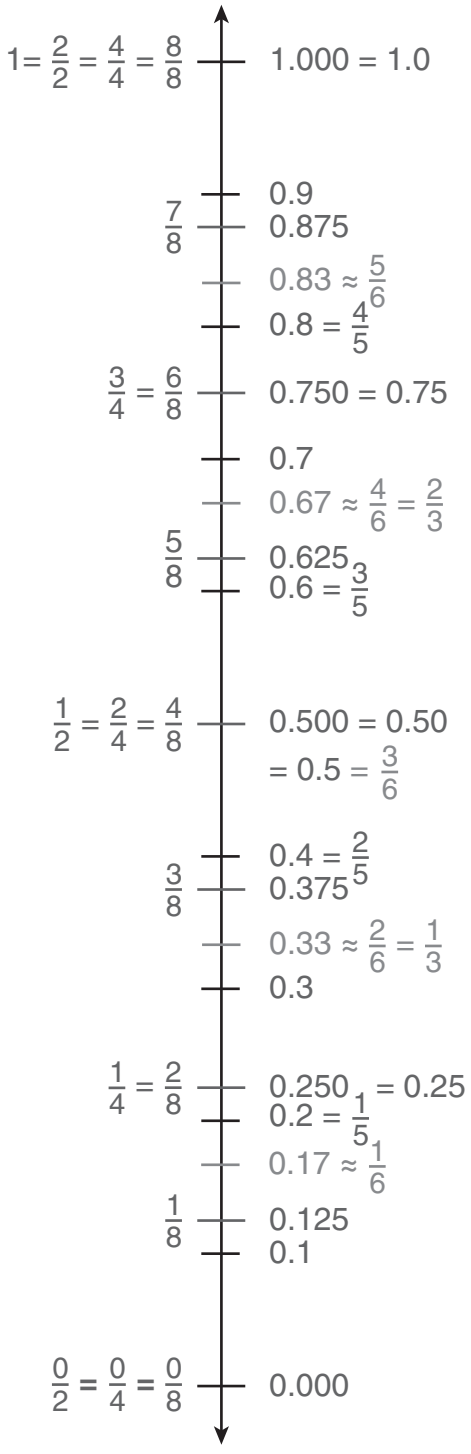
26. $\frac{8}{11} - \frac{1}{3} =$ _____

27. $5.6 - 3.04 =$ _____

3–9
Class Activity

▶ Strategies for Comparing

Look for patterns in the fractions and decimals below.



Below are general and special cases for comparing fractions and decimals.

General Cases

Case 1: Same denominator or number of places

Fraction with greater numerator is greater. $\frac{3}{5} \bigcirc \frac{4}{5}$

Ignore decimal point. Greater number is greater. $0.7 > 0.5$

Case 2: Same numerator or digits

Fraction with lesser denominator is greater. $\frac{6}{9} \bigcirc \frac{6}{8}$

Decimal with leftmost non-zero digit is greater. $0.3 \bigcirc 0.03$

Case 3: Different denominators

Find equivalent fractions with a common denominator to change fractions to Case 1. $\frac{3}{4} \bigcirc \frac{2}{3}$

Case 4: Mixed numbers

Number with greater whole number is greater. If whole numbers are the same, compare fractions using Cases 1–3. $5\frac{1}{8} \bigcirc 2\frac{9}{10}$ $4.7 > 4.07$

Special Cases for Fractions

Case 5: Denominators are factors of 10 or 100.

Compare the decimal equivalents. $\frac{3}{5} \bigcirc \frac{4}{10}$

Case 6: One fraction $> \frac{1}{2}$. One fraction $< \frac{1}{2}$.

Fraction $> \frac{1}{2}$ is greater. $\frac{5}{8} \bigcirc \frac{3}{7}$

Use strategies to compare.

28. $0.76 \bigcirc 0.67$ **29.** $\frac{2}{3} \bigcirc \frac{7}{12}$ **30.** $1\frac{1}{2} \bigcirc 1\frac{2}{5}$

31. $\frac{5}{8} \bigcirc \frac{5}{6}$ **32.** $0.09 \bigcirc 0.1$ **33.** $\frac{4}{9} \bigcirc \frac{3}{5}$

3–10
Class Activity

CA CC Content Standards **6.NS.1, 6.NS.3, 6.NS.4**
Mathematical Practices **MP.1, MP.2, MP.3, MP.4, MP.6, MP.7, MP.8**

▶ Multiplying by Fractions and Decimals Less than 1

Example 1

A. $0.1 \bullet 4 = 0.1(1 + 1 + 1 + 1) = 0.1 + 0.1 + 0.1 + 0.1 = 0.4 = 4 \div 10$

$\frac{1}{10} \bullet 4 = \frac{1}{10}(1 + 1 + 1 + 1) = \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} = \frac{4}{10} = 4 \div 10$

B. $0.2 \bullet 4 = 2 \bullet 0.1 \bullet 4 = 2 \bullet 0.4 = 0.8$ So, $0.2 \bullet 4 = (4 \div 10) \bullet 2$.

$\frac{2}{10} \bullet 4 = 2 \bullet \frac{1}{10} \bullet 4 = 2 \bullet \frac{4}{10} = \frac{8}{10}$ So, $\frac{2}{10} \bullet 4 = (4 \div 10) \bullet 2$.

Example 2

Remember, any whole number can be written as a fraction that has a denominator of 1. So, $4 = \frac{4}{1}$ and $w = \frac{w}{1}$.

A. $\frac{1}{d} \bullet w = \frac{1 \bullet w}{d \bullet 1} = w \div d = \frac{w}{d}$

$\frac{1}{3} \bullet 4 = \frac{1 \bullet 4}{3 \bullet 1} = 4 \div 3 = \frac{4}{3}$

$\frac{1}{3}$ of 4 rectangles is $\frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{4}{3}$.

B. $\frac{n}{d} \bullet w = \frac{n \bullet w}{d \bullet 1} = \frac{n \bullet w}{d}$

$\frac{2}{3} \bullet 4 = \frac{2 \bullet 4}{3 \bullet 1} = 8 \div 3 = \frac{8}{3}$

$\frac{2}{3}$ of 4 rectangles is $\frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} = \frac{8}{3}$.

C. $w \bullet \frac{n}{d} = \frac{w \bullet n}{1 \bullet d} = \frac{w \bullet n}{d}$

$4 \bullet \frac{2}{3} = \frac{4 \bullet 2}{3} = \frac{8}{3}$

4 groups of $\frac{2}{3}$ is $\frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} = \frac{8}{3}$.

Multiplying a number *n* by a fraction less than 1 produces a product less than *n* because only part of *n* is being taken.

