6th Grade Math Packet

(For students entering 6th grade in August 2017)

This packet is OPTIONAL. If you complete it, you will earn BONUS HOMEWORK points.

You will get 2 bonus points for each section you complete up to a *maximum* of 50 points. In order to receive points for a section, you must:

- Show reasonable, clear work on every problem.
- Turn in your packet by September 1st, 2017.

Each section has a *worked example* and then some problems for you to try. If you are still feeling confused, type the section title into any of these websites:

khanacademy.org
ixl.com
Learnzillion.com

You may also email questions to azern@nhcsb.org

We will *not* be going over the answers to the packets when school begins, but there are answer keys at the school if you want to come check your answers.

You may not have a pencil or pen with you when you check your answers =)

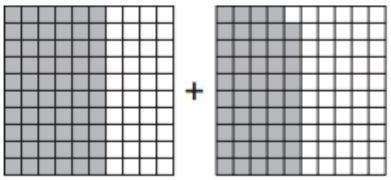
Adding Decimals

In February, Chantell ran a 5K race in 0.6 hour. She ran another 5K race in May in 0.49 hour. What was her combined time for the two races?

Step 1: Write the numbers, lining up the decimal points. Include the zeros to show place value.

$$\begin{array}{r} 0.60 \\ +\ 0.49 \\ \hline \end{array}$$

You can use decimal squares to represent this addition problem.

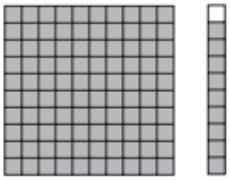


Step 2: Add the hundredths.

$$\begin{array}{r} 0.60 \\ +\ 0.49 \\ \hline 9 \end{array}$$

Step 3: Add the tenths. Remember to write the decimal point in your answer.

$$\begin{array}{r} {\scriptstyle 1} \\ 0.60 \\ +\ 0.49 \\ \hline 1.09 \end{array}$$



Chantell's combined time for the two races was 1.09 hours.

Add.

1. 2.97 + 0.35 = _____

2. 13.88 + 7.694 = _____

---

6. How much combined snowfall was there in Milwaukee and Oklahoma City?

_____

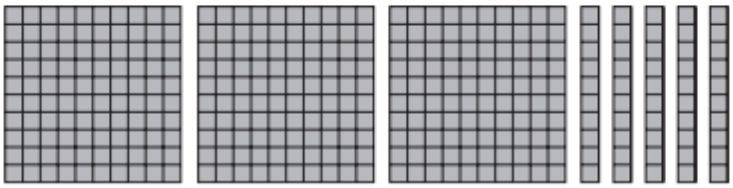
City	Snowfall (inches) in 2000
Milwaukee, WI	87.8
Baltimore, MD	27.2
Oklahoma City, OK	17.3

Subtracting Decimals

Mr. Montoya bought 3.5 lb of ground beef. He used 2.38 lb to make hamburgers. How much ground beef does he have left?

Step 1: Write the numbers, lining up the decimal points. Include the zeros to show place value.

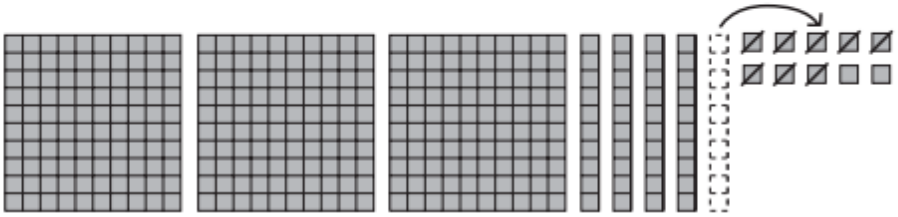
$$\begin{array}{r} 3.50 \\ -2.38 \\ \hline \end{array}$$



You can use decimal squares to represent this subtraction problem.

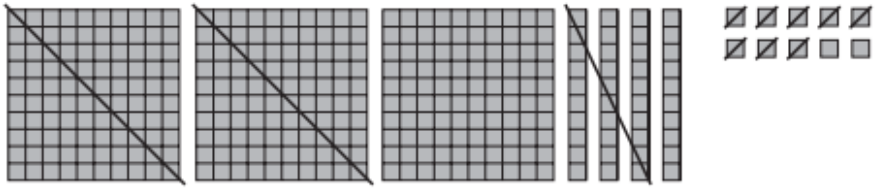
Step 2: Subtract the hundredths. Regroup if you need to.

$$\begin{array}{r} {}^{4}\cancel{3}.{}^{10}\cancel{5}0 \\ -2.38 \\ \hline 2 \end{array}$$



Step 3: Subtract the tenths and the ones. Remember to write the decimal point in your answer.

$$\begin{array}{r} {}^{4}\cancel{3}.{}^{10}\cancel{5}0 \\ -2.38 \\ \hline 1.12 \end{array}$$



Mr. Montoya has 1.12 lb of ground beef left over.

Subtract.

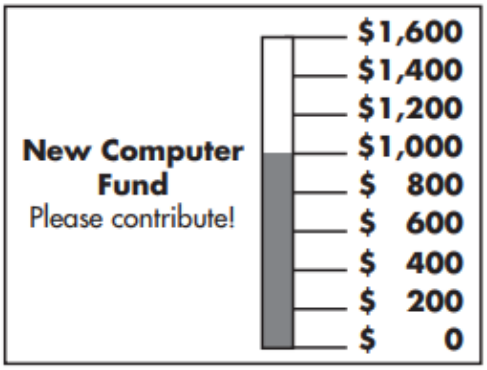
1. $\begin{array}{r} 82.7 \\ -5.59 \\ \hline \end{array}$ _____

2. $\begin{array}{r} 43.3 \\ -12.82 \\ \hline \end{array}$ _____

3. $\begin{array}{r} 7.28 \\ -4.928 \\ \hline \end{array}$ _____

Writing and Solving Equations

A community center is raising funds to buy a computer. Here is a picture of the sign they put outside the center. How much more money must the center raise?



How to write an equation number sentence for a problem:

One Way

The goal is $1,600.

So far, $1,000 has been raised.

The amount yet to be raised is the unknown.

Think: The amount raised so far and the amount yet to be raised will reach the goal.

Write an equation.

$$1{,}000 + x = 1{,}600$$

Think: What number added to 1,000 will result in 1,600?

$$1{,}000 + \mathbf{600} = 1{,}600$$

The amount yet to be raised is $600.

Another Way

The goal is $1,600.

So far, $1,000 has been raised.

The amount yet to be raised is the unknown.

Think: The difference between the goal and what has been raised so far is the amount yet to be raised.

Write an equation.

$$1{,}600 - 1{,}000 = x$$

Think: What number will result if 1,000 is subtracted from 1,600?

$$1{,}600 - 1{,}000 = \mathbf{600}$$

The amount yet to be raised is $600.

A mason needs 22 bricks to make a stoop. So far he has carried 15 to the site. How many more bricks must he carry?

Draw a picture. Write an equation. Write a number sentence. Solve.

_____

Exponents

You can use exponential notation to write a number that is being multiplied by itself.

There are two parts in exponential notation. The **base** tells you what factor is being multiplied. The **exponent** tells you how many of that factor should be multiplied together. The exponent is *not* a factor.

exponent

$8^2 = 8 \times 8$ The base is 8, so 8 is the factor to be multiplied. The exponent is 2, so 2 factors of 8 should be multiplied together.

base

You can write 8^2 in two other forms.

In **expanded** form, you write out your factors. Since 8^2 means you multiply two factors of 8, 8^2 in expanded form is 8×8.

In **standard** form, you write down the product of the factors. Since $8 \times 8 = 64$, 64 is the standard form of 8^2.

Write in exponential notation.

1. $2 \times 2 \times 2$ _____ **2.** $6 \times 6 \times 6 \times 6 \times 6$ _____

Write in expanded form.

