EXAMPLE 1 👁 Add Decimals
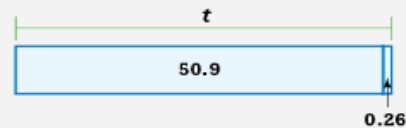
Kim and Martin swam 50 meters. Martin took 0.26 second longer than Kim. What was Martin's time in the race?

Be Precise Why is precision important when working with decimals?

Kim's time: 50.9 seconds

Martin's time: 0.26 second longer
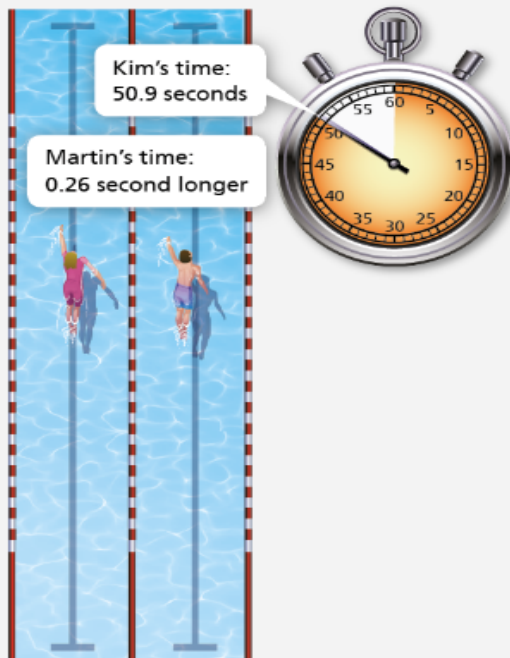
Find $50.9 + 0.26$.

Estimate first by rounding each addend.

50.9 rounds to 51.   0.26 rounds to 0.3.

$51 + 0.3 = 51.3$

Find the sum.

$$\begin{array}{r} 50.90 \\ + \ 0.26 \end{array}$$

Annex a zero so each place has a digit.

Remember to line up the place values to add.

Add each place.

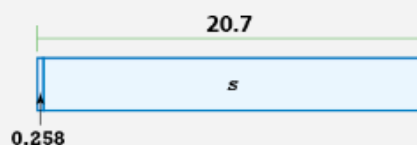$$\begin{array}{r} \overset{1}{5}0.90 \\ + \ 0.26 \\ \hline 51.16 \end{array}$$

You can regroup the sum of nine tenths and two tenths.

Martin swam the race in 51.16 seconds. The sum 51.16 is close to the estimate, 51.3.

EXAMPLE 2 ✋ Subtract Decimals

Amy ran a race in 20.7 seconds. Katie finished the race 0.258 second before Amy. How long did it take Katie to run the race?

Find $20.7 - 0.258$.

Estimate the difference by rounding.

$20.7 - 0.3 = 20.4$

0.258 rounds to 0.3.

To find the difference, line up the place values.

$$\begin{array}{r} 20.700 \\ - \ 0.258 \end{array}$$ ····· Annex zeros as placeholders.

Subtract each place. Regroup as needed.

$$\begin{array}{r} 20.7\overset{6}{\cancel{0}}\overset{10}{\cancel{0}}\overset{10}{\cancel{0}} \\ - \ 0.258 \\ \hline 20.442 \end{array}$$

Katie ran the race in 20.442 seconds. 20.442 is close to the estimate, 20.4, so the answer is reasonable.

EXAMPLE 3 ☝ **Multiply Decimals**

What is the area of this antique map? Use the formula $A = \ell w$ to find the area of the map.

Multiply as you would with whole numbers. Then place the decimal point in the product. Annex zeros if needed. The number of decimal places in the product is the sum of the number of decimal places in the factors.

3.25	2 decimal places (hundredths)
× 2.5	1 decimal place (tenths)
1625	
+ 6500	
8.125	3 decimal places (tenths times hundredths equals thousandths)

The area of the antique map is 8.125 ft².

