Name ______________________ Date __________

4-1 Study Guide

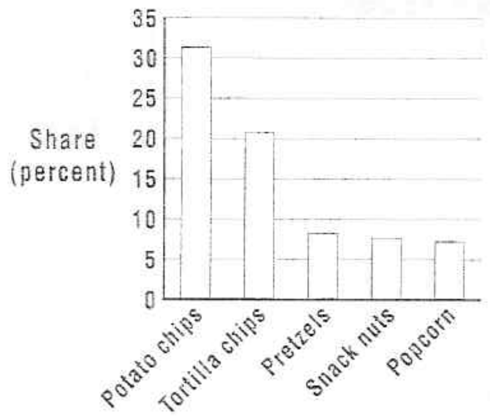
Bar Graphs and Histograms

A **bar graph** compares different categories of data by showing each as a bar whose length is related to the frequency.

Example 1 The table shows Americans' top five favorite snacks, by their share of total sales. Make a bar graph of the data.

Product	Share
Potato chips	31.9%
Tortilla chips	21.4%
Pretzels	8.6%
Snack nuts	8.4%
Popcorn	8.1%

Favorite Snack Foods

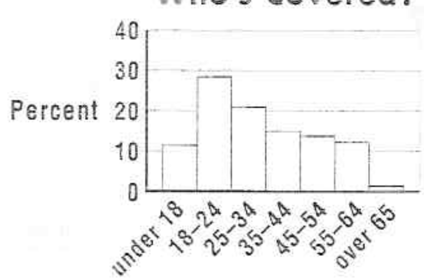


A **histogram** uses bars to display numerical data that have been organized into equal intervals.

Example 2 The table shows the percent of people in several age groups who are not covered by health insurance. Make a histogram of the data.

Age	Percent
under 18	12.4%
18-24	28.9%
25-34	20.9%
35-44	15.5%
45-54	14.0%
55-64	12.9%
over 65	1.2%

Who's Covered?



Make a histogram of the data below.

Pieces of Junk Mail	Frequency
0-4	25
5-9	35
10-14	50
15-19	40
20-24	15

Name ______________________ Date ____________

4-2 Study Guide

Circle Graphs

A **circle graph** shows how a whole is divided into parts.

The chassis of a race car cost \$220,000. The engine cost \$90,000. The tires and wheels cost \$3,000. You can represent this data in a circle graph.

To make a circle graph for this data, first find the total cost of the race car: \$220,000 + \$90,000 + \$3,000 = \$313,000.

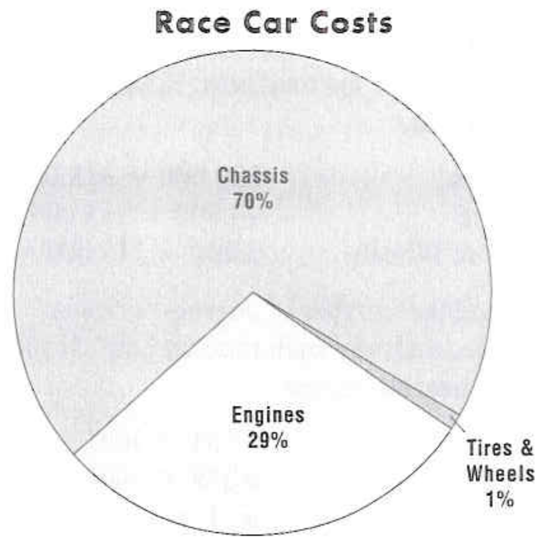
Then find the ratio that compares the cost of each of the parts to the total cost. Round to the nearest thousandth.

Chassis	$220{,}000 \div 313{,}000 \approx 0.701$
Engine	$90{,}000 \div 313{,}000 \approx 0.288$
Tires & Wheels	$3{,}000 \div 313{,}000 \approx 0.01$

To find the number of degrees for each section, multiply each ratio by 360°. Round to the nearest degree.

Chassis	$0.701 \times 360° = 252.36$ or 252
Engine	$0.288 \times 360° = 103.68$ or 104
Tires & Wheels	$0.01 \times 360° = 3.6$ or 4

Use a compass and protractor to construct a circle with angles at the center of 252°, 104°, and 4°.



Make a circle graph of the data below.

