• Negative Exponents
• Scientific Notation for Small Numbers

The Law of Exponents for Negative Exponents

An exponential expression with a negative exponent is the reciprocal of the expression with the opposite exponent.

$$x^{-n} = \frac{1}{x^n} \qquad 10^{-4} = \frac{1}{10^4} = \frac{1}{10{,}000} = 0.0004$$

To simplify a number with a negative exponent, follow these two steps:

1. Find the reciprocal of the number that is raised to a power.
2. Change the exponent from a negative one to a positive one.

Example: Simplify 4^{-3}.

The reciprocal of 4 is $\frac{1}{4}$.

Change the exponent from negative three to positive three.

So, $4^{-3} = \frac{1}{4^3}$.

Scientific Notation for Small Numbers

Small numbers are those between 0 and 1. Negative powers of ten are used to write small numbers in scientific notation.

Example: Write 2.5×10^{-7} in standard form. Just shift the decimal point seven places to the left: 0.00000025

Practice:

Simplify.

1. $5^{-3} =$ _____ **2.** $3^{-2} =$ _____ **3.** $x^{-4} =$ _____

4. $10^{-3} \cdot 10^{-5} =$ _____ **5.** $\frac{10^2}{10^4} =$ _____ **6.** $\frac{4x^{-3}y^2}{2xy} =$ _____

7. Write 10^{-5} as a decimal number. ____________________

8. Write 0.0075 in scientific notation. ____________________

9. Write 3.5×10^{-3} in standard form. ____________________

• Using Unit Multipliers to Convert Measures
• Converting Mixed-Unit to Single-Unit Measures

To convert a measure from one unit to another unit, you can use unit multipliers.

> A unit multiplier is a ratio in which the numerator and denominator are equivalent measures but different units.

For example: the following unit multipliers each equal 1.

$$\frac{3\text{ ft}}{1\text{ yard}} \text{ or } \frac{60\text{ sec}}{1\text{ min}} \text{ or } \frac{1\text{ gallon}}{8\text{ cups}}$$

The identify property tells us that multiplying a quantity by 1 does not change the quantity. We can use unit multipliers to rename a measure from one unit to another unit.

Example: The driveway is 108 feet long.
You can convert this to yards by multiplying 108 feet by $\frac{1\text{ yard}}{3\text{ ft}}$.

$$108\text{ }\cancel{\text{ft}} \times \frac{1\text{ yard}}{3\text{ }\cancel{\text{ft}}} = \longrightarrow \frac{108}{3} = 36\text{ yds}$$

• Mixed measures include two units like feet and inches.

Example: A rug is 8 ft 6 in. long. What is the length of the rug in feet?
6 inches is $\frac{6}{12}$ of a foot or $\frac{1}{2}$ ft. This is equal to 0.50 ft.

8 ft 6 in. $= 8\frac{1}{2}$ ft or 8.5 ft

Practice:

1. A quart is 4 cups. Convert 25 cups to quarts using a unit multiplier. ________
2. Beth ran 3 miles in 21 min and 15 sec. Convert the time to minutes. ________
3. The bus travels 75 miles in one hour and 30 minutes. How many hours does it take for the bus to travel 75 miles? ________________
4. Thomas studied for a total of 540 minutes this week. How many hours did he study? ________________
5. Mr. Cannidy caught a snake that measured 57 inches long and weighed 14 pounds 4 ounces. Convert these measures to feet and to pounds respectively, expressed as decimals. ________________

Name ______________________________

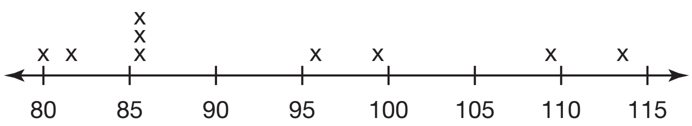
• Solving Problems Using Measures of Central Tendency

To summarize data, we often use:

Mean	the sum of the values divided by the number of values
Median	the middle value
Mode	the item that occurs most often
Range	the difference between the highest and lowest ratings

You can display data using a line plot.