2.5 ft

3.25 ft

Practice & Problem Solving

In 19–27, find each sum or difference.

19. 2.17 − 0.8

20. 4.3 + 4.16

21. 46.91 − 28.7

22. 4.815 + 2.17

23. 5.1 − 0.48

24. 27 + 0.185

25. 9.501 − 9.45

26. 14 + 9.8

27. 12.65 + 14.24

In 28–33, find each product.

28. 7 × 0.5

29. 12 × 0.08

30. 24 × 0.17

31. 0.4 × 0.17

32. 1.9 × 0.46

33. 3.42 × 5.15

EXAMPLE 3 — Divide Decimals

Use the division algorithm to divide with decimals.

A. Find $809.40 ÷ 12.

$809.40

| n | n | n | n | n | n | n | n | n | n | n | n |

Use compatible numbers to estimate, and then divide to solve.

809.40 is close to 840, and $840 ÷ 12 = 70$.

> Place the decimal point in the quotient above the decimal point in the dividend.

```
        67.45
  12)809.40
     -72↓
       89
      -84↓
       54
      -48↓
       60
      -60
        0
```

> The quotient 67.45 is close to the estimate of 70, so the answer is reasonable.

B. Find $4.20 ÷ $1.40.

$4.20

$1.40   n

Multiply both the divisor and the dividend by the same **power of 10** that will make the divisor a whole number.

Multiply 1.40 and 4.20 by 10^2 or 100.

```
               3
1.40)4.20   140)420
              -420
                0
```

> Divide. Place a decimal point in the quotient if needed.

$4.20 ÷ $1.40 = 3

In 16–19, divide. Record remainders.

16. 2,593 ÷ 21

17. 19)6,927

18. 9)2,483

19. 968 ÷ 38

In 20–23, divide. Write remainders as decimals.

20. 5)56

21. 232 ÷ 40

22. 44 ÷ 10

23. 4)2,626

In 24–27, divide.

24. 6)$54.18

25. 187.2 ÷ 8

26. 7)6.3

27. 137.5 ÷ 5

In 28–31, divide. Annex zeros if needed to write remainders as decimals.

28. 6.4 ÷ 0.8

29. 0.6)0.2430

30. 52.056 ÷ 7.23

31. 0.745)9.089

EXAMPLE 1 👁 Multiply Unit Fractions

There was $\frac{1}{4}$ of a pan of lasagna left. Tom ate $\frac{1}{3}$ of this amount. What fraction of a whole pan of lasagna did Tom eat?

To find a part of a whole, multiply to solve the problem.

Find $\frac{1}{3} \times \frac{1}{4}$.

ONE WAY Divide one whole into fourths.

Divide $\frac{1}{4}$ into **3** equal parts.

Divide each of the other $\frac{1}{4}$s into **3** equal parts.

12 parts make one whole, so **one part** is $\frac{1}{12}$.

$$\frac{1}{3} \times \frac{1}{4} = \frac{1 \times 1}{3 \times 4} = \frac{1}{12}$$

Tom ate $\frac{1}{12}$ of a whole pan of lasagna.

ANOTHER WAY

Shade 1 of the 3 rows yellow to represent $\frac{1}{3}$.

Shade 1 of the 4 columns red to represent $\frac{1}{4}$.

The orange overlap shows the product $\frac{1}{3} \times \frac{1}{4}$.

1 out of 12 parts are shaded orange.

$$\frac{1}{3} \times \frac{1}{4} = \frac{1 \times 1}{3 \times 4} = \frac{1}{12}$$

Tom ate $\frac{1}{12}$ of a whole pan of lasagna.

EXAMPLE 2 👆 Multiply Fractions

Find $\frac{2}{3} \times \frac{3}{4}$ using a number line.

$\frac{1}{3}$ means 1 of 3 equal parts, so $\frac{1}{3}$ of $\frac{3}{4}$ is $\frac{1}{4}$.