Types of Human Bones	Number
Skull	29
Spine	26
Ribs and Breastbone	25
Shoulders, Arms and Hands	64
Pelvis, Legs, and Feet	62

Name ______________________________ Date ______________

4-3 Study Guide

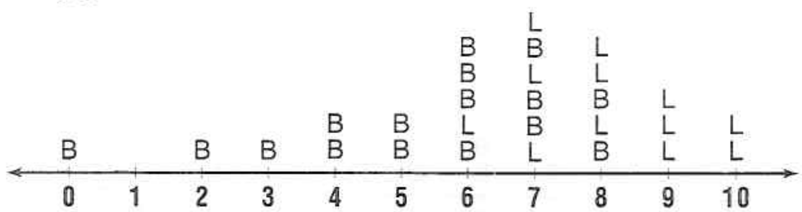
Line Plots

Another way to organize frequency data is with a line plot.

Example **A restaurant owner asked her customers to rate the food on a scale of 0 (very bad) to 10 (very good). The data below shows the results. The meal at which the customer was surveyed is also shown: B = breakfast, L = lunch.**

5-B	7-L	9-L	0-B	6-B	6-L	8-B
10-L	4-B	8-L	8-B	2-B	8-L	7-B
4-B	7-B	7-L	6-B	9-L	10-L	6-B
7-B	5-B	9-L	8-L	7-L	6-B	3-B

For each customer, write the letter of the meal over the rating given.

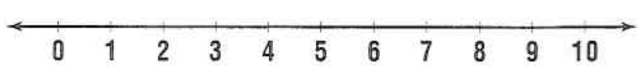


From the line plot, you can see that most ratings are between 6 and 8 and that lunch received better ratings than breakfast.

Movie goers were asked to rate a movie from 0 to 10. The rating and the age of the person responding were recorded: A = Adult, Y = Youth. Use the data to answer the questions.

7-A	***8-A***	***5-Y***	***5-A***	***9-A***	***7-Y***	***6-Y***	***10-A***	***3-Y***	***6-Y***	***6-A***
7-Y	***8-A***	***2-Y***	***7-Y***	***5-A***	***6-Y***	***9-A***	***3-Y***	***8-Y***	***7-A***	***7-A***

1. Make a line plot of the data.



2. Analyze the line plot. Between what ratings does most of the data fall?

3. How are the ratings of adults different from the ratings of youths?

4-4

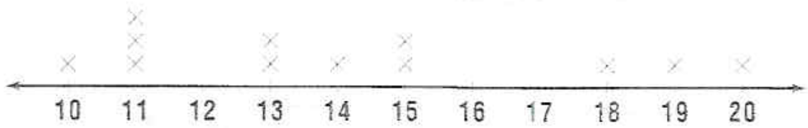
Name ______________________ Date ____________

Study Guide

Measures of Central Tendency

Mean, median, and mode are three ways to measure the central tendency of a set of data.

Example **Find the mean, median, and mode to the nearest tenth for the data shown on the line plot.**



The **mean** is the sum of the data divided by the number of pieces of data.

$$\text{mean} = \frac{10 + 11 + 11 + 11 + 13 + 13 + 14 + 15 + 15 + 18 + 19 + 20}{12}$$

$$= 170 \div 12 \text{ or about } 14.2$$

The **median** is the number in the middle when the data are arranged in order. When there are two middle numbers, add them and divide by 2.

$$\text{median} = \frac{13 + 14}{2} = \frac{27}{2} \text{ or } 13.5$$

The **mode** is the number that appears most often. There may be one mode. There may be more than one mode. There may be no mode.

mode = 11

Find the mean, median and mode for each set of data. When necessary, round to the nearest tenth.

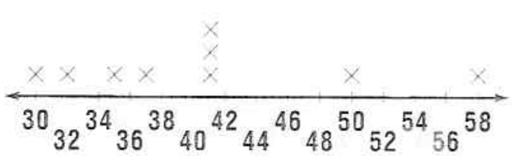
1. 6, 3, 8, 2, 5, 6, 4, 6, 9, 4

2. 15, 18, 34, 25, 10, 21, 16

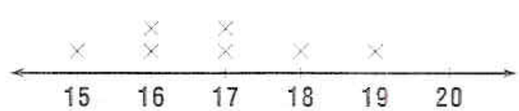
3. 120, 145, 210, 175, 165, 120, 145

4. 15, 16, 37, 47, 2, 19, 22, 7, 5

5.



6.



4-5

Name ______________________ Date ____________

Study Guide

Measures of Variation

The spread of a set of data is called the **variation.** One measure of variation is the **range.** The range of a set of data is the difference between the greatest and the least numbers in the set. Look at the data below.

30	32	34	36	37	41
44	45	48	48	48	49
50	51	52	53	55	

The least number is 30. The greatest number is 55. The range of the data is $55 - 30$ or 25.