3–10
Class Activity

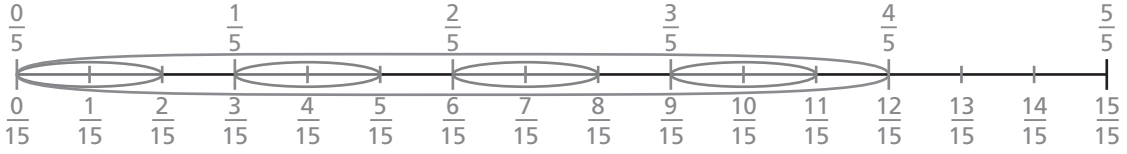
▶ Multiplying Fractions

Example

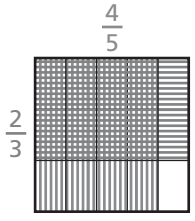
$\frac{a}{b} \bullet \frac{c}{d} = \frac{a \bullet c}{b \bullet d}$ $\quad\quad$ $\frac{2}{3} \bullet \frac{4}{5} = \frac{2 \bullet 4}{3 \bullet 5} = \frac{8}{15}$

Here are two different ways to model the product of $\frac{2}{3}$ and $\frac{4}{5}$.

Ginny's Model "I use a number line. First I model $\frac{4}{5}$ (red loop), and then I separate each fifth into 3 equal parts, or thirds (green tick marks). This makes 15 equal parts altogether. Then I take $\frac{2}{3}$ of each fifth (blue loops), which is $\frac{8}{15}$."

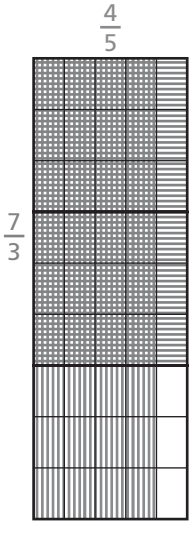


Taylor's Model "I use an area model. First, I model $\frac{4}{5}$ by dividing the area of a square into fifths and shading 4 of them red. To find $\frac{2}{3}$ of those 4 fifths, I divide the area into thirds and shade 2 of them blue. The whole area is divided into fifteenths, and there are 8 fifteenths in which the shading overlaps."



$\frac{2}{3} \bullet \frac{4}{5} = \frac{2 \bullet 4}{3 \bullet 5} = \frac{8}{15}$

1. Explain how the model at the right shows $\frac{7}{3} \bullet \frac{4}{5}$.



$\frac{7}{3} \bullet \frac{4}{5} = \frac{7 \bullet 4}{3 \bullet 5} = \frac{28}{15} = 1\frac{13}{15}$

▶ Multiplying in Different Cases

Multiply.

2. $\frac{5}{8} \bullet 9 =$ _____

3. $\frac{3}{4} \bullet 6 =$ _____

4. $\frac{2}{5} \bullet 10 =$ _____

5. $12 \bullet \frac{5}{6} =$ _____

6. $4 \bullet \frac{2}{7} =$ _____

7. $7 \bullet \frac{4}{9} =$ _____

8. $\frac{3}{5} \bullet \frac{5}{9} =$ _____

9. $\frac{5}{6} \bullet \frac{1}{3} =$ _____

10. $\frac{3}{7} \bullet \frac{1}{8} =$ _____

11. $\frac{1}{2} \bullet \frac{1}{5} =$ _____

12. $\frac{3}{8} \bullet \frac{2}{6} =$ _____

13. $\frac{4}{9} \bullet \frac{5}{7} =$ _____

14. $2\frac{3}{5} \bullet 4\frac{2}{3} =$ _____

15. $3\frac{1}{3} \bullet 4\frac{2}{5} =$ _____

16. $1\frac{2}{7} \bullet 2\frac{3}{8} =$ _____

17. Judy has a $\frac{4}{5}$-liter bottle of juice. Fuchang's bottle of juice contains $\frac{2}{3}$ as much as Judy's bottle.

   a. Does Fuchang have more or less juice than Judy? How do you know?

   _____

   b. How much juice does he have? Which operation did you use?

   _____

   c. How much more or less juice does he have? Which operation did you use to decide?

   _____

3–10
Class Activity

▶ What's the Error?

Dear Math Students,

I am going to make turkey burgers for a barbecue. I'll use $\frac{1}{4}$ pound of turkey for each burger. Since I want to make 6 burgers, I'll need to buy $\frac{1}{24}$ pound of turkey. Does that sound reasonable? Or what mistake did I make?

Your friend,

Puzzled Penguin

18. Write a response to Puzzled Penguin.

Dear Math Students,

I am planting a flower garden! The space I have to plant in is $3\frac{1}{2}$ feet wide and $4\frac{1}{2}$ feet long. I told my friend that the area of my flower garden is $12\frac{1}{4}$ square feet. She says I've made a mistake! Can you help me find my mistake, and the correct area?

Your friend,

Puzzled Penguin

19. Write a response to Puzzled Penguin.

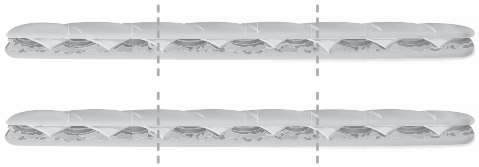
3–11 Class Activity

CA CC Content Standards **6.NS.1, 6.NS.4**
Mathematical Practices **MP.2, MP.3, MP.6, MP.8**

▶ Divide with Unit Fractions

Complete the statements.

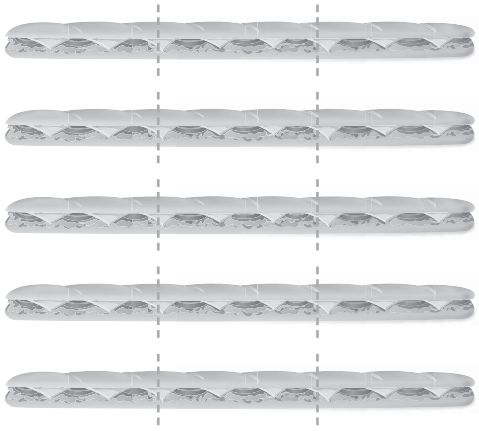
1. Three friends divide 2 submarine sandwiches equally. What part of a sandwich does each friend receive?



$2 \div 3 = \frac{1}{3} \bullet 2 = \frac{1}{3}(1 + 1) = \frac{1}{3} + \frac{1}{3} =$ _____

Each friend receives _____ of a sandwich.

2. If the three friends divide 5 sandwiches equally, what part of a sandwich will each friend receive?

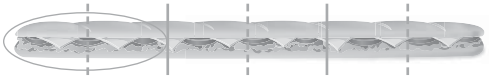


$5 \div 3 = \frac{1}{3} \bullet 5 = \frac{1}{3}(1 + 1 + 1 + 1 + 1)$

$= \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} =$ _____

Each friend receives _____ sandwiches.

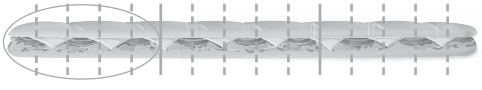
3. Sasha has $\frac{1}{3}$ of a sandwich. He divides it into 2 equal parts and gives one part to his sister. What part of a sandwich does his sister receive?



$\frac{1}{3} \div 2 = \frac{1}{3} \bullet \frac{1}{2} =$ _____

His sister receives _____ of a sandwich.

4. If Sasha divided the $\frac{1}{3}$ of a sandwich into 5 equal parts, what part of a sandwich would each part represent?



$\frac{1}{3} \div 5 = \frac{1}{3} \bullet \frac{1}{5} =$ _____

Each part would represent _____ of a sandwich.

