LESSON 6

Identifying Pairs of Angles

Warm Up

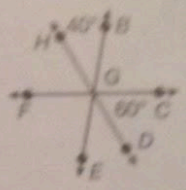
1. (3) **Vocabulary** Two angles that have the same measure are said to be _____.

2. (SB 5) Solve the equation $x + 135 = 180$.

3. (1) Match each term below with the correct definition.

• collinear	A the point or set of points common to different figures
• space	B on the same line
• coplanar	C the set of all points
• intersection	D in the same plane

4. (3) Identify one acute angle and one obtuse angle in the diagram.

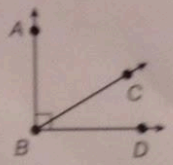
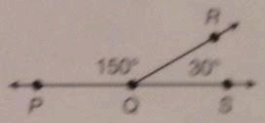


New Concepts

A pair of angles can sometimes be classified by their combined measure. These pairs are known as complementary and supplementary angles.

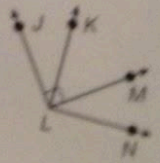
Math Language

The sum of an angle and its **complement** is 90°. The sum of an angle and its **supplement** is 180°.

Complementary Angles	Supplementary Angles
Two angles are **complementary angles** if the sum of their measures is 90°.	Two angles are **supplementary angles** if the sum of their measures is 180°.
$m\angle ABC + m\angle CBD = 90°$, so $\angle ABC$ is complementary to $\angle CBD$.	$m\angle PQR + m\angle RQS = 180°$, so $\angle PQR$ is supplementary to $\angle RQS$.
	

Example 1 Finding Complements and Supplements

a. Find the angles complementary to $\angle KLM$ if $m\angle KLN = 90°$.



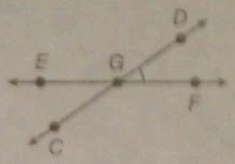
SOLUTION

From the diagram, $m\angle JLK + m\angle KLM = 90°$ and $m\angle KLM + m\angle MLN = 90°$.

So $\angle JLK$ and $\angle MLN$ are complementary to $\angle KLM$.

Online Connection
www.SaxonMathResources.com

b. Find the angles supplementary to $\angle DGF$.



SOLUTION

From the diagram, $m\angle EGD + m\angle DGF = 180°$ and $m\angle DGF + m\angle FGC = 180°$.

So, $\angle EGD$ and $\angle FGC$ are supplementary to $\angle DGF$.

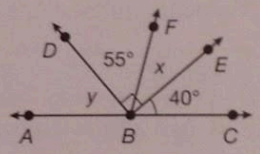
Theorem 6-1: Congruent Complements Theorem
If two angles are complementary to the same angle or to congruent angles, then they are congruent.

Theorem 6-2: Congruent Supplements Theorem
If two angles are supplementary to the same angle or to congruent angles, then they are congruent.

According to Theorem 6-1, if $\angle 1$ is complementary to $\angle 2$ and $\angle 3$ is also complementary to $\angle 2$, then $\angle 1 \cong \angle 3$. Likewise, according to Theorem 6-2, if $\angle 1$ is supplementary to $\angle 2$ and $\angle 3$ is also supplementary to $\angle 2$, then $\angle 1 \cong \angle 3$.

Example 2 Solving with Complements and Supplements

Find the measures of the angles labeled x and y.



SOLUTION

To find x, notice that $\angle DBF$ and $\angle FBE$ are complementary.

$m\angle DBF + m\angle FBE = 90°$	Definition of complementary angles
$55° + x = 90°$	Substitute.
$55° + x - 55° = 90° - 55°$	Substract 55° from each side.
$x = 35°$	Simplify.

Hint

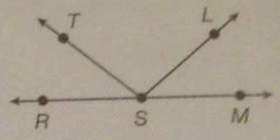
Notice that $m\angle DBC$ is equal to the sum of the measures of three angles: $m\angle DBF + m\angle FBE + m\angle EBC$.

To find y, notice that $\angle ABD$ and $\angle DBC$ are supplementary.

$m\angle ABD + m\angle DBC = 180°$	Definition of supplementary angles
$y + 55° + 35° + 40° = 180°$	Substitute.
$y + 130° = 180°$	Simplify.
$y + 130° - 130° = 180° - 130°$	Subtract 130° from each side.
$y = 50°$	Simplify.

Complementary angles and supplementary angles are related to each other by their angle measures. Angles are also related to each other by their positions relative to each other in the same plane.

Two angles in the same plane that share a vertex and a side, but share no interior points are **adjacent angles**. In the diagram, $\angle TSL$ is adjacent to $\angle LSM$, and $\angle RST$ is adjacent to $\angle TSL$.