3. 1^4 _____ **4.** 5^3 _____

Write in standard form.

5. $2 \times 2 \times 2 \times 2$ _____ **6.** 8^3 _____

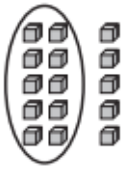
Multiplying

Mr. McGuire drives his truck 275 miles each day. How far does he drive in 3 days?

Find 275 × 3.

Step 1: Multiply the ones. Regroup if necessary.

What You Think
3 × 5 ones = 15 ones
Regroup 15 ones as 1 ten and 5 ones.

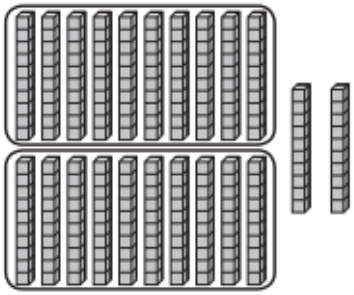


What You Write

$$\begin{array}{r} {\scriptstyle 1} \\ 275 \\ \times\ 3 \\ \hline 5 \end{array}$$

Step 2: Multiply the tens. Regroup if necessary.

What You Think
3 × 7 tens = 21 tens
21 tens + 1 ten = 22 tens
Regroup as 2 hundreds and 2 tens.

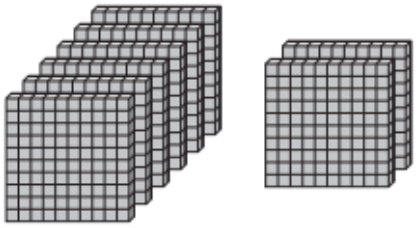


What You Write

$$\begin{array}{r} {\scriptstyle 2\,1} \\ 275 \\ \times\ 3 \\ \hline 25 \end{array}$$

Step 3: Multiply the hundreds. Regroup if necessary.

What You Think
3 × 2 hundreds = 6 hundreds
6 hundreds + 2 hundreds = 8 hundreds
No need to regroup.



What You Write

$$\begin{array}{r} {\scriptstyle 2\,1} \\ 275 \\ \times\ 3 \\ \hline 825 \end{array}$$

Mr. McGuire drives 825 miles in 3 days.

Find each product. Estimate to check that your answer is reasonable.

1. 31 × 7 _____ **2.** 29 × 4 _____ **3.** 88 × 6 _____

4. 25 × 9 _____ **5.** 102 × 8 _____ **6.** 211 × 7 _____

7. 552 × 3 _____ **8.** 471 × 9 _____ **9.** 73 × 4 _____

Multiplying Continued

Find 43 × 26.

Step 1:
Multiply by the ones.
Regroup if necessary.

What You Think
6 × 3 ones = 18 ones
Regroup 18 ones as 1 ten and 8 ones.

6 × 4 tens = 24 tens
24 tens + 1 ten = 25 tens
Regroup 25 tens as 2 hundreds and 5 tens.

What You Write

```
  1
 43
×26
258
```

Step 2:
Multiply by the tens.
Regroup if necessary.

What You Think
20 × 3 ones = 60 ones
Regroup 60 ones as 6 tens.

20 × 4 tens = 80 tens
Regroup 80 tens as 8 hundreds.

```
  1
 43
×26
258
860
```

Step 3:
Add the partial products.

What You Think
6 × 43 = 258
20 × 43 = 860

```
  1
 43
×26
258   ← partial products
+860  ← partial products
1,118
```

Find the product.

1. 38 × 12

2. 64 × 33

3. 49 × 27

4. 85 × 15

5. 26 × 21

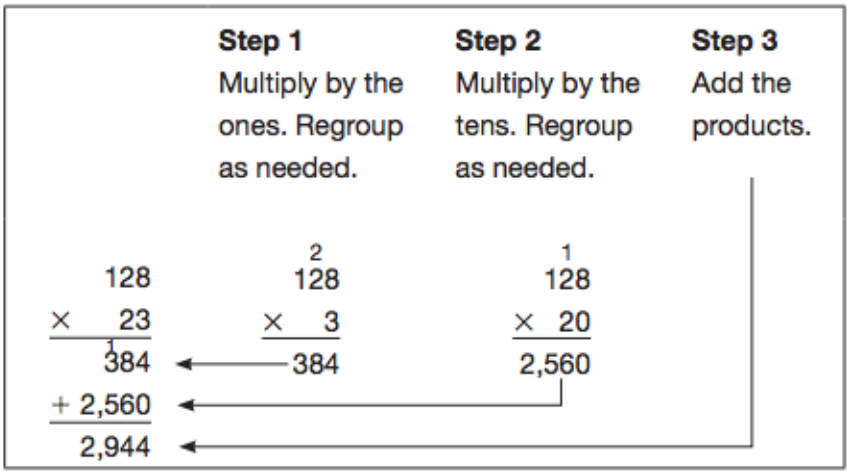
6. 73 × 19

7. 57 × 28

8. 91 × 86

Multiplying Part 3

Find 128 × 23. Estimate: 100 × 20 = 2,000



Because the answer is close to the estimate, the answer is reasonable.

Find the product. Estimate to check if your answer is reasonable.

Problem	Multiply by the Ones	Multiply by the Tens	Add the Products
1. 282 × 19 = 2,538 + ____	71 282 × 9 = 2,538	282 × 10	
2. 538 × 46			

Word Problems with Multiplication

A hardware store ordered 9 packs of screws from a supplier. Each pack contains 150 screws. How many screws did the store order?

Read and Understand

What do you know?

The store ordered nine packs of screws.

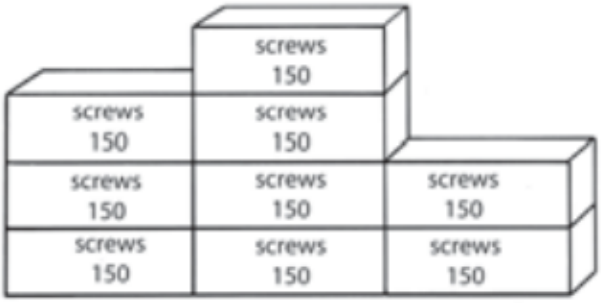
Each pack contained 150 screws.

What are you trying to find?

The total number of screws ordered

Plan and Solve

Draw a picture of what you know.



Write an equation.

Let x = the total number of screws.

$9 \times 150 = x$

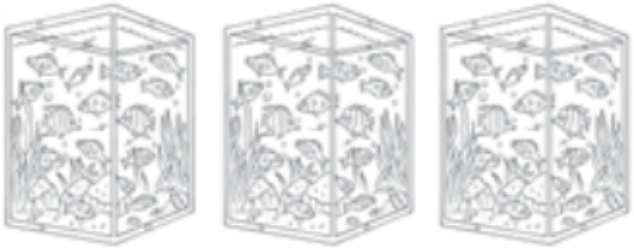
Multiply.

$$\begin{array}{r} {\scriptstyle 4} \\ 150 \\ \times\ 9 \\ \hline 1{,}350 \end{array}$$

The store ordered 1,350 screws.

A state aquarium has display tanks that each contains 75 fish. Three of these tanks are at the entrance. How many fish are on display at the entrance?

Draw a picture. Write an equation. Solve.



_____

Dividing by Multiplies of 10

You can use math facts and patterns to help you divide mentally.