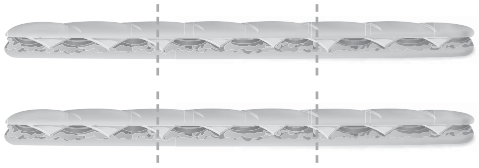
3–11
Class Activity

Vocabulary

reciprocal

▶ Divide with Unit Fractions (continued)

5. How many $\frac{1}{3}$ sandwiches are in 2 sandwiches?

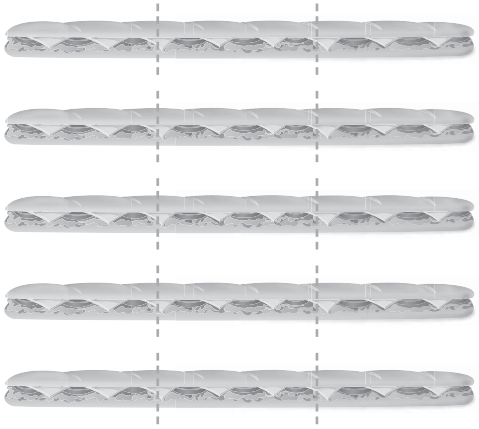


$2 \div \frac{1}{3} = 2 \bullet 3 =$ _____

There are three $\frac{1}{3}$ sandwiches in *each* sandwich because $1 = \frac{3}{3}$.

So, there are _____ $\frac{1}{3}$ sandwiches altogether.

6. How many $\frac{1}{3}$ sandwiches are in 5 sandwiches?



$5 \div \frac{1}{3} = 5 \bullet 3 =$ _____

There are three $\frac{1}{3}$ sandwiches in each sandwich because $1 = \frac{3}{3}$.

So, there are _____ $\frac{1}{3}$ sandwiches altogether.

You just explored three cases of division:

Case 1: If w and d are whole numbers, then $w \div d = w \bullet \frac{1}{d}$.

Case 2: If w is a whole number and $\frac{1}{d}$ is a unit fraction, then $\frac{1}{d} \div w = \frac{1}{d} \bullet \frac{1}{w}$.

Case 3: If w is a whole number and $\frac{1}{d}$ is a unit fraction, then $w \div \frac{1}{d} = w \bullet d$.

The **reciprocal** of a fraction $\frac{a}{b}$ is $\frac{b}{a}$. (So, the reciprocal of whole number w, or $\frac{w}{1}$, is $\frac{1}{w}$.)

> To divide a unit fraction by a whole number or a whole number by a unit fraction, multiply by the reciprocal of the divisor.

▶ Divide with Unit Fractions (continued)

Write the reciprocal of the divisor to make each statement true.

7. $3 \div 4 = 3 \bullet$ _____

8. $10 \div 2 = 10 \bullet$ _____

9. $\frac{1}{6} \div 5 = \frac{1}{6} \bullet$ _____

10. $\frac{1}{3} \div 8 = \frac{1}{3} \bullet$ _____

11. $4 \div \frac{1}{9} = 4 \bullet$ _____

12. $7 \div \frac{1}{2} = 7 \bullet$ _____

▶ Divide in Different Cases

Divide. Look at the Fraction Poster for help.

13. $5 \div 7 =$ _____

14. $\frac{1}{4} \div 2 =$ _____

15. $8 \div \frac{1}{2} =$ _____

16. $\frac{1}{3} \div 6 =$ _____

17. $9 \div 10 =$ _____

18. $7 \div \frac{1}{9} =$ _____

19. $12 \div \frac{1}{4} =$ _____

20. $\frac{1}{5} \div 5 =$ _____

21. $6 \div 11 =$ _____

22. $\frac{1}{8} \div 12 =$ _____

23. $3 \div 2 =$ _____

24. $9 \div \frac{1}{5} =$ _____

25. $7 \div 3 =$ _____

26. $8 \div \frac{1}{6} =$ _____

27. $\frac{1}{3} \div 9 =$ _____

28. $1 \div 8 =$ _____

29. $\frac{1}{6} \div 3 =$ _____

30. $16 \div 4 =$ _____

31. $\frac{1}{4} \div 11 =$ _____

32. $2 \div \frac{1}{5} =$ _____

33. $6 \div \frac{1}{2} =$ _____

▶ Solve Word Problems

34. Greenie the grasshopper hopped 3 meters in the length of time it took Tiny the ant to crawl $\frac{1}{5}$ meter. Greenie hopped how many times as far as Tiny crawled? Explain your answer.

35. Tiny crawled how many times as far as Greenie hopped? Explain your answer.

▶ What's the Error?

Dear Math Students,

The problem below was marked wrong on my math quiz.

$$\frac{1}{3} \div 4 = \frac{3}{1} \bullet 4 = \frac{3}{1} \bullet \frac{4}{1} = \frac{12}{1} = 12$$

Can you describe my mistake and explain how I can find the correct quotient? Thank you.

Your friend,
Puzzled Penguin

36.

CA CC Content Standards **6.NS.1**
Mathematical Practices **MP.1, MP.3, MP.6, MP.8**

► Is it Multiplication or Division?

Name the operation needed to solve the problem, and predict the size of the result. Then solve.

1. Sujita makes 6 quarts of lemonade to sell at her lemonade stand. Her friend Tess makes $\frac{2}{3}$ as much lemonade. Does Tess make more or less lemonade than Sujita?

   _____

   _____

   Find the amount of lemonade Tess makes. _____

2. A tractor loader has a capacity of $\frac{1}{7}$ ton, and will be used to move 2 tons of topsoil. Will the loader be filled fewer or more than 2 times?

   _____

   _____

   How many times will the loader be filled? _____

3. An artist can paint 3 decorative boxes per hour. One day, she painted for $\frac{1}{2}$ hour. Did she paint more or fewer than 3 boxes?

   _____

   _____

   Find the number of boxes the artist painted. _____

4. Anthony rides his bike 2 miles. Stephen rides his bike $\frac{1}{3}$ mile. Does Anthony ride more or less than twice as far as Stephen?

   _____

   _____

   Find how many times as far Anthony rides. _____

▶ Greater Than or Less Than?

Multiplying by a fraction less than 1 gives a lesser answer.
Dividing by a fraction less than 1 gives a greater answer.

Multiply or divide.

5. $8 \div 10 =$ _____

6. $4 \bullet \frac{1}{2} =$ _____

7. $\frac{2}{3} \bullet \frac{1}{6} =$ _____

8. $\frac{3}{4} \bullet \frac{3}{4} =$ _____

9. $5 \div \frac{1}{3} =$ _____

10. $\frac{1}{4} \div 7 =$ _____

11. $\frac{5}{3} \bullet \frac{3}{6} =$ _____

12. $7 \div 3 =$ _____

13. $10 \div \frac{1}{5} =$ _____

14. $\frac{5}{8} \bullet \frac{2}{3} =$ _____

15. $\frac{3}{4} \bullet \frac{2}{6} =$ _____

16. $\frac{1}{3} \div 10 =$ _____

17. $3\frac{1}{2} \bullet 5 =$ _____

18. $4 \bullet 1\frac{2}{3} =$ _____

19. $5 \div 4 =$ _____

20. $6 \div \frac{1}{9} =$ _____

21. $3\frac{5}{8} \bullet 2\frac{1}{3} =$ _____

22. $1\frac{2}{5} \bullet 3\frac{1}{3} =$ _____

23. $8 \div 11 =$ _____

24. $\frac{1}{3} \div 6 =$ _____

25. $12 \div \frac{1}{4} =$ _____

▶ Real World Problems

Solve. *Show your work.*

26. For a snack, the members of an after school club ate five-eighths of 24 bagels. How many bagels did the group eat?

27. One bag of seed is used to plant $\frac{1}{4}$ acre of corn. How many bags of seed are needed to plant 10 acres of corn?