Example: The 9th graders earned the following monthly spirit points for the 2004–2005 school year: 80, 86, 96, 109, 99, 86, 113, 86, 82



The mean, median, and mode can be expressed as follows:

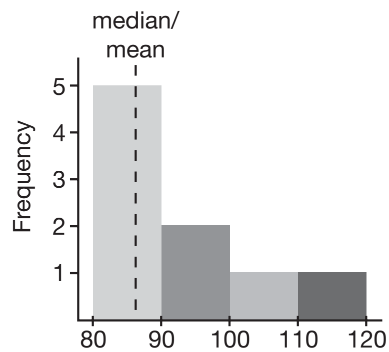
Mean $\frac{80 + 86 + 96 + 109 + 99 + 86 + 113 + 86 + 82}{9} = 93$

Median 86

Mode 86

Range $113 - 80 = 33$

The data can also be displayed in a histogram.



Practice:

1. The amount of gas (in gallons) that Maggie used each week for 9 weeks is listed below.

16, 22, 10, 11, 10, 25, 12, 10, 19

a. Make a line plot of the data. ______________________________

b. Find the mean, median, mode, and range of the data.

____

c. Which measure would be most helpful in budgeting for future gas expenditures?

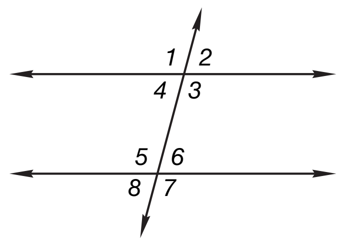
____

Name ______________________

• Angle Relationships

• Refer to Lesson 54 for descriptions and illustrations of angle relationships.

Practice:



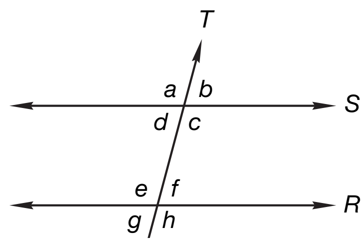
Angle *2* measures 15°.

1. Which angle is the vertical angle of angle *2*? ______________________

2. Which angles are supplements of angle *3*? ______________________

3. What is the measure of angle *4*? ______________________

4. What is the sum of angles *1*, *3*, and *4*? ______________________



Angle *c* measures 105°. Lines *S* and *R* are parallel lines cut by transversal *T*.

5. Name two pairs of alternate interior angles. ______________________

6. Which angles correspond to ∠*a*? ______________________

7. What is the measure of angle *e*? ______________________

8. What is the combined measure of angle *d* and angle *e*? ______________________

Name ______________________________

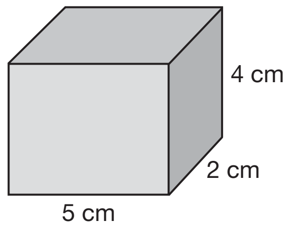
• Nets of Prisms, Cylinders, Pyramids, and Cones

The net of a solid shape is the flat shape which can be cut out and folded to form the solid shape.

Practice:

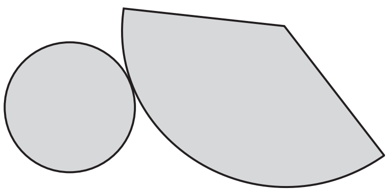
1.

a. Sketch the front, top, and right side view of this rectangular prism.



b. Then sketch a net for the figure with the actual dimensions on the back of this sheet of paper.

2. Name the figures for these nets:

a. 

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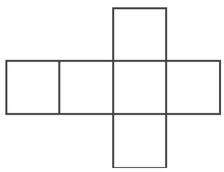
b. 

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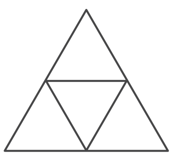
c. 

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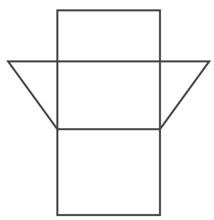
d. 

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3. Sketch a net for this cylinder.