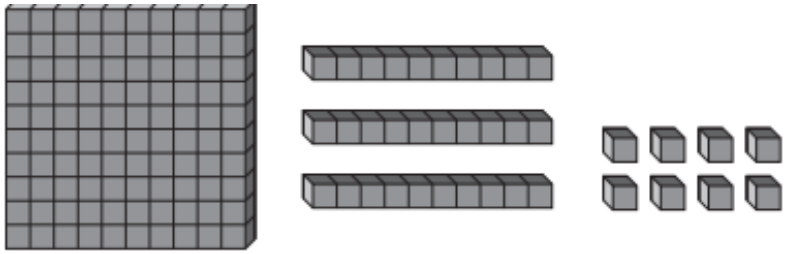
What is 480 ÷ 6?	What is 60,000 ÷ 6?
You already know that 48 ÷ 6 = 8.	60 ÷ 6 = 10
480 has one more zero than 48, so place one more zero in the quotient.	60,000 has three more zeros than 60, so place three zeros in the quotient.
480 ÷ 6 = 80.	60,000 ÷ 6 = 10,000.

Find each quotient. Use mental math.

1. 32 ÷ 8 = _____	**2.** 320 ÷ 8 = _____	**3.** 3,200 ÷ 8 = _____	**4.** 32,000 ÷ 8 = _____
5. 56 ÷ 7 = _____	**6.** 560 ÷ 7 = _____	**7.** 5,600 ÷ 7 = _____	**8.** 56,000 ÷ 7 = _____

Dividing with Models

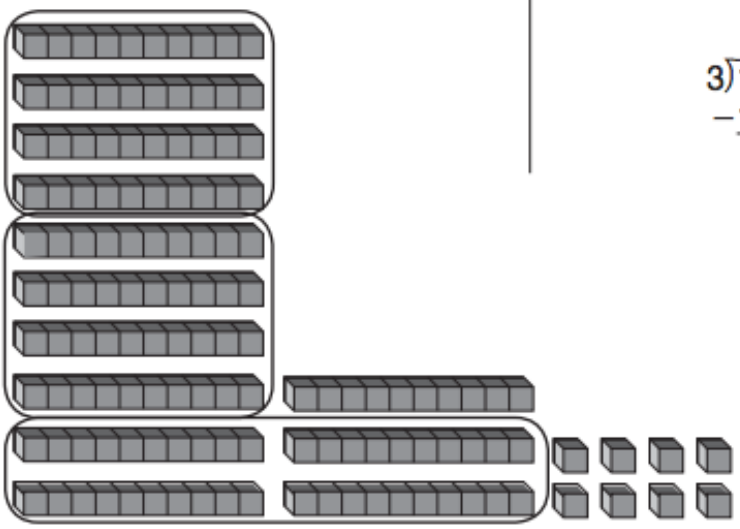
Divide 138 equally into 3 groups.



Step 1:
You can model 138 as 13 groups of 10 plus 8 ones.
Each group will get 4 groups of 10.
$40 \times 3 = 120$
$130 - 120 = 10$, so there is 1 group of 10 left.

Step 2:
There is 1 group of 10 plus 1 group of 8 ones left. You can model 18 as 18 ones.
$18 \div 3 = 6$, so each group will also get 6 ones. There is nothing left.

What You Think



What You Write

$$\begin{array}{r} 4 \\ 3\overline{)138} \\ -12 \\ \hline 1 \end{array}$$

What You Think

What You Write

$$\begin{array}{r} 46 \\ 3\overline{)138} \\ -12\downarrow \\ \hline 18 \\ -18 \\ \hline 0 \end{array}$$

$138 \div 3 = 46$

Use models to help you divide.

1. $4\overline{)76}$ **2.** $2\overline{)94}$ **3.** $5\overline{)130}$

Dividing Part 1

Find 362 ÷ 5.

Step 1: To decide where to place the first digit in the quotient, compare the first digit of the dividend with the divisor.

3 < 5, so the first digit in the quotient will not go in the hundreds place.

Now, compare the first two digits of the dividend with the divisor.

36 > 5, so the first digit in the quotient will go in the tens place.

Step 2: Divide the tens. Use multiplication facts and compatible numbers.
Think 5 × ? = 35.

Write 7 in the tens place of the quotient.
Multiply. 5 × 7 = 35

```
   7
5)36
 −35
   1
```

Subtract. 36 − 35 = 1
Compare. 1 < 5
Bring down the ones.

Step 3: Divide the ones. Use multiplication facts and compatible numbers.
Think 5 × ? = 10.

Write 2 in the ones place of the quotient.
Multiply. 5 × 2 = 10

```
   72R2
5)362
 −35↓
   12
  −10
    2
```

Subtract. 12 − 10 = 2
Compare. 2 < 5
There are no more digits to bring down, so 2 is the remainder.

Step 4: Check by multiplying.

5 × 72 = 360
360 + 2 = 362

Divide. Check by multiplying.

1. $8\overline{)955}$ **2.** $7\overline{)249}$ **3.** $5\overline{)365}$

Find 623 ÷ 40.

Step 1: Estimate the quotient using compatible numbers, 600 ÷ 40 = 15. Then, divide the tens.

```
  1
40)623   Divide 62 ÷ 40
 −40     Multiply 1 × 40 = 40
  22     Subtract 62 − 40 = 22
         Compare 22 < 40
```

Step 2: Bring down the ones. Then, divide the ones.

```
  15
40)623
 −40↓
  223   Divide 223 ÷ 40
 −200   Multiply 5 × 40 = 200
   23   Subtract 223 − 200 = 23
```

Step 3: Since 23 < 40, write 23 as the remainder in the quotient.

```
  15 R23
40)623
 −40↓
  223
 −200
   23   Compare 23 < 40
```

Complete.

1. $60\overline{)288}$ **2.** $20\overline{)455}$ **3.** $80\overline{)866}$

Division Continued

Find 436 ÷ 53.

To find the answer, first estimate the quotient.

Think: 400 ÷ 50 = 8 or 450 ÷ 50 = 9

Try 9:

```
   9
53)436
 −477
```

Write 9 in the ones place.
Multiply, 9 × 53 = 477.
477 > 436.
This estimate is too high.

Try 8:

```
   8
53)436
 −424
   12
```

Write 8 in the ones place.
Multiply, 8 × 53 = 424.
Subtract, 436 − 424 = 12.
Compare, 12 < 53. Write the remainder in the quotient.

436 ÷ 53 = 8 R12
Check:
8 × 53 = 424
424 + 12 = 436

Complete.

1. 11 R □ ; 39)437

2. □□ R3 ; 24)627

3. □□ R□ ; 26)917

Divide. Check by multiplying.

4. 13)175

5. 44)508

6. April has 95 baseball cards. She wants to organize them on pages that hold 18 cards each. She has 5 pages. Does April have enough pages to organize all her cards?

---

7. Explain how you know the answer to the problem below has an error.

```
   2 R86
77)240
 −154
   86
```

_____

_____

Multiplying Decimals by Multiples of 10

You can use patterns to multiply decimals mentally by 10, 100, and 1,000.

Andrew starts selling his baseball cards for $0.10 each. After selling 10 cards, he has made $1.00. After selling 100 cards, he has made $10.00.

$.0.10 $.0.10 × 10 = $1.00 $0.10 × 100 = $10.00

When you multiply by

10 (10^1)	Move decimal point by 1 place to the right
100 (10^2)	Move decimal point by 2 places to the right
1,000 (10^3)	Move decimal point by 3 places to the right

If Andrew sold 1,000 cards, how much money would he make? _____

Mental Math For questions **1** through **4**, find the product using mental math.

1. 6.1 × 10 _____ **2.** 100 × 37.98 _____

3. 92.3 × 1,000 _____ **4.** 0.418 × 100 _____

---

6. Raul can hit a golf ball 26.4 yards. A.J. can hit a golf ball 10 times as far. How far can A.J. hit the ball? _____

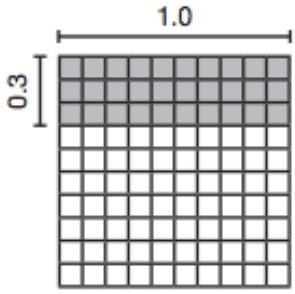
Multiplying Decimals with a Model

Use the same strategy to multiply a decimal by a whole number or to multiply a decimal by a decimal.