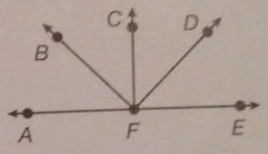


Adjacent angles whose non-common sides are opposite rays are a **linear pair**. In the diagram, $\angle RST$ and $\angle TSM$ are a linear pair. Recall that the measure of a straight line is 180°. Since a linear pair composes a straight line, linear pairs are supplementary.

Theorem 6-3: Linear Pair Theorem
If two angles form a linear pair, then they are supplementary.

Example 3 Identifying Angle Pairs

Identify two sets of adjacent angles and one linear pair.



SOLUTION

There are many adjacent angles in the diagram. Two possible sets are $\angle AFB$ and $\angle BFC$, and $\angle AFC$ and $\angle CFE$.

There are also several linear pairs shown. One is $\angle AFD$ and $\angle DFE$.

Math Reasoning

Generalize Are the statements below true or false?

a. *If two angles are not adjacent, then they are vertical angles.*

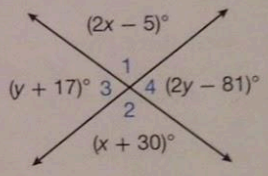
b. *If two angles form a linear pair, then they are adjacent angles.*

Nonadjacent angles formed by two intersecting lines are **vertical angles**. Vertical angles share the same vertex and have no common sides.

Theorem 6-4: Vertical Angle Theorem
If two angles are vertical angles, then they are congruent.

Example 4 Solving with Vertical Angles

Determine the values of x and y.



SOLUTION

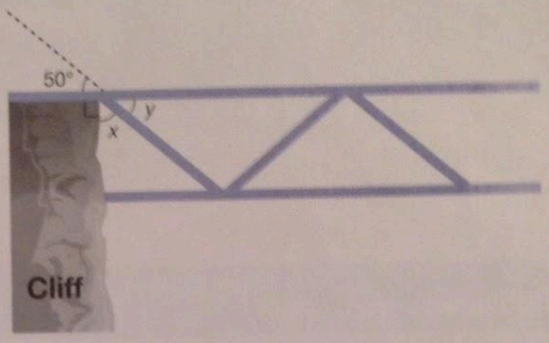
Since $\angle 1$ and $\angle 2$ are vertical angles, they are congruent. The same is true of $\angle 3$ and $\angle 4$. Therefore, $m\angle 1 = m\angle 2$ and $m\angle 3 = m\angle 4$.

$$
\begin{aligned}
m\angle 1 &= m\angle 2 \\
2x - 5 &= x + 30 \\
2x - 5 + 5 &= x + 30 + 5 \\
2x &= x + 35 \\
2x - x &= x + 35 - x \\
x &= 35
\end{aligned}
$$

$$
\begin{aligned}
m\angle 3 &= m\angle 4 \\
y + 17 &= 2y - 81 \\
y + 17 - 17 &= 2y - 81 - 17 \\
y &= 2y - 98 \\
y - 2y &= 2y - 98 - 2y \\
-y &= -98 \\
\frac{-y}{-1} &= \frac{-98}{-1} \\
y &= 98
\end{aligned}
$$

Example 5 Application: Bridge Supports

The diagram shows the part of a bridge where it contacts a vertical cliff, so that the bridge and the cliff are perpendicular. The angle between the surface of the road and the line extended from the bridge's support measures 50°. It is important that the bridge's support be set at the correct angle to hold the weight of the bridge. What is the angle x that the support makes with the cliff?



Math Reasoning

Formulate How could you have solved this problem by looking at a linear pair of angles instead of a vertical pair of angles?

SOLUTION

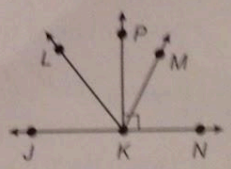
The angle that measures 50° and the angle labeled y are vertical angles. The angles labeled x and y are complementary angles.

$$x + y = 90°$$
$$x + 50° = 90°$$
$$x + 50° - 50° = 90° - 50°$$
$$x = 40°$$

The angle between the support and the cliff measures 40°.

Lesson Practice

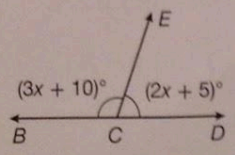
Refer to the diagram to find the complementary and supplementary angles.

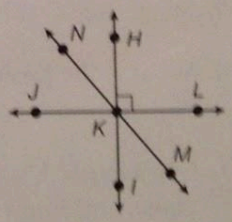


(Ex 1) **a.** Which angle is complementary to $\angle PKM$?

(Ex 1) **b.** Which angle is supplementary to $\angle JKL$?