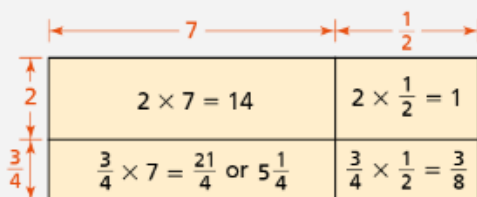$\frac{2}{3}$ means 2 of 3 equal parts, so $\frac{2}{3}$ of $\frac{3}{4}$ is 2 times $\frac{1}{4}$.

$$\frac{2}{3} \times \frac{3}{4} = \frac{6}{12} \text{ or } \frac{1}{2}$$

EXAMPLE 3 — Multiply Mixed Numbers

Find $7\frac{1}{2} \times 2\frac{3}{4}$.

Estimate first. $7\frac{1}{2}$ times $2\frac{3}{4}$ is about 8 times 3.
So, the answer should be about 24.

ONE WAY You can use an area model to find the partial products. Then add to find the final product.

	7	$\frac{1}{2}$
2	$2 \times 7 = 14$	$2 \times \frac{1}{2} = 1$
$\frac{3}{4}$	$\frac{3}{4} \times 7 = \frac{21}{4}$ or $5\frac{1}{4}$	$\frac{3}{4} \times \frac{1}{2} = \frac{3}{8}$

$$14 + 1 + 5\frac{1}{4} + \frac{3}{8} =$$
$$14 + 1 + 5\frac{2}{8} + \frac{3}{8} = 20\frac{5}{8}$$

$5\frac{1}{4}$ is renamed $5\frac{2}{8}$.

ANOTHER WAY You can use an equation to find the product. Rename the mixed numbers and then multiply.

$$7\frac{1}{2} \times 2\frac{3}{4} = \frac{15}{2} \times \frac{11}{4}$$
$$= \frac{165}{8}$$
$$= 20\frac{5}{8}$$

Because $20\frac{5}{8}$ is close to the estimate of 24, the answer is reasonable.

In 21–28, find each product.

21. $\frac{7}{8} \times \frac{1}{2}$

22. $\frac{2}{5} \times \frac{1}{12}$

23. $\frac{5}{7} \times \frac{7}{9}$

24. $\frac{1}{2} \times \frac{3}{4}$

25. $\frac{1}{4} \times \frac{7}{8}$

26. $\frac{5}{6} \times \frac{9}{10}$

27. $\frac{1}{4} \times \frac{1}{8}$

28. $\frac{1}{3} \times \frac{3}{7}$

In 29–36, estimate the product. Then find each product.

29. $2\frac{1}{6} \times 4\frac{1}{2}$

30. $\frac{3}{4} \times 8\frac{1}{2}$

31. $1\frac{1}{8} \times 3\frac{1}{3}$

32. $3\frac{1}{5} \times \frac{2}{3}$

33. $3\frac{1}{4} \times 6$

34. $5\frac{1}{3} \times 3$

35. $2\frac{3}{8} \times 4$

36. $4\frac{1}{8} \times 5\frac{1}{2}$

Lesson 1-4
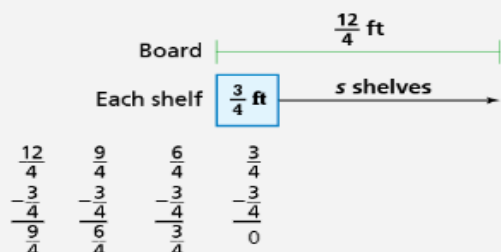## Understand Division with Fractions

EXAMPLE 1 · Divide Whole Numbers by Fractions

Mr. Roberts has a board that is 3 feet long. He plans to cut the board into pieces that are each $\frac{3}{4}$ foot long to build a set of shelves. How many shelves can he make?

> **Use Structure** How many $\frac{3}{4}$s are in 3?