Multiply 1.0×0.3

Use an area model and hundredths grid to find the product.

Each factor becomes a side length of a rectangle.



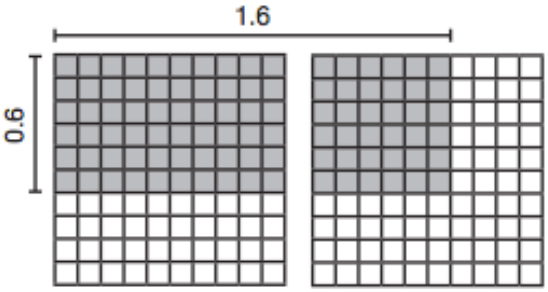
Count the hundredths cells in the shaded area to find the product.

$1.0 \times 0.3 = 0.3$

Multiply 1.6×0.6

Use an area model and a hundredths grid to find the product.

Because one factor is greater than 1, you will need to use 2 hundredths grids (for a total of 2 units).



Count the hundredths cells in the shaded area to find the product.

$1.6 \times 0.6 = 0.96$

Place the decimal point in each product.

1. $1.2 \times 3.6 = 432$ _____

2. $5.5 \times 3.7 = 2035$ _____

3. $4.4 \times 2.3 = 1012$ _____

Find the product.

4. 7×0.5 _____

5. 12×0.08 _____

6. 24×0.17 _____

Dividing Decimals by Multiples of 10

You can use place-value patterns when you divide a decimal by 10, 100, or 1,000.

Sanjai has 27.5 lb of clay. If he uses the clay to make 10 bowls, how much clay will he use for each bowl? What if he makes 100 bowls from the clay? What if he makes 1,000 bowls?

Dividing a number by 10 moves the decimal point one place to the left.

$27.5 \div 10 = 2.75$

Dividing a number by 100 moves the decimal point two places to the left.

$27.5 \div 100 = 0.275$

Dividing a number by 1,000 moves the decimal point three places to the left.

$27.5 \div 1{,}000 = 0.0275$

Sanjai will use 2.75 lb for each of 10 bowls, 0.275 lb for each of 100 bowls, and 0.0275 lb for each of 1,000 bowls.

Remember: When you divide a number by 10, 100, or 1,000, your quotient will be smaller than that number.

For questions **1** through **6**, find the quotient. Use mental math.

1. $16.4 \div 10$

2. $38.92 \div 100$

3. $297.1 \div 100$

4. $540.9 \div 10$

5. $41.628 \div 1{,}000$

6. $0.33 \div 10$

7. The city has a section of land 3,694.7 ft long. The city wants to make 100 equal-sized gardens with this land. How long will each garden be?

_____

Dividing Decimals

Find 196 ÷ 32.

Step 1

Put the decimal point in the dividend. Divide. Put the decimal in the quotient right above the decimal in the dividend. Subtract.

```
    6.
32 ) 196.
   -192
      4
```

Step 2

Add a zero after the decimal point in the dividend. Bring down the zero. Divide. Subtract.

```
    6.1
32 ) 196.0
   -192
      40
     -32
       8
```

Step 3

Repeat Step 2 until there is no remainder.

```
     6.125
32 ) 196.000
   -192
      40
     -32
       80
      -64
       160
      -160
         0
```

Remember, you can use estimation to see if your answer is reasonable: 180 ÷ 30 = 6. You can check your answer using multiplication: 32 × 6.125 = 196

Find the quotient.

1. $11\overline{)93.5}$

2. $25\overline{)1.75}$

3. $6\overline{)573}$

4.
```
    6.
3 ) 18.6
   -18
     0
```

5.
```
    3.
7 ) 22.61
   -21
```

6.
```
    $ 3.
12 )$44.40
    - 36
      8
```

Dividing Decimals Continued

When you divide by a decimal, you need to rewrite the dividend and the divisor so that you are dividing by a whole number.

Find $4.96 \div 0.8$.

Step 1: Estimate. Use compatible numbers.

$480 \div 80 = 6$

Step 2: Make the divisor a whole number. Multiply the divisor AND the dividend by the same power of 10.

$0.8\overline{)4.96}$

$0.8 \times 10 = 8$
$4.96 \times 10 = 49.6$

Place the decimal point in the quotient.

Step 3: Divide as you would with whole numbers. Remember that sometimes you may need to annex zeros to complete your division.

$8\overline{)49.6}$ → $8\overline{)49.6}$

$$\begin{array}{r} 6.2 \\ 8\overline{)49.6} \\ \underline{48} \\ 16 \\ \underline{16} \\ 0 \end{array}$$

Step 4: Compare the quotient with your estimate.

Because 6.2 is close to 6, the answer checks.

Use long division to find each quotient.

1. $0.3\overline{)780}$ _____ **2.** $0.5\overline{)406}$ _____ **3.** $0.02\overline{)1140}$ _____

Solving Word Problems

A multiple-step problem is a problem where you may need more than one step to find your answer.

Marcie was in a 3-day charity walk. Her friend Gayle said she would give the charity $1.50 for each mile that Marcie walked. The first day, Marcie walked 26.42 miles. The second day, Marcie walked 32.37 miles. The third day, Marcie walked 28.93 miles. How much money did Gayle give?

Step 1. Read through the problem again and write a list of what you already know.

Marcie walked 26.42, 32.37, and 28.93 miles.
Gayle gave $1.50 for each mile.

Step 2. Write a list of what you *need* to know.

Total amount Gayle gave

Step 3. Write a list of the steps to solve the problem.

Find the total number of miles Marcie walked.
Find the amount Gayle gave.

Step 4. Solve the problem one step at a time.

$26.42 + 32.37 + 28.93 = 87.72$ *total number of miles Marcie walked*

$87.72 \times \$1.50 = \$131.58$ *total amount Gayle gave*

---

hundredth of a mile?

_____

2. Diego is buying fruit at the store. Which costs less: 1 pound of each fruit or 4 pounds of peaches?

_____

Fruit	Cost per pound
Apples	$0.89
Oranges	$1.29
Peaches	$0.99
Grapes	$1.09

Writing Algebraic Expressions

A **variable** is a letter or symbol. It represents an unknown amount that can change.

You can do mathematical operations with variables and numbers.

You can state these operations in word expressions. You can also state them in algebraic expressions.

Operation	+	−	×	÷
Word expression	the sum of r and 3	the difference between r and 3	the product of r and 3	r divided by 3
Algebraic expression	$r + 3$	$r - 3$	$3r$	$r \div 3$
Other ways of saying the word expression	3 added to r 3 more than r	3 subtracted from r 3 less than r	r multiplied by 3 3 times r	r separated into 3 equal parts

Complete the algebraic expression for each of the following word expressions.

1. the sum of b and 8

b ____ 8

2. the difference between m and 6

m ____ 6

3. the quotient of k and 16

k ____ 16

4. 7 less than z

z ____ 7

5. 2 more than d

d ____ 2

6. j divided by 4

j ____ 4

Circle the letter of the correct word expression for each algebraic expression.

7. $t - 13$ a. 13 subtracted from t b. t subtracted from 13

8. $4n$ a. 4 more than n b. 4 times n

Order of Operations

If you do not use the proper order of operations, you will not get the correct answer.

Evaluate $2^3 \div 2 + 3 \times 6 - (1 \times 5)$.

Step 1. Do the operations inside the parentheses.

$(1 \times 5) = 5$
$2^3 \div 2 + 3 \times 6 - 5$

Step 2. Evaluate any terms with exponents.

$2^3 = 8$
$8 \div 2 + 3 \times 6 - 5$

Step 3. Multiply and divide in order from left to right.

$8 \div 2 = 4$ and $3 \times 6 = 18$
$4 + 18 - 5$

Step 4. Add and subtract in order from left to right.

$4 + 18 = 22$
$22 - 5 = 17$
So, $2^3 \div 2 + 3 \times 6 - (1 \times 5) = 17$

Write which operation should be done first.