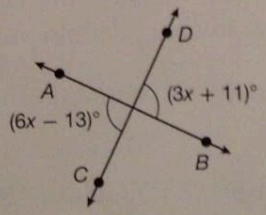
(Ex 2) **c.** Find the value of x.



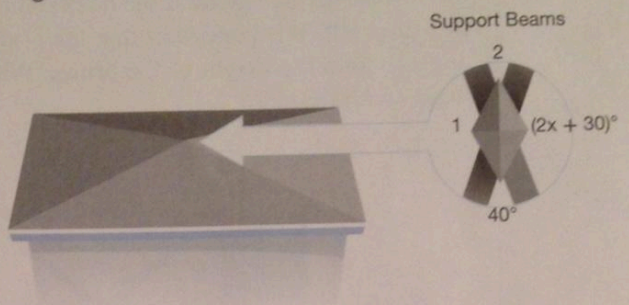


(Ex 3) **d.** Identify three pairs of adjacent angles and two linear pairs.

(Ex 4) **e.** Determine the value of x.



f. (Ex 5) A rectangular roof is made of four triangular sections and is supported at its peak by a diamond-shaped support and four wooden beams, as shown in the diagram. What is the value of x? What are the angle measures of $\angle 1$ and $\angle 2$, respectively?



Practice Distributed and Integrated

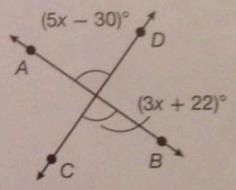
* **1.** (6) An angle measuring 32° has a complement that measures $(2x - 16)°$. What is the value of x?

* **2.** (6) An angle measures 51°. What is the measure of its supplementary angle?

3. (SB 1) **Algebra** Compute $|3 \times 2 - 8| \times 2$.

4. (4) Four noncoplanar points define space, but could they be used to form two intersecting planes? Explain why or why not.

* **5.** (6) Find the value of x in the diagram at right.



6. (4) **Write** Stanley says, "If a point is not on a line, then the line and the point exist on exactly one plane." If the point *is* on the line, how would his statement need to be changed?

7. (2) **Mapping** On a grid of their community, Silvio lives at the point (7, 3) and his friend Andy lives at the point (−11, 3). If they decide to meet halfway between their houses, at what point on the grid will they meet?

8. (SB 14) Evaluate the expression $3xy + 5x + 2y$ for $x = 2$ and $y = -1$.

* **9.** (6) What angle is equal to its complementary angle?

10. (SB 12) What is the probability, expressed as a percentage, of choosing a red marble if a bag of marbles contains 20 red, 15 green, 25 orange, and 40 blue marbles?

11. (1) **Error Analysis** A student says that two points define a line, three points define a plane, and four points define space. Are the student's definitions correct? Explain.

12. (2) Find the midpoint of the values 4 and 8 on the x-axis and the midpoint of the values 1 and 7 on the y-axis.

13. (3) If D is in the interior of $\angle ABC$, which measures 74°, and $m\angle ABD = 32°$, what is $m\angle DBC$?

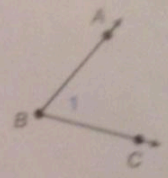
14. (SB 12) **Competition** In 2007, the World Rock-Paper-Scissors Championship was held in Toronto, Ontario, Canada. What is the probability that any two competitors will both have the same combination in a game of rock-paper-scissors, expressed as a fraction?

*15. (5) Simone has been given the challenge of drawing two coplanar lines that are perpendicular to the same line, but the lines must not be parallel to each other. Will she succeed? Explain why or why not.

*16. (5) **Write** Two planes are parallel to each other and are both intersected by a third plane. Describe the property of each intersection and how these intersections are related.

*17. (SB 14) Evaluate the expression $-x^y + 3xy - \frac{x}{y}$ for $x = 4$ and $y = 2$.

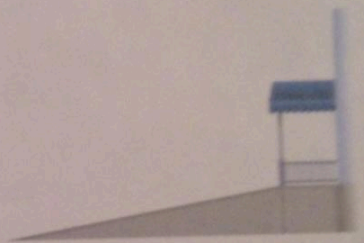
18. (3) **Multiple Choice** Which is *not* a correct way to name the angle in the diagram?



A $\angle 1$ B $\angle B$
C $\angle ABC$ D $\angle A$

19. (SB 5) **Write** Give an example that requires estimation.

20. (3) **Handicap Access** Use a protractor to determine the angle measure of the wheelchair ramp shown in the diagram.



21. (2) Use the Ruler Postulate to find the distance between the values -7 and 11 on a number line.

*22. (5) **Analyze** If $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are both parallel to $\overleftrightarrow{EF}$, what conclusion can be made regarding the relationship between $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$?