0 ft	1 ft	2 ft	3 ft

ONE WAY Write 3 as a fraction with a denominator of 4, $\frac{12}{4}$. Think of division as repeated subtraction.

Board ⊢——— $\frac{12}{4}$ ft ———⊣

Each shelf $\boxed{\frac{3}{4}\text{ ft}}$ ——— s shelves ——→

$$\frac{12}{4} - \frac{3}{4} = \frac{9}{4} \qquad \frac{9}{4} - \frac{3}{4} = \frac{6}{4} \qquad \frac{6}{4} - \frac{3}{4} = \frac{3}{4} \qquad \frac{3}{4} - \frac{3}{4} = 0$$

Mr. Roberts can make 4 shelves.

ANOTHER WAY Use a number line to show 3 feet. Divide it into $\frac{3}{4}$-foot parts.

So, $3 \div \frac{3}{4} = 4$.

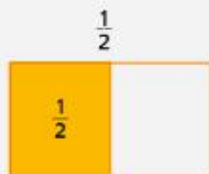> When the divisor is less than 1, the quotient is greater than the dividend.

Mr. Roberts can make 4 shelves.
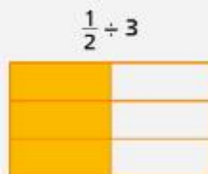
EXAMPLE 2 · Divide Fractions by Whole Numbers

How much cake will each person get if 3 friends decide to share half a cake equally? Find $\frac{1}{2} \div 3$.

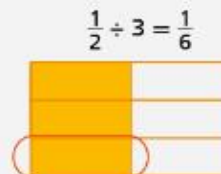Draw a picture to show $\frac{1}{2}$.

$$\frac{1}{2}$$

Divide $\frac{1}{2}$ into 3 equal parts.

$$\frac{1}{2} \div 3$$

Each part is $\frac{1}{6}$ of the whole.

$$\frac{1}{2} \div 3 = \frac{1}{6}$$

> Each person will get $\frac{1}{6}$ of the cake.

In 31–38, find each quotient.

31. $36 \div \frac{3}{4}$

32. $2 \div \frac{3}{8}$

33. $18 \div \frac{2}{3}$

34. $9 \div \frac{4}{5}$

35. $\frac{1}{6} \div 2$

36. $\frac{2}{3} \div 3$

37. $\frac{3}{5} \div 2$

38. $\frac{1}{4} \div 4$

39. A worker is pouring 3 quarts of liquid into $\frac{3}{8}$-quart containers. How many of the containers can she fill? Write and solve a division equation.

3 quarts $\frac{3}{8}$ quart

45. Select all the math statements that have the same quotient.

- ☐ $12 \div \frac{2}{3}$
- ☐ $\frac{2}{3} \div \frac{1}{27}$
- ☐ $16 \div \frac{4}{5}$
- ☐ $12 \div \frac{3}{2}$
- ☐ $24 \div \frac{4}{3}$

46. Select all the math statements that are true.

- ☐ $\frac{1}{3} \div 3$ is $\frac{1}{3} \div \frac{3}{1} = \frac{1}{3} \times \frac{1}{3}$
- ☐ $\frac{4}{5} \div 5$ is $\frac{4}{5} \div \frac{5}{1} = \frac{4}{5} \times \frac{1}{5}$
- ☐ $\frac{7}{8} \div 8$ is $\frac{7}{8} \div \frac{1}{8} = \frac{7}{8} \times \frac{8}{1}$
- ☐ $\frac{2}{3} \div 6$ is $\frac{2}{3} \div \frac{6}{1} = \frac{2}{3} \times \frac{1}{6}$
- ☐ $\frac{4}{9} \div 4$ is $\frac{4}{9} \div \frac{1}{4} = \frac{4}{9} \times \frac{4}{1}$

EXAMPLE 3 👆 **Divide Fractions**

Andrew has $\frac{3}{4}$ gallon of orange juice. He wants to pour it into $\frac{1}{6}$-gallon containers. How many containers can Andrew fill?