1. $6 + 3 \times 2$ _____

2. $13 - 1 + 4 \div 2$ _____

3. $5 \times (7 - 2) + 1$ _____

4. $(19 + 23) - (4 \times 5)$ _____

For questions **5** through **8**, evaluate the expression for $x = 6$ and $y = 17$.

5. $4x + 5y$ _____

6. $2x + (20 - y)$ _____

Writing a Rule with Addition and Subtraction

How do you find a rule to write an expression?

To find a rule and write an expression, look at the numbers being compared. Which is the greater number?

v	57	28	10
	50	21	3

Compare the numbers in each column of the table.

Consider 57 and 50. 57 is greater than 50, so rule out addition.

Find how much greater 57 is than 50. 57 is 7 more than 50, so the rule must involve subtraction.

Look at the other two columns of numbers and compare them. The top number is 7 more than the bottom number.

A rule is subtract 7, so the expression is $v - 7$.

Find a rule for each table.

1.

r	24	28	31	36
	11	15	18	23

2.

f	17	41	86	93
	21	45	90	97

Find a rule and write the missing number for each table.

3.

c	7	10	15	19
	32	35		44

4.

h	52	47	40	36
	44	39		28

Writing a Rule with Multiplication and Division

Find a rule and write an expression using multiplication and division.

To find a rule and write an expression, look at the numbers being compared. Which is the greater number?

Consider 3 and 24. Because 24 is greater than 3, you can rule out subtraction and division.

Find how much greater 24 is than 3. Since 24 is 8 times 3, the rule must involve multiplication.

Look at the other two columns of numbers and compare them. The bottom number is 8 times as great as the top number.

A rule is multiply by 8, so the expression is $8 \times b$.

b	3	6	8
	24	48	64

Compare the numbers in each column of the table.

Find a rule for each table.

1.

a	48	56	64	72
	6	7	8	9

2.

u	8	11	13	16
	32	44	52	64

Find a rule and write the missing number for each table.

3.

j	18	14	12	8
	9	7		4

4.

e	2	4	6	7
	6	12	18	

Equivalent Fractions

Use multiplication to find an equivalent fraction:

$\frac{3}{7} \times \frac{4}{4} = \frac{12}{28}$

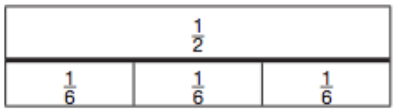
$\frac{3}{7} = \frac{12}{28}$

Use division to find an equivalent fraction.

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

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

Equivalent fractions name the same amount.



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

Use multiplication to find an equivalent fraction.

1. $\frac{3}{8}$ _____ **2.** $\frac{1}{3}$ _____ **3.** $\frac{4}{7}$ _____

Use division to find an equivalent fraction.

10. $\frac{15}{20}$ _____ **11.** $\frac{4}{18}$ _____ **12.** $\frac{15}{60}$ _____

Writing Fractions in Simplest Form

Write $\frac{20}{24}$ in simplest form. Divide by common factors.

- Divide by common factors until the only common factor is 1.
- You can start by dividing by 2, since both numbers are even.

$\frac{20 \div 2}{24 \div 2} = \frac{10}{12}$

But both 10 and 12 are also even, so they can be divided by 2.

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

- Since 5 and 6 do not have any common factors, $\frac{5}{6}$ is the simplest form.

$\frac{20}{24}$ written in simplest form is $\frac{5}{6}$.

Write each fraction in simplest form.

1. $\frac{16}{20}$ _____ **2.** $\frac{8}{16}$ _____ **3.** $\frac{5}{10}$ _____

Finding a Least Common Multiple

A multiple of a number is a product of a given whole number and another whole number. The first four multiples of 3 are 3, 6, 9, and 12.

A least common multiple (LCM) is the least number that is a common multiple of two or more numbers.

Find the least common multiple of 4 and 6.

4	6	Are there the same number of X's in each column? No.
XXXX	XXXXXX	Since the 1st column has fewer, add another set of 4 X's.

4	6	Are there the same number of X's in each column? No.
XXXX	XXXXXX	Since the 2nd column has fewer, add another set of 6 X's.
XXXX		

4	6	Are there the same number of X's in each column? No.
XXXX	XXXXXX	Since the 1st column has fewer, add another set of 4 X's.
XXXX	XXXXXX	

4	6	Are there the same number of X's in each column? Yes.
XXXX	XXXXXX	Since the columns are equal, the number of X's is the
XXXX	XXXXXX	LCM. The LCM = 12.
XXXX		

Find the least common multiple of each number pair.

1. 2 and 3 _____ **2.** 6 and 9 _____ **3.** 5 and 6 _____ **4.** 8 and 3 _____

Finding Common Denominators

How to find a common denominator.

Find a common denominator for $\frac{4}{10}$ and $\frac{3}{8}$.

List multiples of the denominators 10 and 8.Then look for a common multiple.

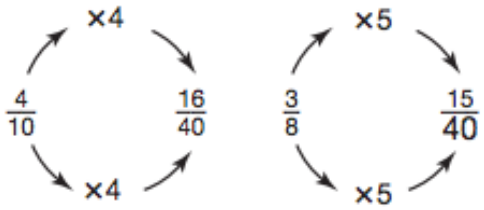
10: 10, 20, 30, 40
8: 8, 16, 24, 32, 40

The number 40 can be used as the common denominator.

How to rename fractions to have the same denominator.

Rename $\frac{4}{10}$ and $\frac{3}{8}$ using 40 as the common denominator.

Multiply the numerator and denominator by the same nonzero numbers.



The renamed fractions are $\frac{16}{40}$ and $\frac{15}{40}$.

In **1** through **8**, find a common denominator for each pair of fractions.

1. $\frac{2}{7}$ and $\frac{1}{2}$ **2.** $\frac{4}{5}$ and $\frac{2}{3}$ **3.** $\frac{3}{4}$ and $\frac{5}{6}$ **4.** $\frac{7}{8}$ and $\frac{3}{10}$

In **9** through **16**, find a common denominator for each pair of fractions. Then rename each fraction in the pair.

9. $\frac{4}{10}$ and $\frac{1}{5}$ **10.** $\frac{4}{9}$ and $\frac{4}{6}$ **11.** $\frac{1}{2}$ and $\frac{1}{7}$ **12.** $\frac{2}{3}$ and $\frac{3}{18}$

Adding Fractions with Unlike Denominators

Danisha ate $\frac{2}{3}$ cup of yogurt at breakfast. She ate $\frac{1}{4}$ cup of yogurt at lunch. How much yogurt did she eat today?

You can add fractions with unlike denominators.

Step 1: Find the least common denominator of the two fractions.

multiples of 3: 3, 6, 9, 12, 15

multiples of 4: 4, 8, 12, 16, 20

$\frac{2}{3} = \frac{8}{12}$ and $\frac{1}{4} = \frac{3}{12}$

Step 2: Once you have equivalent fractions with the same denominator, add the numerators.

$8 + 3 = 11$

So, $\frac{8}{12} + \frac{3}{12} = \frac{11}{12}$.

Step 3: Place the sum over the common denominator and simplify your fraction if possible.

Danisha ate $\frac{11}{12}$ cup of yogurt today.

For **1** through **5**, find each sum. Simplify if possible.

1. $\frac{3}{5} + \frac{1}{6}$

2. $\frac{2}{9} + \frac{2}{6}$

3. $\frac{3}{8} + \frac{3}{12}$

Subtracting Fractions with Unlike Denominators

You can subtract fractions with unlike denominators by using the least common multiple (LCM) and the least common denominator (LCD).

Beth wants to exercise for $\frac{4}{5}$ hour. So far, she has exercised for $\frac{2}{3}$ hour. What fraction of an hour does she have left to go?