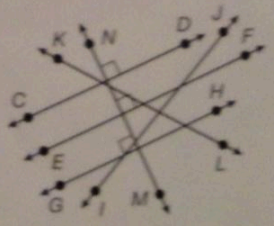
23. (SB 4) Find 20% of 654.

24. (SB 2) **Justify** Does subtraction exhibit the property of closure over the set of real numbers? Is subtraction commutative? If not, give an example to demonstrate.

*25. (6) **Landscaping** A tree is secured with a support wire that makes a 40° angle with the ground. The angle between the tree and the wire is complementary to the angle between the wire and the ground. What is the measure of the angle between the tree and the wire?

26. (4) If $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ intersect at point K, how many planes are needed to contain the two lines?

*27. (5) List all of the lines that are parallel to $\overleftrightarrow{CD}$ in the diagram at right.



28. (SB 22) **Comparison Shopping** A price tag reads \$1.59/kg for apples, and \$0.82/lb for oranges. Which fruit is cheaper by weight? Show your steps.

*29. (6) If $m\angle DEF = (3x + 5)°$ and $m\angle KLM = (x + 31)°$, and both angles are complementary to $\angle PQR$, what are the measures of the angles?

30. (SB 17) **Algebra** Evaluate the function $f(x) = \frac{5}{x + 2}$ for $x = \frac{2}{3}$.

LAB

3

Perpendicular Bisectors and Angle Bisectors

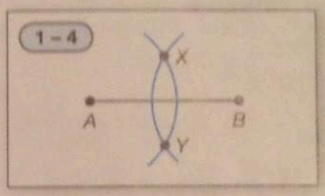
Construction Lab 3 ***(Use with Lesson 6)***

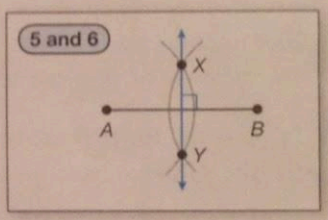
Math Language

A **locus** is a set of points that satisfies a list of given conditions.

A **perpendicular bisector** is a line, segment, or ray that intersects a segment at its midpoint, forming 90° angles. Another way to define a perpendicular bisector is as a locus of points that are equidistant from the endpoints of a segment.

1. To construct a perpendicular bisector of a segment, begin with a segment, $\overline{AB}$.
2. Set your compass to a setting wider than half the length of the segment and place one end on A.
3. Use your compass to draw an arc through the segment. Be sure to draw the arc both above and below the segment.
4. Repeat this process with the same compass setting, starting at point B.
5. Label the points where the two arcs intersect as points X and Y.
6. Draw the line through points X and Y. Line XY is the perpendicular bisector of $\overline{AB}$.





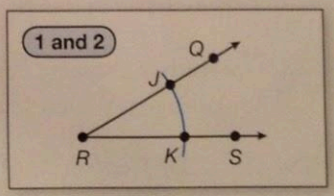
There are two important theorems about perpendicular bisectors that you will use throughout this program.

Theorem 6-5
If a point lies on the perpendicular bisector of a segment, then the point is equidistant from the endpoints of the segment.

Theorem 6-6
If a point is equidistant from the endpoints of a segment, then the point lies on the perpendicular bisector of the segment.

An **angle bisector** is a line, segment, or ray that divides an angle into two congruent adjacent angles.

1. To construct the bisector of an angle, begin with an angle, $\angle QRS$.
2. Using a compass, draw an arc centered at R that intersects both sides of the angle. Label these points of intersection J and K.

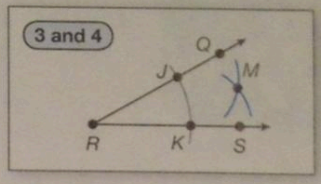


Math Reasoning

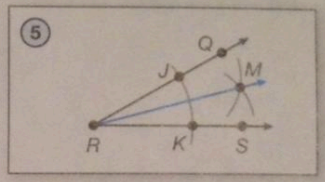
Connect Try using this process to bisect a 180° angle. What do you notice?

3. Using the same compass setting, draw an arc centered at J as shown.

4. Repeat this process with the same compass setting to draw an arc centered at K. Label the intersection of the two arcs M.



5. Draw $\overrightarrow{RM}$, the angle bisector of $\angle QRS$.



There are also two important theorems about angle bisectors that you will use throughout this program.

Theorem 6-7
If a point lies on the bisector of an angle, then the point is equidistant from the sides of the angle.

Theorem 6-8
If a point is equidistant from the sides of an angle, then the point lies on the bisector of the angle.