The **interquartile range** is the range of the middle half of the data. To find the interquartile range, first find the median. The median of the data above is 48. Then find the **upper quartile** and **lower quartile** by finding the median of each half of the data.

lower quartile $= \frac{36 + 37}{2}$ or 36.5

upper quartile $= \frac{50 + 51}{2}$ or 50.5

The interquartile range is $50.5 - 36.5$ or 14.

Use the data in the list below to answer each question.

70	*71*	*74*	*76*	*78*	*78*	*79*
81	*85*	*87*	*88*	*89*	*90*	
93	*96*	*96*	*97*	*97*	*98*	

1. What is the range?

2. What is the median?

3. What are the upper and lower quartiles?

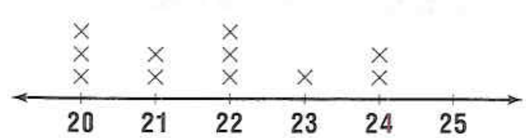
4. What is the interquartile range?

Use the data in the line plot.

5. What is the range?

6. What is the median?

7. What is the interquartile range?



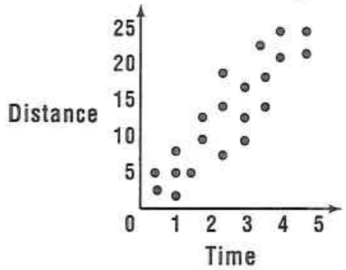
Name ____________________ Date ____________

4-6 Study Guide

Integration: Algebra Scatter Plots

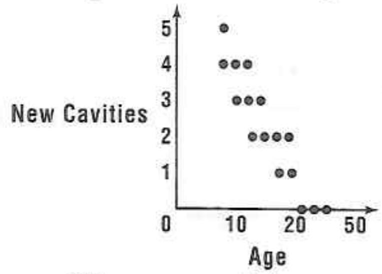
When you graph two sets of data as ordered pairs, you make a **scatter plot**. The pattern of the dots determines the relationship between the two sets of data.

Positive Relationship



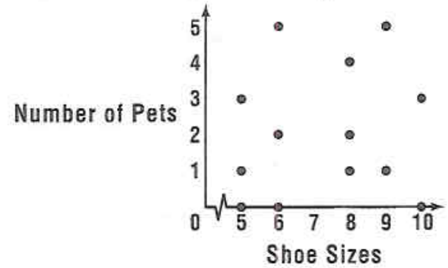
The pattern of dots slants upward to the right.

Negative Relationship



The pattern of dots slants downward to the right.

No Relationship



The dots are spread out. There is no pattern.

Determine whether a scatter plot of the data below would show a positive, negative, or no relationship.

1. eye color and age

2. miles driven and gallons of gas used

3. driving speed and driving time

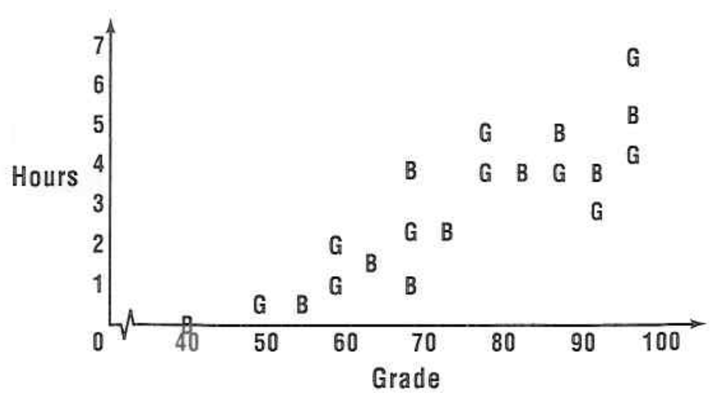
4. laps swum and swimming time

The scatter plot shows the amount of time boys (B) and girls (G) spent studying and their grades on a history test. Use the scatter plot to answer the questions.

5. Describe the relationship shown by the scatter plot.

6. Is the relationship the same for boys and for girls?

7. What other factors might affect the grades on the history test?



Name ______________________ Date ____________

4-7 Study Guide

Choosing an Appropriate Display

You are given data on the percentage of each age group in a recent survey that knew all 50 state capitals. What is the best way to display the data to show the differences between the age groups?

A circle graph is not appropriate. Circle graphs show how parts relate to the whole. A scatter plot is also not appropriate. Scatter plots illustrate the relationship between two variables.

Bar graphs and histograms are best used when showing a category on one axis and a frequency on the other axis. A histogram is most appropriate when the groups are organized in equal intervals. Thus, since these data would be divided into equal-sized age groups, a histogram would be the best choice.