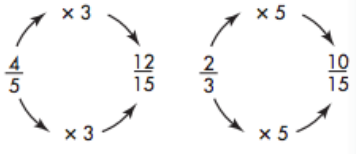
Step 1: Find the LCM of 5 and 3.

multiples of 5: 5, 10, 15, 20

multiples of 3: 3, 6, 9, 12, 15

Since 15 is the LCM, it is also your LCD.

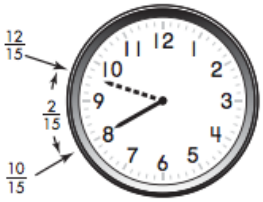
Step 2: Using your LCD, write the equivalent fractions.



$\frac{4}{5} = \frac{12}{15}$ and

$\frac{2}{3} = \frac{10}{15}$

Step 3: Subtract the numerators. Place the difference over the LCD. Simplify if possible.



$\frac{12}{15} - \frac{10}{15} = \frac{2}{15}$

Beth has $\frac{2}{15}$ hour left.

In **1** through **7**, find each difference. Simplify if possible.

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

2. $\frac{7}{10} - \frac{1}{5}$

3. $\frac{8}{8} - \frac{4}{9}$

4. $\frac{17}{18} - \frac{2}{3}$

Word Problems with Fractions

Use what you know about adding and subtracting fractions to solve problems.

Carla wants to make a Veggie Toss using eggplant, green peppers, spring onions, and mushrooms. Besides the eggplant, how many pounds of the other ingredients does she need in all?

Use data from the recipe.

Step 1: Find the amount of green peppers and spring onions. $\frac{1}{3}$ and $\frac{1}{4}$

Step 2: To add these amounts, find a common denominator for both fractions and rewrite each fraction with that denominator.

$$\frac{1}{3} + \frac{1}{4} = \frac{4}{12} + \frac{3}{12} = \frac{7}{12}$$

Step 3: Add the amount of mushrooms to the sum from Step 2. Remember to rewrite the addends with a common denominator.

$$\frac{7}{12} + \frac{3}{8} = \frac{14}{24} + \frac{9}{24} = \frac{23}{24}$$

Carla needs $\frac{23}{24}$ pound of the other veggies in all.

Veggie Toss Recipe

Eggplant	$\frac{3}{4}$ pound (lb)
Green peppers	$\frac{1}{3}$ pound (lb)
Spring onions	$\frac{1}{4}$ pound (lb)
Mushrooms	$\frac{3}{8}$ pound (lb)

Chop all ingredients to desired size. Toss eggplant with spring onions in olive oil. Add green peppers and saute for 5 minutes. Add mushrooms. Stir. Cover. Simmer over medium low heat until cooked.

For **1** through **3**, use the Veggie Toss Recipe.

1. Suppose you wanted to make a Veggie Toss using spring onions and mushrooms. How many pounds of ingredients do you need? _____

2. How much more eggplant than mushrooms does the recipe call for? _____

Mixed Numbers and Improper Fractions

A mixed number combines a whole number with a fraction. It is greater than one.

An improper fraction has a numerator that is larger than its denominator.

How to Write an Improper Fraction as a Mixed Number

Write $\frac{12}{5}$ as a mixed number.

Divide the numerator by the denominator.

The quotient is the whole number in the mixed number.

$$5\overline{)12}\quad 2,\ -10,\ 2 \qquad 2\frac{2}{5}$$

The remainder is the numerator. The denominator stays the same.

$$\frac{12}{5} = 2\frac{2}{5}$$

How to Write a Mixed Number as an Improper Fraction

Multiply the denominator by the whole number.

$3\frac{2}{5}$ (× 5)

$5 \times 3 = 15$

Then add the numerator. $15 + 2 = 17$

Write this number for the numerator. ⟶ $\frac{17}{}$

Use the original denominator. ⟶ $\frac{}{5}$

$$3\frac{2}{5} = \frac{17}{5}$$

For **2–4,** write each improper fraction as a whole number or mixed number in simplest form.

2. $\frac{30}{20}$ _____ **3.** $\frac{66}{20}$ _____ **4.** $\frac{24}{14}$ _____

Write each mixed number as an improper fraction.

5. $4\frac{1}{3}$ _____ **6.** $1\frac{20}{50}$ _____ **7.** $8\frac{7}{8}$ _____

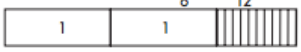
Adding Mixed Numbers

Randy talks on the telephone for $2\frac{5}{6}$ hours, and then surfs the Internet for $3\frac{3}{4}$ hours. How many hours does he spend on the two activities?

Step 1. Write equivalent fractions with the least common denominator. You can use fraction strips to show the equivalent fractions.

$3\frac{3}{4} = 3\frac{9}{12}$

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



Step 2. Add the fraction part of the mixed number first. Then add the whole numbers.

$\frac{9}{12} + \frac{10}{12} = \frac{19}{12}$ $\qquad 3 + 2 = 5$

$\frac{19}{12} + 5 = 5\frac{19}{12}$

Step 3. Simplify the sum if possible.

$5\frac{19}{12} = 6\frac{7}{12}$ hours

So, $2\frac{5}{6} + 3\frac{3}{4} = 6\frac{7}{12}$.

In **1** through **6**, find each sum. Simplify if possible.

1. $2\frac{5}{6} + 3\frac{1}{4}$

2. $1\frac{3}{8} + 6\frac{3}{4}$

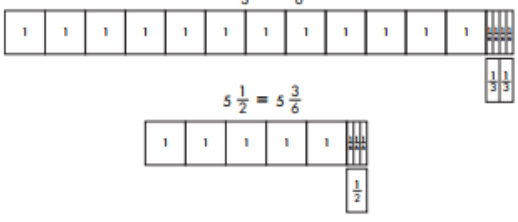
3. $5\frac{2}{5} + 4\frac{1}{2}$

Subtracting Mixed Numbers

The Plainville Zoo has had elephants for $12\frac{2}{3}$ years. The zoo has had zebras for $5\frac{1}{2}$ years. How many years longer has the zoo had elephants?

Step 1: Write equivalent fractions with the least common denominator. You can use fraction strips.

$12\frac{2}{3} = 12\frac{4}{6}$



$5\frac{1}{2} = 5\frac{3}{6}$

Step 2: Find the difference of $12\frac{4}{6} - 5\frac{3}{6}$. Subtract the fractions. Then subtract the whole numbers. Simplify the difference if possible.

$\frac{4}{6} - \frac{3}{6} = \frac{1}{6}$ $\qquad 12 - 5 = 7$

So, $12\frac{2}{3} - 5\frac{1}{2} = 7\frac{1}{6}$ years.

Example 2: Sometimes you may have to rename a fraction so you can subtract. Find the difference of $6 - 2\frac{3}{8}$.

$6 \longrightarrow$ rename $\longrightarrow 5\frac{8}{8}$

$-2\frac{3}{8}$ $\qquad -2\frac{3}{8}$

$3\frac{5}{8}$

For **1** through **4**, find each difference. Simplify, if possible.
Remember: You may have to rename a fraction in order to subtract.

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

2. $5\frac{6}{7} - 1\frac{1}{2}$

3. $3 - 1\frac{3}{4}$

4. $6\frac{5}{6} - 5\frac{1}{2}$

Mixed Number Word Problems

A jeweler has a strand of gold wire that is $1\frac{3}{8}$ inches. He cuts $\frac{3}{4}$ of an inch of wire to make a loop. How long is the remaining piece of wire?

Read and Understand

What do you know?

The length of the wire is $1\frac{3}{8}$ inches.

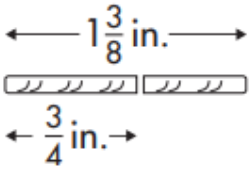
The length he cuts off is $\frac{3}{4}$ of an inch.

What are you trying to find?

The length of the wire that is left over.

Plan and Solve

Draw a picture for what you know.