Lab Practice

a. Use a ruler to draw a 4 inch segment, then use construction techniques to draw a perpendicular bisector.

b. Use a straightedge to draw a segment of any length, then use construction techniques to bisect it. Use a ruler to verify that your bisector divides the segment into two congruent parts.

c. Use a protractor to draw a 108° angle, then use construction techniques to bisect it.

d. Use a straightedge to draw an angle of any measure, then use construction techniques to bisect it. Use a protractor to verify that your bisector divides the angle into two congruent angles.

LESSON 7

Using Inductive Reasoning

Warm Up

1. **Vocabulary** A statement that has been proved true is a _____. (6)

2. Which statement about postulates and/or theorems is false? (4)

   A A postulate is a proven statement.
   B A postulate is assumed to be true.
   C A theorem is a proven statement.
   D Both **B** and **C** are false.

3. Which statement is true? (5)

   A If two lines are perpendicular, they make a 90° angle.
   B If two lines are parallel, they make a 90° angle.
   C Both **A** and **B** are correct.
   D Neither **A** nor **B** is correct.

New Concepts

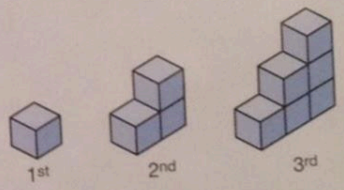
Inductive reasoning is the process of reasoning that a rule or statement is true because several specific cases are true. Inductive reasoning can be used to formulate a conjecture about something. A **conjecture** is a statement that is believed to be true. If a conjecture can be proven, it becomes a theorem.

Math Reasoning

Analyze Tad saw a brown bear and made the conjecture, "All bears are brown." Did Tad use inductive reasoning appropriately? Explain.

Example 1 Formulating a Conjecture

Look at the progression of the pattern and formulate a conjecture regarding the number of blocks there will be in the fifth arrangement of this series.



SOLUTION

Each successive step of the series adds a row of blocks to the bottom of the figure that is one block longer than the previous row of blocks. For example, the second arrangement has a bottom row that is 2 blocks long, so to make the third one, a row of 3 blocks is added to the bottom.

To continue, the fourth step would have a row of 4 blocks added for a total of 10, and the fifth would have 5 more blocks added for a total of 15. The statement, "There will be 15 blocks in the fifth step of this pattern," is a conjecture.

Instead of formulating a conjecture by looking at data, it may be necessary to test a conjecture using given data. If even one example can be found that does not support the conjecture, then the conjecture must be incorrect. An example that does not support the conjecture is called a **counterexample**. You will learn more about counterexamples in Lessons 10 and 14.

Online Connection
www.SaxonMathResources.com

Caution

Testing a conjecture is not the same as proving it. Testing a conjecture can disprove it, or it can prove it for certain values, but it cannot prove the conjecture for all possible values.

Example 2 Testing a Conjecture

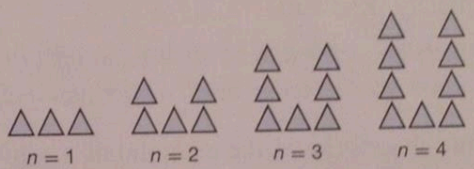
a. Michelle made the conjecture, "The expressions $6n + 1$ and $6n - 1$ will always result in two prime numbers." Show that this conjecture is true for $n = 1$, 2, and 3, but not true for $n = 4$.

SOLUTION

For $n = 1$: $6(1) + 1 = 7$ and $6(1) - 1 = 5$; both are prime.
For $n = 2$: $6(2) + 1 = 13$ and $6(2) - 1 = 11$; both are prime.
For $n = 3$: $6(3) + 1 = 19$ and $6(3) - 1 = 17$; both are prime.
But for $n = 4$: $6(4) + 1 = 25$ and $6(4) - 1 = 23$; 25 is not prime.

Since we have found one case in which the conjecture is incorrect, we can conclude that the conjecture is false.

b. Maria looks at the diagram below and conjectures that the number of triangles in the figure is given by the expression $2n + 1$. Is this conjecture true for the four steps of the pattern shown below?



SOLUTION

Yes, the conjecture is true for all 4 steps.

For $n = 1$, $2(1) + 1 = 3$
For $n = 2$, $2(2) + 1 = 5$
For $n = 3$, $2(3) + 1 = 7$
For $n = 4$, $2(4) + 1 = 9$

Even though conjectures are not proven, scientists often use conjectures to describe real-world phenomena. These conjectures are carefully studied and tested, but it is often difficult to prove them formally.

Example 3 Application: Research

A researcher studying crows for several years made the observation that every crow she studied was black. Her research assistant made this conjecture: "All crows are black." How can this conjecture be tested? Can it be proved?