Choose the most appropriate type of display for each data set and situation.

1. percentages of people who best like each of 5 different pizza toppings
2. ages and numbers of people who like in-line skating to determine marketing strategies for a brand of skates
3. age ranges of people who volunteer in America
4. total sales of the 8 best-selling soft drinks
5. amount of money spent on food, clothing, housing, and so on as compared to the monthly budget
6. numbers of different colors of candy in a package
7. number of telephones in homes surveyed for a newspaper article
8. number of people with 0, 1, 2, 3, 4, 5, . . . children
9. years and amount of the federal trade deficit for a report
10. prices of new 4-door sedans from 8 manufacturers to help you make a purchase

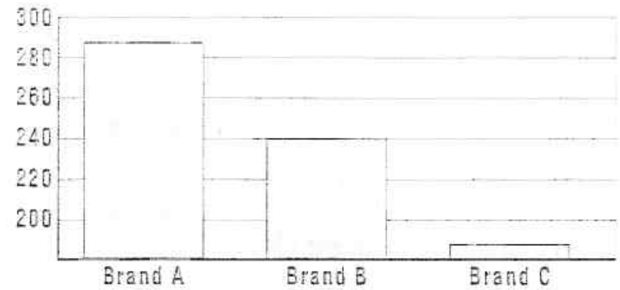
Name ______________________________ Date ______________

4-8 Study Guide

Misleading Graphs and Statistics

Graphs and statistics can be used to present data in ways that are misleading.

Examples



1 The scale does not begin at 0. The heights of the bars give the impression that twice as many people chose the Brand A as chose Brand B and that very few people chose Brand C.

2 Fifty 13- and 14-year-old students were surveyed. This sample is not representative of the entire population.

> 80% of the people surveyed believe that 14-year-olds should be allowed to drive!

Use the graph to answer the questions.

1. About how many times as many soccer balls did the uptown store sell as the downtown store?

2. How do the sizes of the soccer balls compare to the sales?

3. Is this a misleading graph? Explain.

Decide whether each population is a representative sample for a survey.

Survey Topic	Population
4. best brand of baby food	mothers of children under age 3
5. longest wearing tires	junior high school students
6. best movie of the year	people entering a movie theater
7. best football team	people in San Francisco

Name ______________________ Date __________

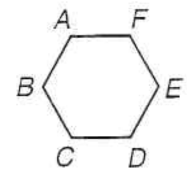
5-1 Study Guide

Parallel Lines

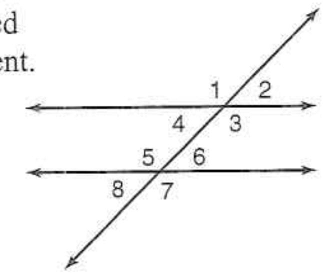
Parallel lines are lines in the same plane that never intersect. To say *line m is parallel to line n* we write $m \parallel n$.

Example 1 **Name the parallel segments in the figure.**

$\overline{AB} \parallel \overline{ED}$, $\overline{BC} \parallel \overline{FE}$, $\overline{CD} \parallel \overline{AF}$



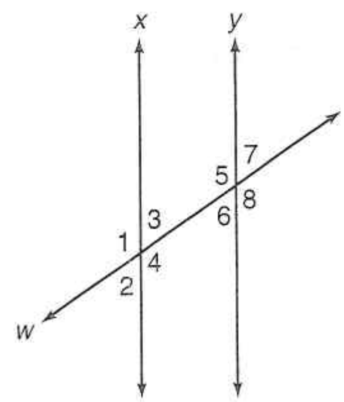
A line that intersects two or more lines is called a **transversal.** If a pair of parallel lines is intersected by a transversal, these pairs of angles are congruent. The symbol $\cong$ means *is congruent to.*



alternate interior angles: $\angle 4 \cong \angle 6$, $\angle 3 \cong \angle 5$
alternate exterior angles: $\angle 1 \cong \angle 7$, $\angle 2 \cong \angle 8$
corresponding angles: $\angle 1 \cong \angle 5$, $\angle 2 \cong \angle 6$,
$\angle 3 \cong \angle 7$, $\angle 4 \cong \angle 8$

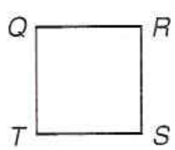
Example 2 **In the figure, $x \parallel y$. Find $m\angle 3$ if $m\angle 7 = 70°$.**

$\angle 3$ and $\angle 7$ are corresponding angles.
They are congruent, so their measures are the same.
$m\angle 3 = m\angle 7$, $m\angle 3 = 70°$
Find $m\angle 2$ if $m\angle 7 = 70°$.
$\angle 2$ and $\angle 7$ are alternate exterior angles.
They are congruent, so their measures are the same.
$m\angle 2 = m\angle 7$, $m\angle 2 = 70°$

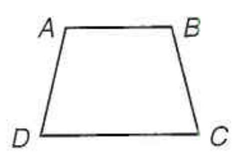


Name the parallel segments, if any, in each figure.