Write an equation.
Let x = the length of wire left over.

$1\frac{3}{8} - \frac{3}{4} = x$

Solve the problem.

$1\frac{3}{8} - \frac{6}{8} = \frac{11}{8} - \frac{6}{8} = \frac{5}{8}$

Write the answer in a sentence.

The remaining wire is $\frac{5}{8}$ inch long.

Look Back and Check

Is your answer correct?

Yes, $\frac{3}{4} + \frac{5}{8} = \frac{6}{8} + \frac{5}{8} = \frac{11}{8} = 1\frac{3}{8}$

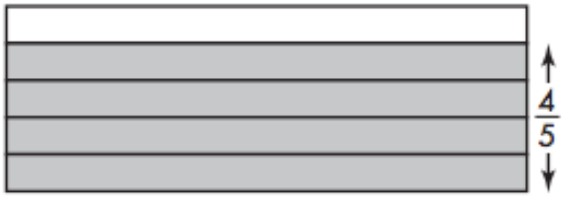
From his house, Jason rode his bike $1\frac{1}{3}$ miles to the post office. He then rode in the same direction to the park, which is $\frac{1}{4}$ of a mile from the post office. How far did Jason ride?

Multiplying Fractions

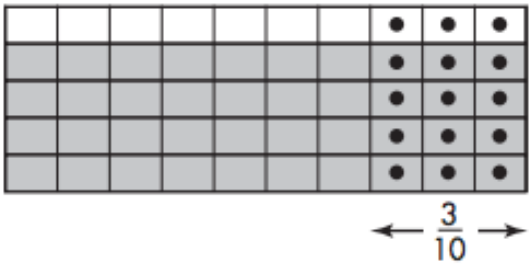
Musa and Karen are riding a bike path that is $\frac{4}{5}$ mile long. Karen's bike got a flat tire $\frac{3}{10}$ of the way down the path and she had to stop. How many miles did Karen ride?

You can find the product of two fractions by drawing a diagram.

Step 1. Draw a diagram using shading to represent $\frac{4}{5}$.



Step 2. Draw lines vertically using dots to represent $\frac{3}{10}$.



Step 3. Count the parts of the diagram that are shaded and dotted. This is the product numerator.

12

Step 4. Count the total number of parts of the diagram. This is the product denominator.

50

Step 5. Simplify if possible.

$$\frac{12}{50} = \frac{6}{25}$$

Another way to find the product:

Step 1. Multiply the numerators: $4 \times 3 = 12$.

Step 2. Multiply the denominators: $5 \times 10 = 50$.

Step 3. Simplify if possible: $\frac{12}{50} = \frac{6}{25}$.

In **1** through **6**, find the product. Simplify if possible.

1. $\frac{1}{3} \times \frac{2}{5} =$ _____ **2.** $\frac{5}{8} \times \frac{1}{4} =$ _____ **3.** $\frac{5}{6} \times \frac{3}{10} =$ _____

Dividing a Whole Number by a Fraction

How can you divide a whole number by a fraction?

$2 \div \frac{1}{3}$	Think: How can I divide two into one-thirds?
1. Two is the sum of one plus one. **2.** Each one is the sum of three one-thirds. **3.** Count the number of one-thirds. **Check** To divide a whole number by a fraction, multiply the whole number by the reciprocal of the fraction.	**2** = **1** + **1** $\frac{1}{3} + \frac{1}{3} + \frac{1}{3}$ + $\frac{1}{3} + \frac{1}{3} + \frac{1}{3}$ **6** $2 \div \frac{1}{3} = 2 \times \frac{3}{1} = \frac{2}{1} \times \frac{3}{1} = \frac{6}{1} = 6$

$3 \div \frac{3}{4}$	Think: How can I divide three into three-fourths?
1. Three is the sum of one plus one plus one. **2.** Each one is the sum of one three-fourths and one one-fourth. **3.** Count the number of three-fourths. **Check** Multiply the whole number by the reciprocal of the fraction.	**3** = **1** + **1** + **1** $\frac{3}{4} + \frac{1}{4}$ + $\frac{3}{4} + \frac{1}{4}$ + $\frac{3}{4} + \frac{1}{4}$ $\frac{3}{4} + \frac{3}{4} + \frac{3}{4}$ + $\frac{1}{4} + \frac{1}{4} + \frac{1}{4}$ $\frac{3}{4} + \frac{3}{4} + \frac{3}{4}$ + $\frac{3}{4}$ **4** $3 \div \frac{3}{4} = 3 \times \frac{4}{3} = \frac{3}{1} \times \frac{4}{3} = \frac{12}{3} = 4$

Draw a picture that shows each division and write the answer.

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

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

Volume

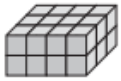
Volume is the measure of space inside a solid figure. If you had a box, the number of cubic units it would take to fill the box would be the volume.

Find the volume of this box in cubic units by counting the number of unit cubes.

There are 16 cubes in the front layer and there are two layers. The total number of unit cubes is 32.

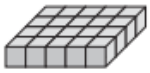
So, the volume is 32 cubic units.

In **1** through **6**, find the volume in cubic units.

1.  _____

2.  _____

3.  _____

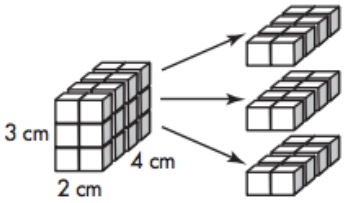
4.  _____

Volume Continued

Volume is a measure of the space inside a solid figure. It is measured in cubic units. A **cubic unit** is the volume of a cube that has edges that are each 1 unit.

How to find the volume of a rectangular prism

Counting unit cubes:



Count the cubes in each layer: 8 cubes.

Multiply by the number of layers.

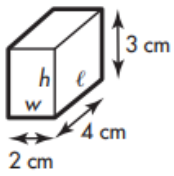
8 cubes × 3 = 24 cubes

The volume of each cube is 1 cm^3.

The volume of the prism is 24 cm^3.

Using a formula:

You know the length ℓ, the width w, and the height h. Calculate the volume, V, using the formula $V = \ell \times w \times h$.

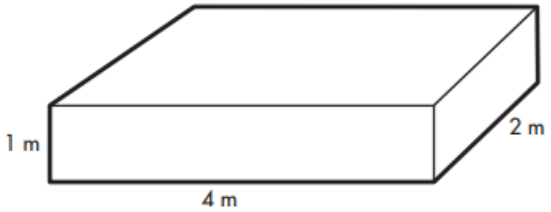


$V = 4 \text{ cm} \times 2 \text{ cm} \times 3 \text{ cm}$

$V = 24 \text{ cm}^3$

Find the volume of each rectangular prism using a formula.

1.

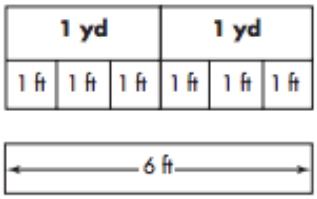


Converting Lengths

How to change a length measurement from one unit to another:

Converting a length measurement from a smaller unit to a larger unit

6 feet = _____ yards



Think: If I measure the same length using a larger unit, I will need a smaller number of units.

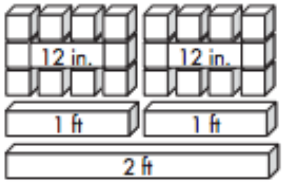
Operation: Divide.

You know 3 ft = 1 yd.

Find 6 ÷ 3; 6 ft = 2 yd

Converting a length measurement from a larger unit to a smaller unit

2 feet = _____ inches



Think: If I measure the same length using a smaller unit, I will need a larger number of units.

Operation: Multiply.

You know 1 ft = 12 in.

Find 2 × 12; 2 ft = 24 in.