SOLUTION

The conjecture can be tested by observing as many crows as possible. If even one crow is found that is not black, then the conjecture is disproved. The only way to prove this conjecture is to observe every crow. If every crow can be studied, and they are all black, then the conjecture is true. However, it is impossible to study every crow that exists, so the conjecture cannot be proved.

Lesson Practice

(Ex 1) **a.** Formulate a conjecture about how the next value in this pattern would be found: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, ...

(Ex 2) **b.** Test the conjecture that every even integer 4 through 14, can be written as the sum of two prime numbers.

(Ex 3) **c.** How might you disprove the conjecture below?

Apples, pears, lemons, and peaches all grow on trees, therefore all fruits grow on trees.

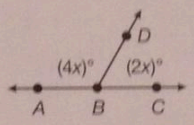
Practice Distributed and Integrated

(SB 3) **1.** **Justify** In the following description, are rational and irrational numbers defined adequately? Explain.

Rational numbers are defined to be all terminating or repeating decimals, and irrational numbers are defined to be all nonterminating, nonrepeating decimals.

(2) * **2.** **Analyze** Leilani suggests that if the midpoint of a segment connecting 6 and 8 on the x-axis is 7, and the midpoint of a segment connecting 2 and 10 on the y-axis is 6, then the midpoint of a segment connecting the points (6, 2) and (8, 10) must be (7, 6). Is this a valid conclusion? Explain.

(6) **3.** What is the value of x in the diagram?



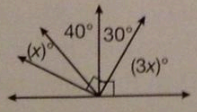
(5) * **4.** **Model** Draw an example of skew lines using a geometric figure. Clearly show the skew lines.

(7) * **5.** **Generalize** Formulate a conjecture about how the next step in this pattern would be found: 4, 16, 36, 64, 100, 144, ...

(4) **6.** **Air Traffic Control** Two airplanes have the same latitudinal and longitudinal coordinates, but the air traffic controller is not concerned. Why would she not be concerned?

(SB 7) **7.** **Write** A number is rounded to 9000. Is it possible to tell exactly how many significant figures the number had before rounding? Explain.

(6) **8.** Find the value of x in the diagram.



(4) **9.** **Justify** What is the fewest number of points that can define a plane? Use a postulate or theorem to justify your answer.

*10. **Justify** When Raul studied objects that were released from a position of rest, all of the objects fell to the ground. He conjectured that any object released from a position of rest will immediately fall to the ground. Find an example that disproves Raul's conjecture. (7)

*11. Is the following conjecture true for $x = 5$, $x = 10$, and $x = 15$? (7)

For any x, *the sum of the whole numbers 1 through* x *is equal to* $\frac{1}{2}x(x + 1)$.

12. **Summer Employment** Devondra estimated that she would make $4000 this summer at her part-time job. She actually made $3450. What was her percent error, to the nearest percentage? (SB 10)

13. **Write** Explain what is meant when a term in mathematics is said to be *undefined*. (1)

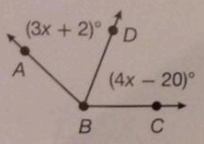
14. **Algebra** Find the value of x in the equation $\frac{2x - 5}{3} = \frac{x + 10}{4}$. (SB 15)

15. **Landscaping** A rectangular field that is 119 square yards in area is to be covered with sod. It is known that the field is 3 yards longer than twice the width. Find the dimensions of the field. (SB 22)

16. **Travel** Marcella lives at (4, 22) on a city grid, and Arnault lives at (−3, −4) on the same grid. One grid line represents one mile. If Arnault's mom drives him to Marcella's house by driving on a road that is parallel to the x-axis, then turns and drives along a road that is parallel to the y-axis, how many miles does Arnault's mom drive? (SB 13)

*17. **Write** Can a conjecture be proved or disproved by studying examples or cases of the conjecture? Explain. (7)

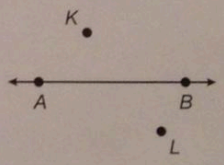
18. **Algebra** Ray BD is the angle bisector of $\angle ABC$. What is the value of x? (3)



*19. Sketch an example of two lines that are coplanar. (4)

20. How many significant figures does the number 0.0100 have? (SB 7)

*21. Draw a line parallel to and a line perpendicular to $\overleftrightarrow{AB}$ from each of the points K and L. Discuss the relationship between these drawn lines. (5)



*22. What type of reasoning is used in the statement below? Provide a counterexample to the conjecture if possible. (7)

Every car I have ever owned ran on gas, therefore all cars run on gas.