28. In a staring contest, suppose you stare at your friend for 2 minutes without blinking. Your friend stares at you without blinking for $\frac{9}{10}$ of that time. How long does your friend stare?

29. A car traveled 8 miles in 8 minutes. In that same length of time, a three-toed sloth traveled $\frac{1}{5}$ mile. How many times the sloth's distance did the car travel?

30. Three-fourths of a gallon of milk remains in a jug. Six friends want to share the milk equally. How much milk does each friend receive?

31. A batch of raisin muffins requires $1\frac{1}{4}$ cups of raisins. How many cups of raisins are needed for $2\frac{1}{2}$ batches of muffins?

▶ Multiplication and Division Practice

Multiply or divide.

32. $\frac{1}{8} \div 2 =$ _____

33. $9 \div 11 =$ _____

34. $2 \bullet 3\frac{1}{2} =$ _____

35. $\frac{2}{3} \bullet \frac{6}{7} =$ _____

36. $\frac{1}{2} \bullet \frac{5}{8} =$ _____

37. $5 \div \frac{1}{5} =$ _____

38. $\frac{1}{12} \div 6 =$ _____

39. $\frac{8}{9} \bullet 3 =$ _____

40. $\frac{2}{3} \bullet 1\frac{1}{2} =$ _____

41. $\frac{1}{7} \div 3 =$ _____

42. $3 \div \frac{1}{7} =$ _____

43. $\frac{4}{5} \bullet \frac{1}{3} =$ _____

44. $\frac{1}{8} \bullet 2 =$ _____

45. $5 \bullet \frac{1}{3} =$ _____

46. $6 \div 5 =$ _____

47. $8 \div \frac{1}{4} =$ _____

48. $\frac{3}{7} \bullet \frac{1}{12} =$ _____

49. $1\frac{1}{3} \bullet 2\frac{1}{3} =$ _____

50. $\frac{1}{10} \div 3 =$ _____

51. $4 \div \frac{1}{3} =$ _____

52. $\frac{6}{7} \bullet \frac{3}{5} =$ _____

CA CC Content Standards **6.NS.1**
Mathematical Practices **MP.1, MP.2, MP.3, MP.6, MP.7**

► Finding an Unknown Factor

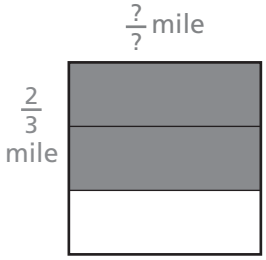
1. On Gino's farm, there is a rectangular wooded area in a cornfield. This wooded section has area $\frac{8}{15}$ square mile and is $\frac{2}{3}$ mile long. How wide is the wooded section?

We can write the division $\frac{8}{15} \div \frac{2}{3} = n$.

This is the same as the unknown-factor multiplication $\frac{2}{3} \bullet n = \frac{8}{15}$.

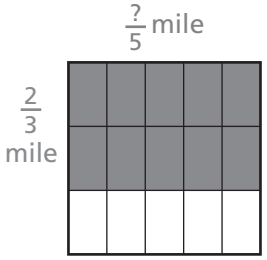
Step 1
Write an equation.

$$\frac{2}{3} \bullet \frac{?}{?} = \frac{8}{15}$$



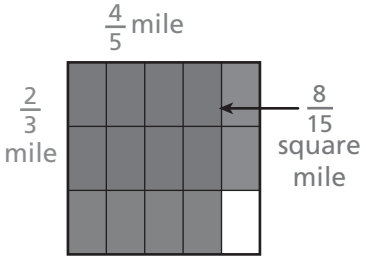
Step 2
Look at the denominators.

$$\frac{2}{3} \bullet \frac{?}{?} = \frac{8}{15}$$
$$3 \bullet 5 = 15$$
$$\frac{?}{?} = \frac{?}{5}$$



Step 3
Look at the numerators.

$$\frac{2}{3} \bullet \frac{?}{5} = \frac{8}{15}$$
$$2 \bullet 4 = 8$$
$$\frac{?}{5} = \frac{4}{5}$$



2. The mugs at a restaurant hold $\frac{2}{3}$ cup of hot chocolate. The restaurant has $\frac{8}{15}$ cup hot chocolate left in its pot. How many servings of $\frac{2}{3}$ cup are in the pot?

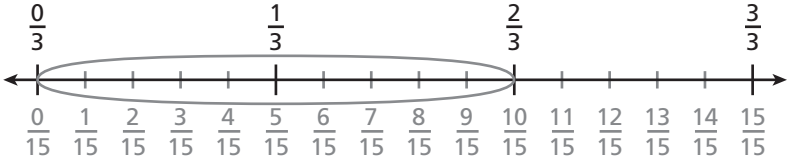
Step 1 Write an equation.

$$\frac{?}{?} \bullet \frac{2}{3} = \frac{8}{15}$$

Step 2 Look at the denominators.

Divide each $\frac{1}{3}$ into 5 equal parts to make fifteenths.

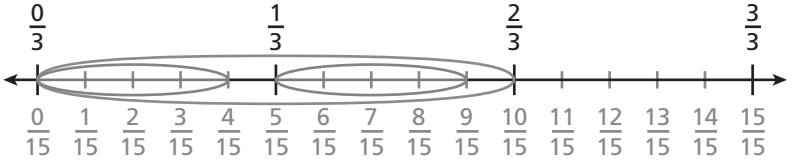
$$\frac{?}{5} \bullet \frac{2}{3} = \frac{8}{15}$$



Step 3 Look at the numerators.

Take 4 fifteenths from each of the 2 thirds to make $\frac{8}{15}$.

$$\frac{4}{5} \bullet \frac{2}{3} = \frac{8}{15}$$



3–13 Class Activity

Vocabulary

inverse operations

▶ Relating Multiplication and Division

Find the unknown factor in each equation. Then rewrite the multiplication as a division equation.

Multiplication Equation	Related Division Equation
3. $\frac{2}{3} \bullet \frac{\square}{\square} = \frac{8}{15}$	$\frac{8}{15} \div \frac{2}{3} = \frac{\square}{\square}$
4. $\frac{5}{7} \bullet \frac{\square}{\square} = \frac{15}{56}$	$\frac{15}{56} \div \frac{5}{7} = \frac{\square}{\square}$
5. $\frac{5}{8} \bullet \frac{\square}{\square} = \frac{20}{72}$	
6. $\frac{3}{4} \bullet \frac{\square}{\square} = \frac{15}{36}$	

Multiplication and division are **inverse operations** for all whole numbers, decimals, and fractions. One operation undoes the other.