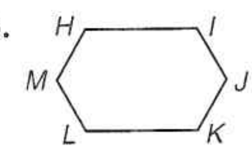
1.



2.



3.



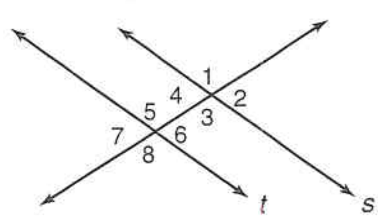
Use the figure at the right for Exercise 4-7. In the figure, s $\parallel$ t.

4. Find $m\angle 2$ if $m\angle 6 = 75°$.

5. Find $m\angle 5$ if $m\angle 3 = 105°$.

6. Find $m\angle 8$ if $m\angle 3 = 105°$.

7. Find $m\angle 4$ if $m\angle 6 = 75°$.



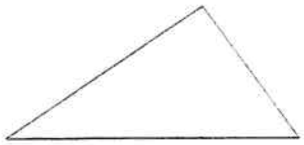
5-2

Name ______________________ Date ______________

Study Guide

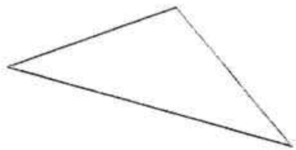
Classifying Triangles

Triangles may be classified by the lengths of their sides or by the measures of their angles.



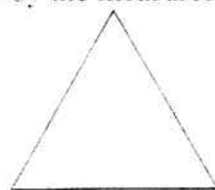
scalene

All sides are different lengths.



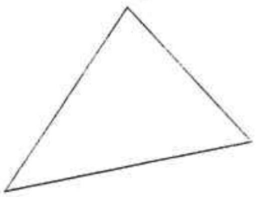
isosceles

Two sides are the same length.



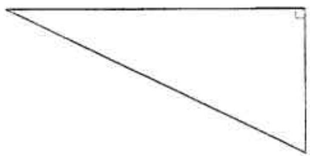
equilateral

All three sides are the same length.



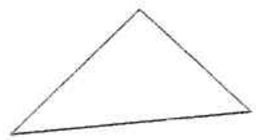
acute

All three angles are acute.



right

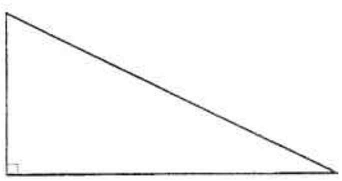
One angle is a right angle. The symbol ∟ shows a right angle.

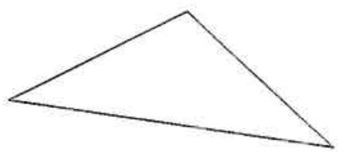


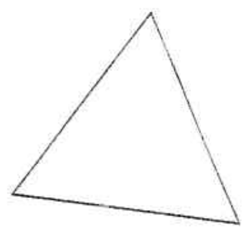
obtuse

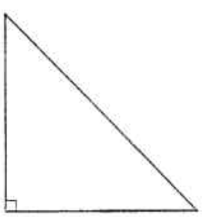
One angle is an obtuse angle.

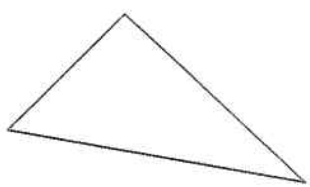
Classify each triangle by its angles and by its sides.

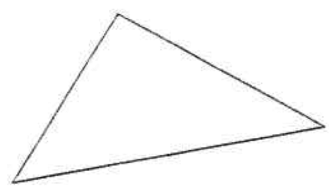
1. 

2. 

3. 

4. 

5. 

6. 

Tell whether each statement is true or false. Then draw a figure to justify your answer.

7. A right triangle can never be isosceles.

8. A triangle can be right and equilateral.

5-3

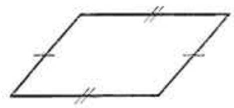
Name ______________________ Date __________

Study Guide

Classifying Quadrilaterals

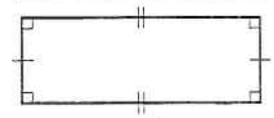
A **quadrilateral** is a figure with four sides and four angles. You can use sides and angles to classify quadrilaterals.