Relationships Among Customary Units of Length			
Inch	Foot	Yard	Mile
12 in. =	1 ft		
36 in. =	3 ft =	1 yd	
	5,280 ft =	1,760 yd =	1 mi

Complete.

1. 5 ft = _____ in.

2. 3 mi = _____ ft

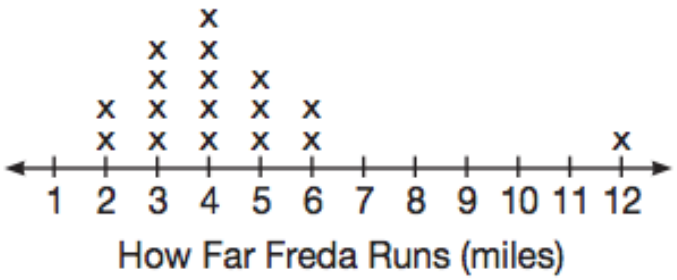
3. 108 in. = _____ ft

4. 72 in. = _____ yd

Line Plots

The table below gives the number of miles Freda ran over a period of days. A line plot shows data along a number line. Each *X* represents one number in the data set.

Miles Run	Days
2	2
3	4
4	5
5	3
6	2
12	1



How Far Freda Runs (miles)

On the line plot, each *X* represents 1 day. An outlier is a number in a data set that is very different from the rest of the numbers.

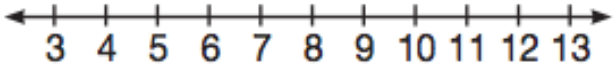
---

1. Is there an outlier in the data set above? Explain.

_____

2. Complete the line plot to show the data in the table for puppies' weights at birth. Identify the outlier in the data set.

_____



Weights of Puppies (lb)

Weight (lb)	Number of Puppies
3	5
4	3
5	2
6	0
7	1
13	1

Representing Data

In a survey, each student was asked this question. What color is your math notebook? Here are the responses: red, blue, green, red, yellow, yellow, red, blue, red, yellow, blue.

How to display data collected from surveys:

The data can be displayed in a frequency table or a line plot.

Frequency Table

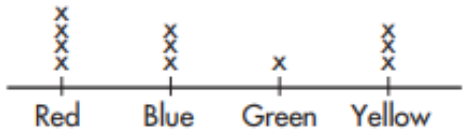
1. Count the number of times each different response was made.
   red: ////; blue: ///; green: /; yellow: ///
2. Construct a frequency table. The table lists each response and its frequency. (The frequency of a response is how many times it was made.)
3. Give the frequency table a title that clearly explains what information is in the table.

Survey Question: What color is your math notebook?	
Notebook Color	**Number**
Red	4
Blue	3
Green	1
Yellow	3

Line Plot

1. Count the number of times each different response was made.
   red: ////; blue: ///; green: /; yellow: ///
2. Construct a line plot. The plot lists each response along a horizontal line. The frequencies are stacked as x's above each response.
3. Give the line plot a title that clearly explains what information is in the plot.

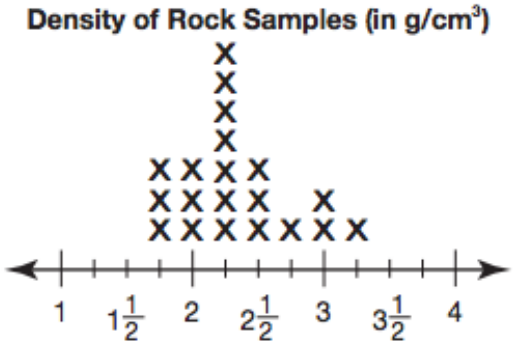
Survey Question: What color is your math notebook?



1. How many students responded to the notebook survey? _____
2. Which color are the greatest number of math notebooks? _____

Using a Dot Plot

You have learned how to draw line plots. Now you can analyze the data in a line plot. Mrs. Calderwood separated the rock samples in her science classroom using their densities. She made a line plot of the data.



For questions **1–4**, use the line plot above.

1. Find how many rocks were used in the line plot.

_____

2. Which density occurs most often?

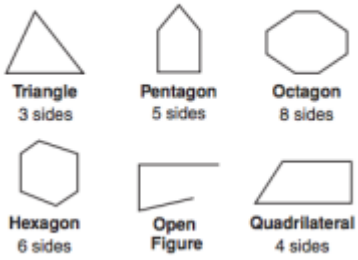
_____

3. What is the difference between the greatest density and the least density?

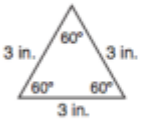
_____

Polygons

A polygon is a closed plane figure made up of line segments. Common polygons have names that tell the number of sides the polygon has.

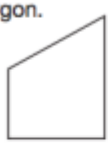


A **regular polygon** has sides of equal length and angles of equal measure.



Each side is 3 in. long.
Each angle is 60°.

Name each polygon. Then tell if it appears to be a regular polygon.

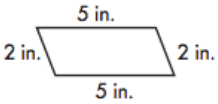
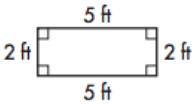
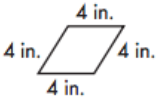
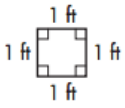
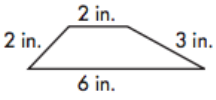
1. 

2. 

3. 

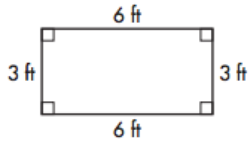
4. 

Classifying Quadrilaterals

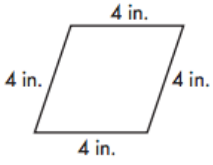
Quadrilateral	Definition	Example
Parallelogram	A quadrilateral with both pairs of opposite sides parallel and equal in length	
Rectangle	A parallelogram with four right angles	
Rhombus	A parallelogram with all sides the same length	
Square	A rectangle with all sides the same length	
Trapezoid	A quadrilateral with only one pair of parallel sides	

Remember that the sum of the measures of the angles of a quadrilateral is 360°.

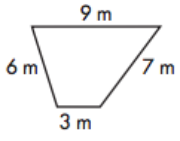
Classify each quadrilateral. Be as specific as possible.

1. 

_____

2. 

_____

3. 

_____

Points on the Coordinate Grid

Locating a point on a coordinate grid

The ordered pair (5, 7) describes the location of Point *A*.

(5, 7)

The first number tells how far to move to the right along the *x*-axis from zero.

This number is called the *x*-coordinate.

The second number tells how far to move up from the number on the *x*-axis.

This number is called the *y*-coordinate.

Locating a point from an ordered pair

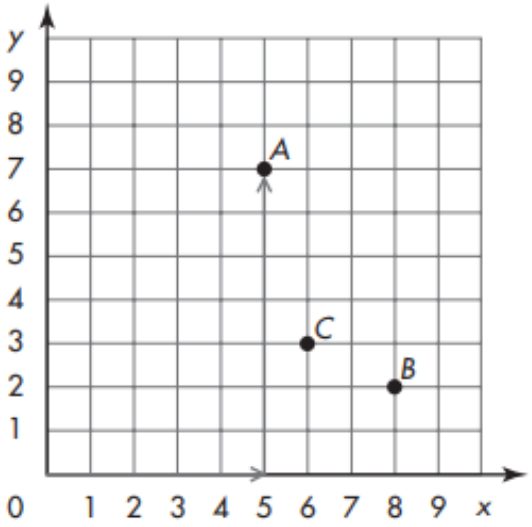
Step 1: Start at zero.

Step 2: Move 5 spaces to the right.

Step 3: Move 7 spaces up.

The ordered pair for *B* is (8, 2).

The ordered pair for *C* is (6, 3).



Name the point that is located by each ordered pair.

1. (7, 1) _____ **2.** (2, 6) _____

3. (0, 8) _____ **4.** (4, 3) _____

Write the ordered pair for each point.

5. *F* _____ **6.** *B* _____

7. *D* _____ **8.** *A* _____