$\frac{2}{5} \bullet \frac{1}{5} \div \frac{1}{5} = \frac{2}{5}$

Divide.

7. $\frac{9}{20} \div \frac{3}{5} =$ _____ 8. $\frac{16}{45} \div \frac{2}{9} =$ _____ 9. $\frac{6}{45} \div \frac{2}{9} =$ _____

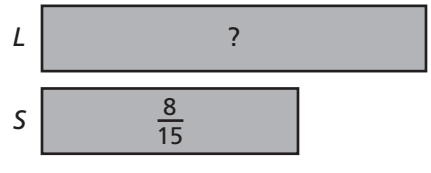
The products in each multiplication equation are simplified. Find the unknown factor. Then choose a related division equation to solve.

10. $\frac{2}{5} \bullet \frac{\square}{\square} = \frac{6}{20} = \frac{3}{10}$ Solve $\frac{6}{20} \div \frac{2}{5} = \frac{\square}{\square}$ or $\frac{3}{10} \div \frac{2}{5} = \frac{\square}{\square}$.

11. $\frac{3}{4} \bullet \frac{\square}{\square} = \frac{15}{24} = \frac{5}{8}$ Solve $\frac{15}{24} \div \frac{3}{4} = \frac{\square}{\square}$ or $\frac{5}{8} \div \frac{3}{4} = \frac{\square}{\square}$.

12. Shaun can hop for $\frac{8}{15}$ of a block. Shaun can hop $\frac{2}{3}$ of the distance Lisa can hop. How far can Lisa hop?

_____



$S = \frac{2}{3} \bullet L \quad L = S \div \frac{2}{3}$

3–14 Class Activity

CA CC Content Standards **6.NS.1**
Mathematical Practices **MP.2, MP.3, MP.6, MP.8**

Vocabulary
unsimplify

▶ Unsimplify to Divide

$\frac{2}{3} \div \frac{5}{7} = ?$

We cannot divide the numerator of $\frac{2}{3}$ by 5 or the denominator by 7.

To be able to divide, we need to unsimplify $\frac{2}{3}$. To **unsimplify** we rewrite it as an equivalent fraction so the numerators and denominators divide evenly.

Step 1 $\frac{2}{3} \div \frac{5}{7} = (\overbrace{\underbrace{\frac{2}{3}}_{\frac{2}{3}\text{ unsimplified}} \bullet \frac{5}{5} \bullet \frac{7}{7}}^{\frac{2}{3} \bullet 1 \bullet 1}) \div \frac{5}{7}$

Step 2 $= \frac{2 \bullet \overbrace{5 \bullet 7}^{5 \div 5 = 1}}{3 \bullet \underbrace{5 \bullet 7}_{7 \div 7 = 1}} \div \frac{5}{7}$

Step 3 $= \frac{2 \bullet 7}{3 \bullet 5}$

Step 4 $= \frac{2}{3} \bullet \frac{7}{5}$

1. How is the number you divide $\frac{2}{3}$ by in the original division problem related to the number you multiply $\frac{2}{3}$ by in the final multiplication problem?

_____

_____

2. Complete.

Step 1 $\frac{3}{8} \div \frac{2}{5} = (\overbrace{\underbrace{\frac{3}{8}}_{\frac{3}{8}\text{ unsimplified}} \bullet \frac{2}{2} \bullet \frac{5}{5}}^{\frac{3}{8} \bullet 1 \bullet 1}) \div \frac{2}{5}$

Step 2 $= \frac{3 \bullet \overbrace{2 \bullet 5}^{2 \div 2 = \_\_\_\_}}{8 \bullet 2 \bullet \underbrace{5}_{5 \div 5 = \_\_\_\_}} \div \frac{2}{5}$

Step 3 $= \frac{3 \bullet 5}{8 \bullet 2}$

Step 4 $= \frac{3}{8} \bullet \frac{\square}{\square}$

3. Complete.

Step 1 $\frac{4}{9} \div \frac{3}{8} = (\overbrace{\underbrace{\frac{4}{9}}_{\frac{4}{9}\text{ unsimplified}} \bullet \frac{3}{3} \bullet \frac{8}{8}}^{\frac{4}{9} \bullet 1 \bullet 1}) \div \frac{3}{8}$

Step 2 $= \frac{4 \bullet \overbrace{3 \bullet 8}^{3 \div 3 = \_\_\_\_}}{9 \bullet 3 \bullet \underbrace{8}_{8 \div 8 = \_\_\_\_}} \div \frac{3}{8}$

Step 3 $= \frac{4 \bullet 8}{9 \bullet 3}$

Step 4 $= \frac{4}{9} \bullet \frac{\square}{\square}$

Summary: When dividing fractions, unsimplifying the dividend and then dividing numerators and denominators is the same as multiplying by the reciprocal of the divisor. For example, $\frac{2}{3} \div \frac{5}{7} = \frac{2}{3} \bullet \frac{7}{5}$.

▶ Divide by Either Method

Divide either by dividing numerators and denominators or by multiplying by the reciprocal of the divisor.

4. $\frac{1}{10} \div \frac{2}{3}$ _____

5. $\frac{15}{12} \div \frac{5}{6}$ _____

6. $\frac{2}{3} \div \frac{3}{4}$ _____

7. $2\frac{1}{4} \div \frac{3}{4}$ _____

8. $\frac{15}{16} \div \frac{5}{4}$ _____

9. $2\frac{1}{5} \div \frac{2}{3}$ _____

10. $\frac{2}{7} \div \frac{3}{4}$ _____

11. $\frac{4}{10} \div \frac{4}{5}$ _____

12. $\frac{5}{6} \div \frac{4}{5}$ _____

13. $1\frac{3}{8} \div \frac{1}{2}$ _____

14. $\frac{18}{24} \div \frac{9}{12}$ _____

15. $2\frac{1}{4} \div 1\frac{1}{2}$ _____

16. Choose a problem from Exercises 4–15 that you solved by dividing numerators and dividing denominators. Solve it again, but this time multiply by the reciprocal of the divisor. Do you get the same answer?

_____

The following division methods give the same answer:

Method 1: Dividing numerators and dividing denominators.

Method 2: Multiplying by the reciprocal of the divisor.

CA CC Content Standards **6.NS.1**
Mathematical Practices **MP.1, MP.3, MP.6, MP.8**

▶ Divide by Multiplying by the Reciprocal

You can solve any division problem involving two fractions or a fraction and a whole number by multiplying by the reciprocal of the divisor.

You know that you can think of a division problem like this:

product ÷ known factor = unknown factor

To divide you multiply by the reciprocal of the known factor.

Think: "Flip the factor and multiply."

Study the examples and discuss them with your class.