Parallelogram — Opposite sides are parallel. Opposite sides are congruent.

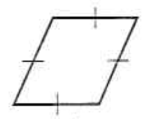


Trapezoid — One pair of parallel sides.

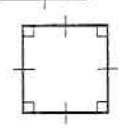
Rectangle — Opposite sides are parallel. Opposite sides are congruent. All four angles are right angles.



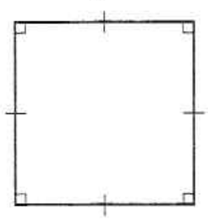
Rhombus — Opposite sides are parallel. All four sides are congruent.



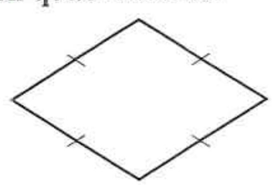
Square — Opposite sides are parallel. All four sides are congruent. All four angles are right angles.



Example **Identify all names that describe each quadrilateral.**



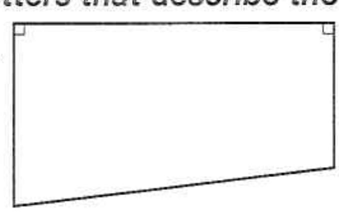
quadrilateral
parallelogram
rectangle
rhombus
square



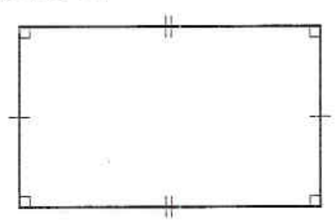
quadrilateral
parallelogram
rhombus

Let Q = quadrilateral, P = parallelogram, R = rectangle, S = square, RH = rhombus, and T = trapezoid. Write all of the letters that describe the figure inside it.

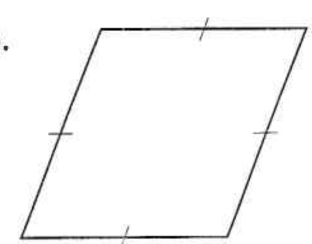
1.



2.



3.



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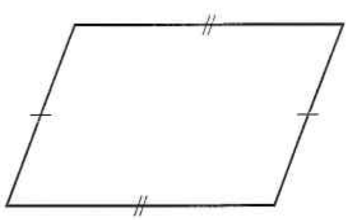

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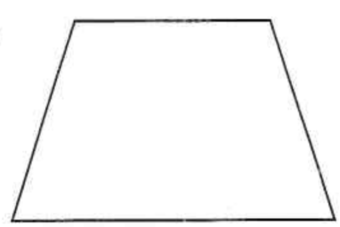

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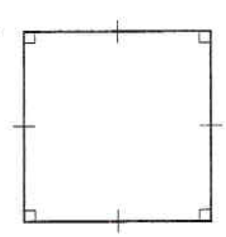


Name ______________________ Date __________

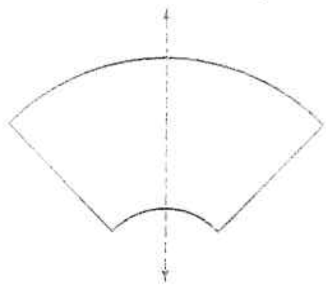
5-4

Study Guide

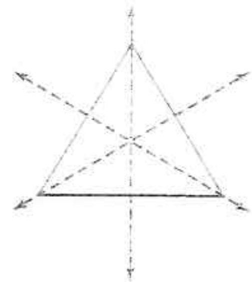
Symmetry

If you can fold a figure along a line so that the two parts reflect each other, the figure has a line of symmetry.

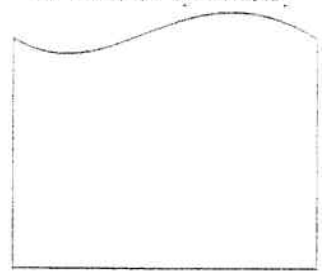
Examples one line of symmetry



three lines of symmetry



no lines of symmetry



A figure has rotational symmetry if it can be turned less than 360° about its center and it looks like the original figure.

Example Original

72° turn

144° turn

216° turn

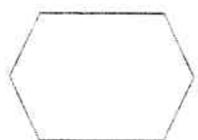
288° turn

Draw the line(s) of reflection for each figure.

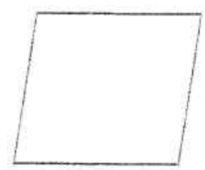
1.

2.

3.