Find $\frac{3}{4} \div \frac{1}{6}$. To divide by a fraction, rewrite the problem as a multiplication problem using the reciprocal of the divisor.

$\frac{3}{4} \div \frac{1}{6} = \frac{3}{4} \times \frac{6}{1}$ ⟵ $\frac{6}{1}$ is the reciprocal of $\frac{1}{6}$.

$= \frac{18}{4}$ or $4\frac{1}{2}$

Andrew can fill $4\frac{1}{2}$ containers.

$\frac{3}{4}$ gallon

$\frac{1}{6}$ gallon

In 14–25, find each quotient.

14. $\frac{2}{3} \div \frac{1}{3}$

15. $\frac{1}{2} \div \frac{1}{16}$

16. $\frac{1}{4} \div \frac{1}{12}$

17. $\frac{6}{7} \div \frac{3}{7}$

18. $\frac{5}{14} \div \frac{4}{7}$

19. $\frac{5}{8} \div \frac{1}{2}$

20. $\frac{7}{12} \div \frac{3}{4}$

21. $\frac{2}{7} \div \frac{1}{2}$

22. $\frac{4}{9} \div \frac{2}{3}$

23. $\frac{7}{12} \div \frac{1}{8}$

24. $\frac{3}{10} \div \frac{3}{5}$

25. $\frac{2}{5} \div \frac{1}{8}$

---

26. Be Precise A large bag contains $\frac{12}{15}$ pound of granola. How many $\frac{1}{3}$-pound bags can be filled with this amount of granola? How much granola is left over?

GRANOLA $\frac{1}{3}$ pound

$\frac{12}{15}$ lb

27. Higher Order Thinking Find $\frac{3}{4} \div \frac{2}{3}$. Then draw a picture and write an explanation describing how to get the answer.

28. The area of a rectangular painting is $\frac{1}{6}$ square yard. The width is $\frac{2}{3}$ yard. What is the length of the painting? Use the formula $A = \ell \times w$.

29. Solve for n in the equation $\frac{13}{16} \div \frac{1}{6} = n$.

Date: ……………   Name: …………………

Mark: ……………   Test (1)-ch1   6th Grade

_____

1) **Add, subtract, or multiply.**

1. $91.2 + 89.9$ **2.** $902.3 - 8.8$

3. 5×98.2 **4.** 4×0.21

5. $62.99 - 10.83$ **6.** $423.22 + 98.30$

2) **Divide.**

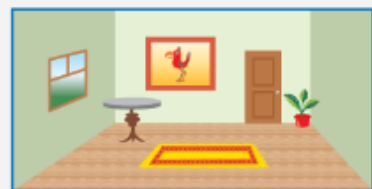**1.** $9.6 \div 1.6$ **2.** $48.4 \div 0.4$

3. $13.2 \div 0.006$ **4.** $10.8 \div 0.09$

3)

. The larger room is twice as long as the smaller room. How long is the larger room?

. If the length of the smaller room is divided into 4 equal parts, how long is each part?

$20\frac{4}{5}$ feet   ?

_____

4) **Find each quotient.**

1. $7 \div \frac{1}{2}$

2. $6 \div \frac{2}{5}$

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

4. $5\frac{1}{2} \div 3\frac{3}{8}$

5) **Find each product.**

1. $\frac{2}{3} \times \frac{3}{8}$

2. $\frac{1}{4} \times \frac{3}{5}$

3. $\frac{1}{6} \times \frac{1}{8}$

4. $\frac{4}{7} \times \frac{4}{7}$

5. $2\frac{1}{3} \times 4\frac{1}{5}$

6. $4\frac{1}{2} \times 6\frac{2}{3}$

7. $3\frac{3}{5} \times 2\frac{5}{7}$

8. $14\frac{2}{7} \times 4\frac{3}{10}$