Example 1

fraction ÷ fraction

$\frac{5}{6} \div \frac{2}{3} = \frac{5}{\cancel{6}_{2}} \bullet \frac{\cancel{3}^{1}}{2} = \frac{5}{4}$ or $1\frac{1}{4}$

Example 2

whole number ÷ unit fraction

$8 \div \frac{1}{4} = \frac{8}{1} \div \frac{1}{4} = \frac{8}{1} \bullet \frac{4}{1} = 32$

Example 3

unit fraction ÷ whole number

$\frac{1}{4} \div 8 = \frac{1}{4} \div \frac{8}{1} = \frac{1}{4} \bullet \frac{1}{8} = \frac{1}{32}$

Example 4

whole number ÷ fraction

$5 \div \frac{3}{4} = \frac{5}{1} \div \frac{3}{4} = \frac{5}{1} \bullet \frac{4}{3} = \frac{20}{3}$ or $6\frac{2}{3}$

Example 5

fraction ÷ whole number

$\frac{3}{4} \div 5 = \frac{3}{4} \div \frac{5}{1} = \frac{3}{4} \bullet \frac{1}{5} = \frac{3}{20}$

Example 6

fraction ÷ unit fraction

$\frac{2}{3} \div \frac{1}{12} = \frac{2}{\cancel{3}_{1}} \bullet \frac{\cancel{12}^{4}}{1} = 8$

Example 7

unit fraction ÷ fraction

$\frac{1}{12} \div \frac{2}{3} = \frac{1}{\cancel{12}_{4}} \bullet \frac{\cancel{3}^{1}}{2} = \frac{1}{8}$

▶ Practice Dividing Fractions

Divide using any method.

1. $\frac{3}{4} \div \frac{5}{2}$ _____

2. $\frac{3}{4} \div 5$ _____

3. $\frac{8}{25} \div \frac{4}{5}$ _____

4. $\frac{3}{4} \div \frac{1}{5}$ _____

5. $\frac{7}{8} \div \frac{5}{8}$ _____

6. $\frac{1}{21} \div \frac{1}{7}$ _____

7. $3 \div \frac{1}{7}$ _____

8. $3 \div \frac{4}{7}$ _____

Solve.

Show your work.

9. Marilla's dress had $1\frac{5}{6}$ yards of blue lace around it. Her sister Ana's dress had $\frac{3}{4}$ yard of purple lace around it. Marilla's lace is how many times as long as Ana's lace?

_____

10. Ms. Padilla divided $\frac{3}{4}$ liter of apricot juice into 5 glasses for her family. How much did each person get?

_____

11. The sixth grade garden at Sunnyside School is $\frac{4}{3}$ yards long and has an area of $\frac{8}{9}$ square yard. How wide is the garden?

_____

12. Bronwyn's prize-winning yellow zucchini is $1\frac{1}{6}$ feet long. This is $\frac{3}{4}$ the length of her prize-winning green zucchini. How long is the green zucchini?

_____

13. A pot contains $5\frac{1}{3}$ cups of oatmeal. How many $\frac{3}{4}$-cup servings is this? How much will be left over?

_____

CA CC Content Standards **6.NS.1, 6.NS.4**
Mathematical Practices **MP.1, MP.2, MP.3, MP.6, MP.8**

▶ Predict, Solve, and Check

Will each product or quotient below be greater or less than the first fraction? Circle your prediction, and then find the actual product or quotient to check your prediction.

1. $\frac{3}{4} \bullet \frac{6}{5}$ Predict: $> \frac{3}{4}$ or $< \frac{3}{4}$

   $\frac{3}{4} \bullet \frac{6}{5} =$ _____

2. $\frac{2}{3} \bullet \frac{3}{5}$ Predict: $> \frac{2}{3}$ or $< \frac{2}{3}$

   $\frac{2}{3} \bullet \frac{3}{5} =$ _____

3. $\frac{9}{10} \div \frac{6}{5}$ Predict: $> \frac{9}{10}$ or $< \frac{9}{10}$

   $\frac{9}{10} \div \frac{6}{5} =$ _____

4. $\frac{3}{10} \div \frac{2}{5}$ Predict: $> \frac{3}{10}$ or $< \frac{3}{10}$

   $\frac{3}{10} \div \frac{2}{5} =$ _____

Solve.

5. Four friends discovered $\frac{3}{4}$ of a pizza in the refrigerator and ate $\frac{2}{3}$ of it for a snack. What fraction did they eat?

   a. What fraction is $\frac{3}{4}$ being multiplied by? _____

   b. Is the fraction in Part a greater or less than 1? _____

   c. Will the product be greater or less than $\frac{3}{4}$? _____

   d. What fraction of the pizza did the friends eat? _____

6. A baker placed $4\frac{2}{3}$ cups of bread flour into small plastic containers that each had a capacity of $\frac{2}{3}$ cup. How many containers did the baker fill?

   a. What fraction is $4\frac{2}{3}$ being divided by? _____

   b. Is the fraction in Part a greater or less than 1? _____

   c. Will the quotient be greater or less than $4\frac{2}{3}$? _____

   d. How many containers did the baker fill? _____

▶ Real World Problems

Decide if you need to multiply or divide. Then solve.

Show your work.

7. Todd used $\frac{2}{3}$ cup of oatmeal for a muffin recipe. To make a different recipe, he needs only $\frac{3}{4}$ of that amount. What amount of oatmeal does the different recipe require?

8. Amelia is using a wheelbarrow to move $1\frac{1}{2}$ cubic yards of topsoil. The capacity of the wheelbarrow is $\frac{1}{6}$ cubic yard. How many wheelbarrow loads will be needed to move the soil?

9. A rectangular field measures $\frac{3}{10}$ mile by $\frac{1}{6}$ mile. In square miles, what is the area of the field?

10. A pitcher contains $\frac{7}{16}$ gallon of lemonade. How many cups, each having a $\frac{1}{12}$-gallon capacity, can be filled from the jug?

11. Carlos jogs the same route each day. The route is $3\frac{1}{4}$ miles long, and he stops to rest every $\frac{7}{8}$ mile. How many times does Carlos stop to rest during his jog?

12. Last night Julian needed $\frac{5}{12}$ hour to complete his homework. Aaliyah needed only $\frac{4}{5}$ as long. How many *minutes* did it take Aaliyah to complete her homework?

▶ Fraction Mixed Review

Solve.

Show your work.

13. The table at the right uses fractions and mixed numbers to represent the weights and costs of peaches that can be purchased at a roadside fruit stand.

Complete the table.

Weight (pounds)	Cost (dollars)
$\frac{3}{4}$	
1	$3\frac{3}{5}$
	$4\frac{1}{2}$
$1\frac{5}{8}$	

14. A triangle has a base measure of $5\frac{1}{2}$ centimeters and a height of $2\frac{1}{2}$ centimeters. What is the area of the triangle? Use a mixed number in simplest form in your answer.

_____

15. Quinn knows that the area of a triangle is $\frac{1}{18}$ square yard and its base measures $\frac{1}{9}$ yard. What is the height of the triangle?

_____

Simplify before multiplying.