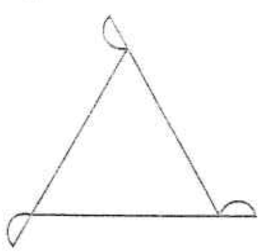
4.



Determine whether each figure has rotational symmetry.

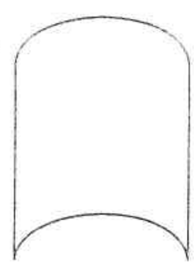
5.

6.



7.

8.



5-5

Name ____________________ Date ____________

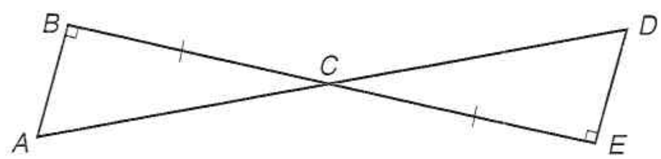
Study Guide

Congruent Triangles

If two figures are exactly the same size and shape, they are **congruent.** Two triangles are congruent if the following corresponding parts of two triangles are congruent.

- three sides (SSS)
- two angles and the included side (ASA)
- two sides and the included angle (SAS)

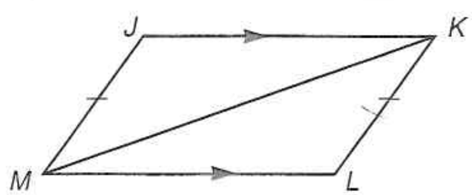
Example **Determine whether the triangles are congruent. If so, write a congruence statement and tell why the triangles are congruent.**



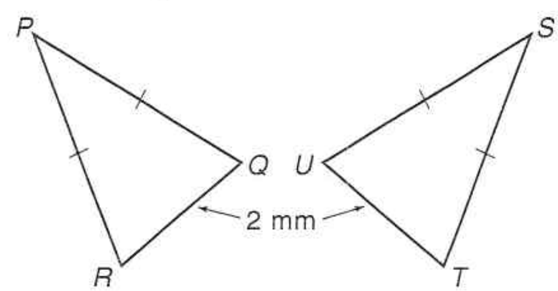
$\overline{BC} \cong \overline{CE}$
$\angle ACB \cong \angle DCE$ by vertical angles.
Since $\angle B$ and $\angle E$ are right angles, $\angle B \cong \angle E$.
Therefore, $\triangle ABC \cong \triangle CDE$ by ASA.

Determine whether each set of triangles is congruent. If so, write a congruence statement and tell why the triangles are congruent.

1.

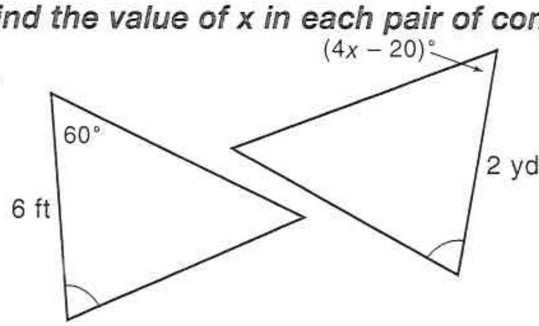


2.

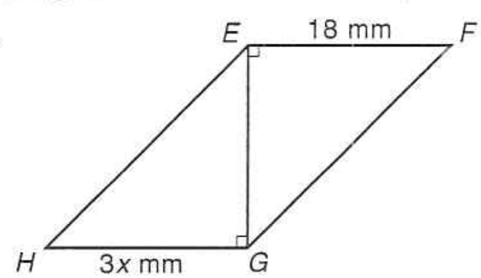


Find the value of x in each pair of congruent triangles.

3.



4.



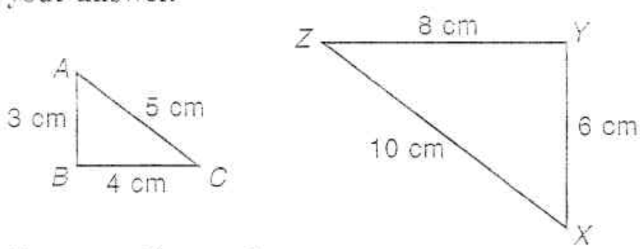
Name ______________________ Date ____________

5-6 Study Guide

Similar Triangles

Triangles that have the same shape, but may differ in size are called **similar triangles.** If corresponding angles are congruent and corresponding sides are proportional, then the triangles are similar.

Example Determine whether the triangles are similar. Justify your answer.