23. **Multi-Step** The formula for converting kilometers to miles is $m = 1.609k$, where m is miles and k is kilometers. Transform this formula to find a formula for converting miles to kilometers. Use this formula to determine the number of kilometers in 539 miles and in 7380 miles, rounded to the nearest kilometer. (SB 16)

24. **Justify** Can two acute adjacent angles form a linear pair? Explain why or why not. (6)

25. (SB 16) **Temperature** The conversion for temperature from degrees Celsius to degrees Fahrenheit is given by the formula $F = \frac{9}{5}C + 32$. Transform this formula to find a formula to convert degrees Fahrenheit to degrees Celsius.

26. (4) **Multiple Choice** Which statement is true?

A Two distinct coplanar lines can intersect at two points.

B Two distinct coplanar lines can intersect at one point or never intersect if they are parallel.

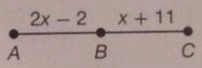
C Two distinct coplanar lines can intersect at one point or intersect everywhere.

D Two distinct coplanar lines intersect at every point if they are parallel.

27. (6) The sum of the measures of three congruent angles is 180°. What would be the complementary angle to each of the angles?

***28.** (1) **Justify** Is it possible for three planes to intersect at a point? Explain why or why not, and if it is possible, sketch an example showing how.

29. (2) If B is the midpoint of $\overline{AC}$, find the value of x.



30. (3) The measure of $\angle XYZ$ is 110°. What would the resulting angles' measures be if the angle bisector to $\angle XYZ$ were drawn?

LESSON 8

Using Formulas in Geometry

Warm Up

1. **Vocabulary** _____ lines are coplanar lines that do not intersect. (5) (*parallel, perpendicular, skew*)

2. If the length of $\overline{AC}$ is 12, and $\overline{AC}$ is bisected at point B, what are the lengths of $\overline{AB}$ and $\overline{BC}$? (2)

3. **Multiple Choice** Which of the following is not a theorem? (6)

A Right Angle Congruence Theorem
B Congruent Complements Theorem
C Congruent Supplements Theorem
D Reflexive Property of Equality

New Concepts

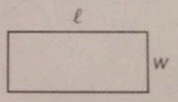
A **formula** is a mathematical relationship expressed with symbols. Some formulas have already been encountered in algebra.

Math Reasoning

Write List some other formulas used in other math classes, such as in algebra. How might these formulas be helpful in geometry?

A familiar formula is the formula for **perimeter**. The perimeter is the sum of the side lengths of a closed geometric figure. It is often thought of as the distance around a figure.

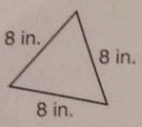
There is a special formula to find the perimeter of a rectangle, where P is the perimeter, ℓ is the length of the rectangular base, and w is the width, or height, of the rectangle.



$$P = 2\ell + 2w$$

Example 1 Finding Perimeter of a Figure

a. Find the perimeter of the triangle.

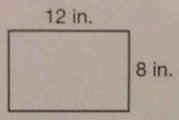


SOLUTION Add the lengths of the sides together.

$8 + 8 + 8 = 24$

The perimeter of the triangle is 24 inches.

b. Find the perimeter of the rectangle.



SOLUTION Use the formula for the perimeter of a rectangle.

$P = 2\ell + 2w$	Perimeter formula
$P = 2(12) + 2(8)$	Substitute.
$P = 40$ in.	Simplify.

c. If a regular pentagon has a side length of 8 inches, what is its perimeter?

SOLUTION There are five sides in a pentagon and each side of a regular pentagon has the same measure. Therefore, the perimeter is $5 \times 8 = 40$ inches.

Online Connection
www.SaxonMathResources.com

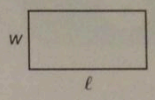
Math Reasoning

Formulate Draw a diagonal from one corner of a rectangle to the other. What shapes does the diagonal create? Explain how this relates to the formula for area of a triangle.

The **area** of a figure is the size of the region bounded by the figure.

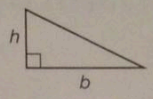
The area of a rectangle is found by the following formula, where ℓ is the length of the figure's base and w is the length of the figure's height:

$A = \ell w$



The area of a triangle is found by the following formula:

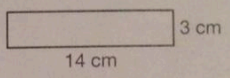
$A = \frac{1}{2}bh$



The area of a figure is always expressed in square units.

Example 2 Using the Area Formula for a Rectangle

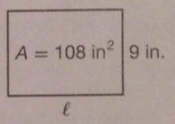
a. Find the area of the rectangle.



SOLUTION

$A = \ell w$	Area formula
$A = (14)(3)$	Substitute.
$A = 42 \text{ cm}^2$	Simplify.

b. Find the length of the rectangle.

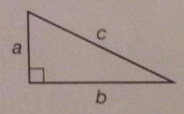


SOLUTION

$A = \ell w$	Area formula
$108 = \ell(9)$	Substitute.
$12 \text{ in.} = \ell$	Divide both sides by 9.