16. $\frac{14}{8} \bullet \frac{32}{42} =$ _____

17. $\frac{44}{36} \bullet \frac{72}{33} =$ _____

18. $\frac{16}{24} \bullet \frac{15}{28} =$ _____

19. $\frac{14}{25} \bullet \frac{27}{32} \bullet \frac{35}{21} \bullet \frac{64}{8} =$ _____

20. $\frac{32}{18} \bullet \frac{21}{20} \bullet \frac{15}{32} \bullet \frac{8}{49} =$ _____

3–16
Class Activity

▶ What's the Error?

Dear Math Students,

To find the product at the right, I followed the steps below.

$2\frac{1}{3} \bullet 1\frac{3}{7}$

Step 1: Multiply the whole numbers. $2 \bullet 1 = 2$

Step 2: Multiply the fractions. $\frac{1}{\cancel{3}_{1}} \bullet \frac{\overset{1}{\cancel{3}}}{7} = \frac{1}{7}$

Step 3: Add the results from Step 1 and Step 2. $2 + \frac{1}{7} = 2\frac{1}{7}$

I learned that $2\frac{1}{7}$ was not the correct product. Please explain my mistake, and how I can find the correct product.

Your friend,

Puzzled Penguin

21. _____

_____

_____

Dear Math Students,

To find the quotient at the right, I followed the steps below.

$3\frac{3}{4} \div 1\frac{1}{3}$

Step 1: Change the mixed numbers to fractions. $3\frac{3}{4} = \frac{15}{4}$ and $1\frac{1}{3} = \frac{4}{3}$

Step 2: Multiply the fractions. $\frac{\overset{5}{\cancel{15}}}{\underset{1}{\cancel{4}}} \bullet \frac{\overset{1}{\cancel{4}}}{\underset{1}{\cancel{3}}} = \frac{5}{1} = 5$

I was told that 5 is not the correct quotient. Please explain my mistake, and how I can find the correct quotient.

Your friend,

Puzzled Penguin

22. _____

_____

_____

CA CC Content Standards **6.NS.1**
Mathematical Practices **MP.1**

▶ Review Operations with Fractions and Decimals

To add, subtract, or compare fractions and decimals, use $1 = \frac{D}{D}$ to make equivalent fractions or decimals with the same denominator.

$\frac{2}{3} + \frac{4}{5} = \frac{5}{5} \bullet \frac{2}{3} + \frac{3}{3} \bullet \frac{4}{5} = \frac{10}{15} + \frac{12}{15} = \frac{22}{15}$

$0.2 + 0.04 = 0.20 + 0.04 = 0.24$

$\frac{2}{10} \bullet \frac{10}{10} = \frac{20}{100}$

$\frac{4}{5} - \frac{2}{3} = \frac{3}{3} \bullet \frac{4}{5} - \frac{5}{5} \bullet \frac{2}{3} = \frac{12}{15} - \frac{10}{15} = \frac{2}{15}$

$0.2 - 0.04 = 0.20 - 0.04 = 0.16$

To multiply fractions, multiply the numerators and multiply the denominators.

$\frac{2}{3} \bullet \frac{4}{5} = \frac{8}{15}$

To multiply decimals, multiply the numbers and count decimal places in the factors to place the decimal point in the product.

$0.2 \bullet 0.4 = 0.08$

$\frac{2}{10} \bullet \frac{4}{10} = \frac{8}{100}$

To divide fractions, divide the numerators and divide the denominators or multiply by the reciprocal.

$\frac{8}{15} \div \frac{2}{3} = \frac{8 \div 2}{15 \div 3} = \frac{4}{5}$

$\frac{8}{15} \div \frac{2}{3} = \frac{8}{15} \bullet \frac{3}{2} = \frac{24}{30}$ or $\frac{4}{5}$

To divide decimals, unsimplify using $1 = \frac{D}{D}$ to make the divisor a whole number, or move the decimal points the same number of places.

$0.08 \div 0.2 = \frac{0.08}{0.2} \bullet \frac{10}{10} = \frac{0.8}{2} = 0.4$

$0.2\overline{)0.08} = 0.4$

Simplify.

1. $\frac{3}{4} + \frac{5}{8}$ _____

2. $\frac{5}{6} \bullet \frac{2}{3}$ _____

3. $3\frac{7}{8} - \frac{1}{2}$ _____

4. $7.6 - 1.81$ _____

5. $2.29 + 0.8$ _____

6. $5.2 \bullet 1.5$ _____

7. $1\frac{2}{5} + \frac{7}{8}$ _____

8. $0.27 \div 0.6$ _____

9. $\frac{1}{3} + 6\frac{7}{10}$ _____

▶ Choose the Operation

Write and solve an equation. *Show your work.*

10. Hala can ride her bike $7\frac{1}{2}$ miles in an hour. How far will she ride in 3 hours? How far will she ride in $\frac{2}{3}$ of an hour?

11. Jonny can throw a baseball $30\frac{1}{3}$ yards. Joey can throw a baseball $33\frac{1}{2}$ yards. How much farther can Joey throw?

12. Eryn's rabbit eats $\frac{5}{16}$ pound of food each day. Eryn buys food in 5-pound bags. How many days of food are in a bag?

13. Marcus has soccer practice for 9 hours each week. Luis spends $\frac{5}{6}$ as much time practicing soccer. How much time each week does Luis spend practicing?

14. In a long jump competition, Stacey jumped 10 feet, which was 0.75 foot farther than Reggie jumped. How far did Reggie jump?

15. Evan bought $\frac{3}{8}$ pound of sunflower seeds and $\frac{3}{16}$ pound of thistle seeds for his bird feeder. How many pounds of seeds did he buy?

16. Casandra's fish bowl holds 0.9 gallon. The bowl is $\frac{3}{4}$ full. How much water is in the bowl?

17. Ty practices trumpet for $1\frac{2}{3}$ hours every day. He plays scales every $\frac{1}{3}$ hour. How often during a practice does Ty play scales?

3–18
Class Activity

CA CC Content Standards **6.NS.1, 6.NS.3**
Mathematical Practices **MP.2, MP.4, MP.5, MP.7**

▶ Math and the Stock Market

Many people save for retirement by making investments. One example of an investment is to buy shares of stock in a company. Companies use the money they receive from the sale of stock for operating expenses. Most companies have operating expenses of millions or billions of dollars.

When you buy shares of stock in a company, you become a shareholder, which is a part-owner of the company. Shares of stock are bought and sold on a stock exchange like the one shown at the right.

The following terms and definitions are related to buying and selling shares of stock.

Dividend A portion of a company's profits that are paid to shareholders. Dividends are often paid quarterly.

Sales The number of shares sold that day.

High The highest price per share that day.

Low The lowest price per share that day.

Last The price per share for the last sale of the day.

Change The increase or decrease from the price at the end of the previous day.

Stock prices can be given as fractions or decimals.

Name	Dividend	Sales	High	Low	Last	Change
Alphabet Foods	–	72,500	\$6.44	\$6.39	\$6.44	$^{+}$\$0.02
Colossal Corp.	\$0.30	440,000	$14\frac{5}{8}$	$14\frac{1}{4}$	$14\frac{1}{2}$	$^{-}\frac{1}{8}$

▶ Buying Stocks

The table below shows the cost of one share of the stock of two different companies.