Name ______________________________

• The Slope-Intercept Equation of a Line

The equation of a line can be written in slope-intercept form: $y = mx + b$.
You can read the slope and y-intercept directly from the equation:

$$y = (\text{slope})x + (y\text{-intercept})$$

A horizontal line has zero slope and can be expressed in slope-intercept form without an x-term, $y = 3$.
However, a vertical line cannot be expressed in slope-intercept form.

Practice:

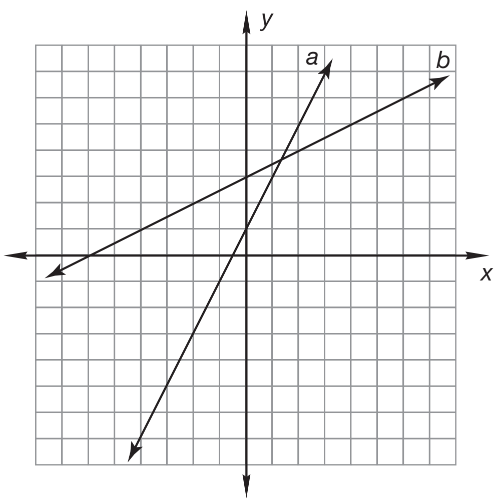
1. Identify the slope and y-intercept of the graph for each equation:

a. $y = 2x + 4$ ______________________________

b. $y = \frac{1}{2}x + 2$ ______________________________

c. $y = 5x - 3$ ______________________________

2. Write equations for lines *a* and *b* in slope-intercept form.



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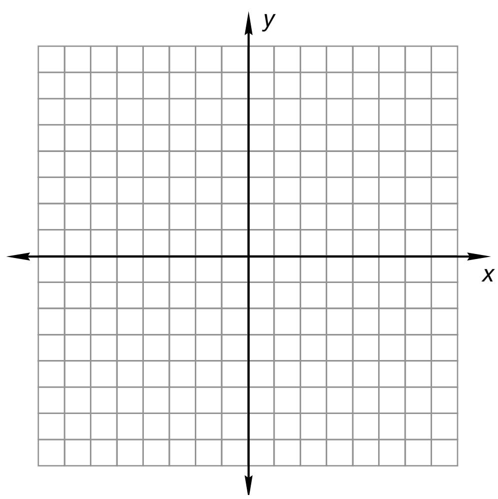
3. On the coordinate plane below graph these equations.
a. $y = 2x + 2$ **b.** $y = \frac{1}{2}x - 2$



• Operations with Small Numbers in Scientific Notation

To multiply powers of 10, add the exponents.
$10^4 \cdot 10^3 = 10^7$ $10^{-3} \cdot 10^{-2} = 10^{-5}$
$10^2 \cdot 10^6 = 10^8$ $10^{-2} \cdot 10^5 = 10^3$

To divide powers of 10, subtract the exponents.
$\frac{10^7}{10^3} = 10^4$ $\frac{10^{-6}}{10^{-4}} = 10^{-2}$ $\frac{10^5}{10^{-2}} = 10^7$

You can use what you know about multiplying and dividing powers of 10 to solve problems like these.

Example: $\frac{3.2 \times 10^6}{2 \times 10^{-2}}$

First divide $3.2 \div 2 = 1.6$.

Then, subtract the exponents $^{6 - {-2}} = {}^8$.

The result in scientific notation is 1.6×10^8.

Example: $(3 \times 10^2)(6.5 \times 10^{-4})$

First multiply $3 \times 6.5 = 19.5$.

Then, add the exponents $^2 + {}^{-4} = {}^{-2}$.

The result in scientific notation is 19.5×10^{-2}.

Adjustments: $19.5 \times 10^{-2} = 1.95 \times 10^1 \times 10^{-2} = 1.95 \times 10^{-1}$

Practice:

Find each product or quotient.