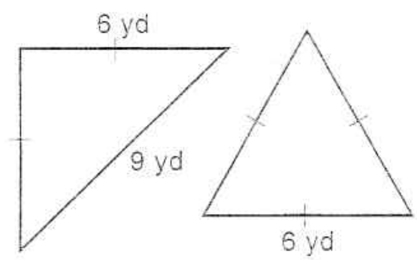


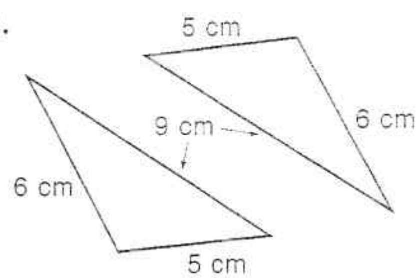
Corresponding angles are congruent.
Corresponding sides are proportional.

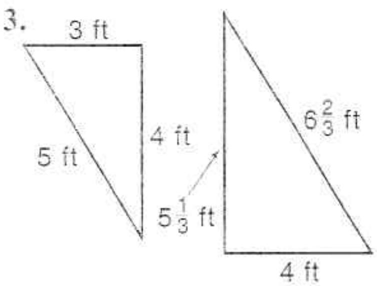
$\frac{AB}{XY} = \frac{3}{6}$ or $\frac{1}{2}$ $\quad \frac{BC}{YZ} = \frac{4}{8}$ or $\frac{1}{2}$ $\quad \frac{AC}{XZ} = \frac{5}{10}$ or $\frac{1}{2}$

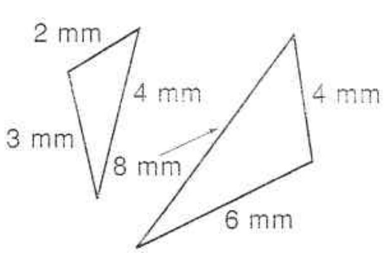
Therefore, the triangles are similar.

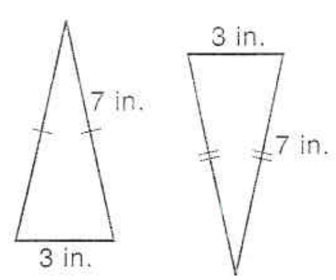
Tell whether each pair of triangles is congruent, similar, or neither. Justify your answer.

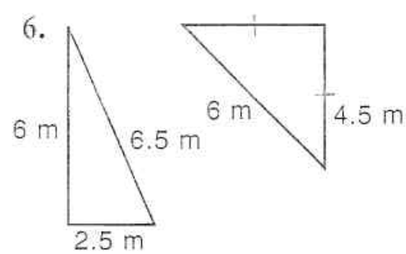
1. 

2. 

3. 

4. 

5. 

6. 

Name ______________________ Date __________

5-7 Study Guide

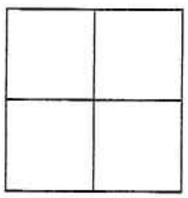
Transformations and M.C. Escher

M.C. Escher (1898-1972) was a Dutch artist famous for his repetitive interlocking patterns. You can use transformations to create Escher-like patterns.

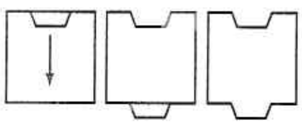
Slides and rotations are examples of **transformations.**

Example 1 **Use slides to modify a tessellation of squares.**

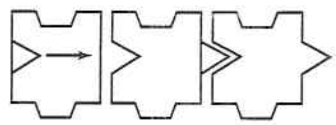
Tessellation of squares



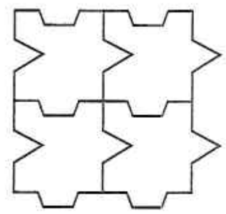
Make a change on the top of the square. Slide the change to the bottom of the square.



Make a change on one side of the square. Slide the change to the other side of the square.

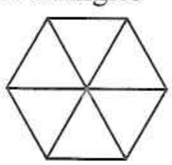


Repeat the pattern.



Example 2 **Use a rotation to modify a tessellation of triangles.**

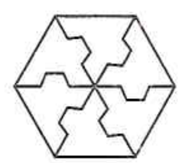
Tessellation of triangles



Change one side.

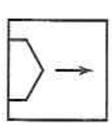
Rotate the triangle. Copy the change.

Repeat the pattern.

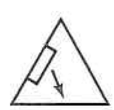


Make an Escher-like drawing for each pattern described. For squares, use a tessellation of two rows of three squares as the base. For the triangle, use a tessellation of two rows of five equilateral triangles as the base.

1.



2.



3.