Company Name	Monday Price	Tuesday Price	Wednesday Price	Thursday Price	Friday Price
Exploration Inc.	$8\frac{1}{4}$	$8\frac{1}{8}$	$8\frac{5}{8}$	$8\frac{1}{2}$	$8\frac{3}{4}$
Miles of Styles	$12.04	$12.03	$12.05	$12.02	$11.98

1. Suppose you purchase 125 shares of each company's stock on Monday. Write an equation that represents the cost (c) of each purchase in dollars. Then solve each equation.

2. Find the change in price for a share of each company's stock during the times shown below. Write + to indicate an increase in price and write − to indicate a decrease.

   a. from Monday to Tuesday _____

   b. from Tuesday to Wednesday _____

   c. from Wednesday to Thursday _____

   d. from Thursday to Friday _____

3. Suppose you sell your 125 shares on Friday. Calculate the amount of money you should receive for each stock. Did you earn a profit, or lose money?

4. Suppose you had purchased 12,500 shares of each company's stock instead of 125. How would your profit or loss for each stock change? Use a calculator to help decide.

Select all that apply.

1. $2\overline{)629}$

   (A) 213

   (B) 314 R1

   (C) 314.5

   (D) 345

2. $25\overline{)2{,}515}$

   (A) 55

   (B) 95.6

   (C) 100.6

   (D) 100 R15

3. Is the problem below a multiplication or a division problem? Explain your answer.

   The rectangular floor of a playpen has an area of 14 square feet. One measure of the floor is $3\frac{1}{2}$ feet. What is the other measure?

4. Select True or False for each statement.

   4a. $0.9 \div 7.5 = 0.12$ ○ True ○ False

   4b. $63.2 \div 8 = 7.8$ ○ True ○ False

   4c. $72.8 \div 5.2 = 1.4$ ○ True ○ False

   4d. $7 \div 0.35 = 20$ ○ True ○ False

Name _____ Date _____

5. Without doing any computation, predict if the quotient 73 ÷ 0.42 will be greater than or less than the product 0.42 • 73. Explain your reasoning in terms of the size of 0.42.

Use the numbers and the decimal point (if needed) to write the product. Each tile may be used more than once.

0	1	2	4
6	7	8	.

6. $\begin{array}{r} 0.4 \\ \times 0.3 \\ \hline \end{array}$

7. $\begin{array}{r} 0.06 \\ \times 12 \\ \hline \end{array}$

8. The fraction pairs in the table are not equivalent. Find the LCM for each fraction pair. Rewrite each pair as an equivalent fraction pair using the LCM as the denominator.

Fraction Pair	$\frac{2}{7}, \frac{1}{3}$	$\frac{5}{12}, \frac{3}{4}$	$\frac{7}{10}, \frac{4}{15}$
LCM			
Equivalent Fraction Pair			

Multiply. Write the product.

9. $\begin{array}{r} 5.8 \\ \times\ 2.5 \\ \hline \end{array}$

Product: _____

10. $\begin{array}{r} 2.9 \\ \times\ 0.81 \\ \hline \end{array}$

Product: _____

Find the sum or difference. Select one number from each column to make the equation true.

11. $\frac{3}{8} + \frac{7}{8} =$ ☐

whole number	fraction
○ 0	○ $\frac{5}{8}$
○ 1	○ $\frac{4}{5}$
○ 2	○ $\frac{1}{4}$
○ 3	○ $\frac{3}{4}$

12. $\frac{7}{9} + \frac{5}{6} =$ _____

whole number	fraction
0	$\frac{3}{7}$
1	$\frac{7}{9}$
2	$\frac{11}{13}$
3	$\frac{11}{18}$

Write a number in the box to make the equation true.

13. $3\frac{2}{5} -$ ☐ $= 1\frac{1}{2}$

14. ☐ $- 1.78 = 0.82$

15. George calculated a sum of $\frac{15}{24}$.

Which fractions are equivalent to $\frac{15}{24}$? Choose all that apply.

- (A) $\frac{10}{16}$
- (B) $\frac{5}{6}$
- (C) $\frac{7}{12}$
- (D) $\frac{5}{8}$
- (E) $\frac{3}{8}$
- (F) $\frac{30}{48}$

16. Read the division problem below. Then select True or False for each statement.

$\frac{3}{4} \div 7 = \square$

16a. To find the quotient, first find a common denominator. ○ True ○ False

16b. The quotient will be less than $\frac{3}{4}$. ○ True ○ False

16c. You will need to simplify the quotient. ○ True ○ False

Draw a line to match each missing numerator or denominator to its value. You will not use all of the choices.

17. $\frac{3}{5} \bullet \frac{\square}{\square} = \frac{6}{35}$

18. $\frac{1}{4} \bullet \frac{\square}{\square} = \frac{3}{20}$

2	3	4	5	6	7

Choose the expressions that make the equation true. Select all that apply.

19. $\frac{8}{15} \div \frac{4}{5} =$ _____

Ⓐ $\frac{1}{3}$

Ⓑ $\frac{2}{3}$

Ⓒ $\frac{20}{60}$

Ⓓ $\frac{40}{60}$

20. $1\frac{5}{8} \div 1\frac{1}{2} =$ _____

Ⓐ $2\frac{7}{16}$

Ⓑ $\frac{39}{16}$

Ⓒ $\frac{26}{24}$

Ⓓ $1\frac{1}{12}$

Name _____ Date _____

21. Seth wrote an expression that simplifies to 0.36.

Choose Yes or No to indicate if the expression has a value of 0.36.

21a.	$36 \bullet 0.01$	○ Yes	○ No
21b.	$3.6 \bullet 0.1$	○ Yes	○ No
21c.	$3.6 \div 0.1$	○ Yes	○ No
21d.	$0.036 \div 0.01$	○ Yes	○ No

22. Darnell has two scraps of cloth. The first scrap is 3.75 cm in length. The second scrap is $\frac{1}{5}$ as long as the length of the first.

Part A

What is the total length of the scraps? Show your work.

_____ cm

Part B

Answer the following question without making a calculation. Explain how you know the answer.

If Darnell's second scrap was $\frac{1}{3}$ as long as the first, would the total length of the scraps be greater than or less than the answer you found in Part A?

Name _____ Date _____

23. Lydia has $8\frac{1}{2}$ cups of juice to serve.

Part A

If each serving is $\frac{3}{4}$-cup, how many full servings can she make? What amount of juice, if any, will be left over? Show your work.

_____ servings

_____ leftover

Part B

If she needs 15 servings, how much more juice does she need?

Ⓐ $2\frac{1}{4}$ cups Ⓑ 3 cups Ⓒ $2\frac{3}{4}$ cups Ⓓ 4 cups

Part C

Lydia decides to make each serving of juice $\frac{5}{8}$-cup. Without calculating, predict if she can make more full servings or fewer full servings using the $8\frac{1}{2}$ cups of juice. Explain your choice. Then confirm your prediction.

Predict:

Confirm:

24. Dana's dog Skippy weighs 20.4 pounds. In comparison, her cat Bruiser weighs 0.75 as much as Skippy.

24a. Does Bruiser weigh more or less than Skippy? Explain.

24b. How much does Bruiser weigh?

_____ pounds