1. $(2 \times 10^6)(3 \times 10^{-4})$ ____________________
2. $(1.5 \times 10^3)(2 \times 10^{-5})$ ____________________
3. $(2.3 \times 10^{-2})(3 \times 10^{-5})$ ____________________
4. $\frac{2.8 \times 10^4}{4 \times 10^{-2}}$ ____________________
5. $\frac{6.2 \times 10^{-3}}{2 \times 10^{-5}}$ ____________________
6. $\frac{1.5 \times 10^{-4}}{3 \times 10^{-2}}$ ____________________

• Solving Percent Problems with Equations

A percent of a whole is a part.

To solve a percent problem, use this formula:

$$\% \times W = P$$

The three numbers in the equation are the percent, the whole, and the part.
You can solve an equation if you know two of the three numbers.
Covert the percent to a decimal or a fraction before performing the calculation.

Example: Twelve percent of 250 is what number?
As a decimal: $0.12 \times 250 = 30$
As a fraction: $\frac{12}{100} \times 250 = 30$
Therefore, 12% of 250 is 30.

Sometimes you may be given the whole and the part and have to determine the percent. For example, Tom filled 30 of the 50 boxes. What percent of the boxes did he fill?

Solve the problem like this: $P \cdot 50 = 30$ $\frac{P \cdot 50}{50} = \frac{30}{50}$ $P = 0.6$ or 60%

Practice:

1. Of the 1200 people who attended the Friday night football game, 57% were high school students. How many students attended the game? ________________

2. How much is a 20% tip on a meal that costs $35.60? ____________________

3. Martin paid $120 towards his $2400 credit card bill. What percentage of his bill did he pay? ____________________

4. What is $7\frac{1}{2}\%$ of $620? ______________________________

• Experimental Probability

The **probability** of an event is a measure of the likelihood that the event will occur. **Experimental probability** is the ratio of the number of times an event occurs to the number of trials.

$$\text{Experimental probability} = \frac{\text{number of times an event occurs}}{\text{number of trials}}$$

Example: Diane rolled a number cube 100 times. She got a three 20 times. The probability can be written as $\frac{20}{100}$ or $\frac{2}{10}$ or 0.2.

Example: A baseball player got 22 hits in 70 at-bats. The probability can be written as $\frac{22}{70}$ or .314. (Express batting averages with three decimals places.)

The more times you conduct an experiment, the more accurate your estimate of the probability is likely to be. So, it is important to have a large number of trials when conducting probability experiments.

You'll find experimental probability commonly used in the following fields: sports, business, weather forecasting, insurance, and banking.

Practice:

1. Diana added a new designer to her store's line of clothing. Since adding the new designer, 36 out of 90 customers have bought the new label. What is the probability that the next shopper will buy a piece of clothing by the new designer?

   ____

2. If Diana normally has 150 customers each day, about how many items by the new designer should she expect to sell? ____________________

3. Dion completes about 40% of the passes he throws. Describe a model to simulate a game in which Dion throws 15 passes.

   ____

   ____

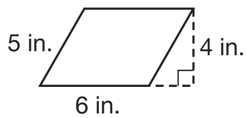
4. How many passes would Dion be expected to complete in a game in which he throws 20 passes? ____________________

• Area of a Parallelogram

To find the area of a parallelogram we multiply its base times its height. The base is the length of one side. The height is the perpendicular distance to the opposite side.

To find the perimeter of a parallelogram we add the lengths of the four sides.

Example: Find the perimeter and area of this parallelogram.



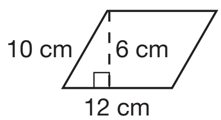
Perimeter = 5 in. + 6 in. + 5 in. + 6 in. = 22 in.

Area = 6 in. × 4 in. = 24 in.^{2}

Practice:

Determine the area and the perimeter of the following parallelograms:

1.



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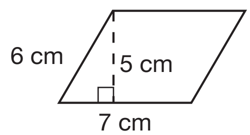

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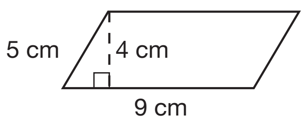

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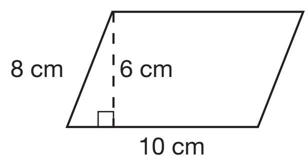

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