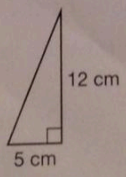
Theorem 8-1: Pythagorean Theorem

The sum of the square of the lengths of the legs, a and b, of a a right triangle is equal to the square of the length of the hypotenuse c and is written $a^2 + b^2 = c^2$.



Example 3 Using the Pythagorean Theorem

a. Find the length of the hypotenuse.



SOLUTION

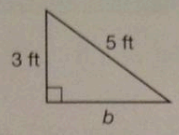
$a^2 + b^2 = c^2$	Pythagorean Theorem
$12^2 + 5^2 = c^2$	Substitute.
$144 + 25 = c^2$	Simplify.
$\sqrt{169} = \sqrt{c^2}$	Square root of both sides
$13 \text{ cm} = c$	Simplify.

Caution

The Pythagorean Theorem only applies to right triangles.

A right angle is denoted with a small square in the corner that has a measure of 90°.

b. Find the area of the triangle.



SOLUTION

Use the Pythagorean Theorem to find the length of b.

$a^2 + b^2 = c^2$	Pythagorean Theorem
$3^2 + b^2 = 5^2$	Substitute.
$9 + b^2 = 25$	Simplify.
$9 + b^2 - 9 = 25 - 9$	Subtract 9 from both sides.
$b^2 = 16$	Simplify.
$\sqrt{b^2} = \sqrt{16}$	Square root of both sides
$b = 4$ ft	Simplify.

Then calculate the area of the triangle.

$A = \frac{1}{2}bh$	Formula for area of a triangle
$A = \frac{1}{2}(4)(3)$	Substitute.
$A = 6\ \text{ft}^2$	Simplify.

Example 4 Application: Measuring Temperature

Different countries use different units to measure the temperature. Much of the world uses degrees Celsius, but a few countries use degrees Fahrenheit. For scientists and travelers, converting between Celsius and Fahrenheit is an important skill.

To convert to Celsius from Fahrenheit, use the formula:

$C = \frac{5}{9}(F - 32)$.

a. If it is 77°F, what is the temperature in degrees Celsius?

SOLUTION

$C = \frac{5}{9}(F - 32)$	Conversion formula
$C = \frac{5}{9}(77 - 32)$	Substitute.
$C = 25$	Simplify.

b. If it is 10°C, what is the temperature in degrees Fahrenheit?

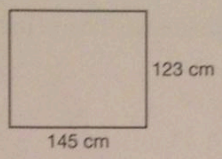
SOLUTION

$C = \frac{5}{9}(F - 32)$	Conversion formula
$10 = \frac{5}{9}(F - 32)$	Substitute.
$10 \times \frac{9}{5} = \frac{5}{9}(F - 32) \times \frac{9}{5}$	Multiply by the reciprocal of $\frac{5}{9}$, $\frac{9}{5}$.
$18 = F - 32$	Simplify.
$18 + 32 = F - 32 + 32$	Add 32 to both sides
$50 = F$	Simplify.

Lesson Practice

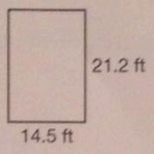
(Ex 1) **a.** Find the perimeter of a triangle with congruent side lengths all equal to 6.5 meters.

(Ex 1) **b.** Find the perimeter of the rectangle.



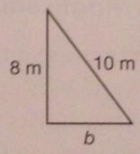
(Ex 1) **c.** Find the perimeter of a six-sided figure with side lengths that are all equal to 16 inches.

(Ex 2) **d.** Find the area of the rectangle.



(Ex 2) **e.** Find the base of a rectangle with an area of 12 cm^2 and a length of 6 centimeters.

(Ex 3) **f.** Use the Pythagorean Theorem to find b.



(Ex 3) **g.** Use the Pythagorean Theorem to find the area of a triangle with a hypotenuse of 17 millimeters and a side length of 15 millimeters.

(Ex 4) **h.** If it is 0° Fahrenheit, what is the temperature in degrees Celsius? Round to the nearest tenth.

(Ex 4) **i.** If it is 100° Celsius, what is the temperature in degrees Fahrenheit?

Practice Distributed and Integrated

(7) **1.** Complete the following conjecture.

The product of an even and an odd number is _____.

(7) **2.** **Plants** A bean sprout grows 3 inches in its first week, 2 inches in its second week, and 1.333... inches in its third week. If the sprout's growth follows this pattern, how much will the bean sprout have grown in its fourth week?

(1) **3.** What are three undefined terms of geometry?

(SB 13) **4.** **Coordinate Geometry** State the quadrant in which each point is located.

a. $(-2, -2)$ **b.** $(-2, 2)$ **c.** $(2, -2)$

5. If there are twelve turtles in the pet store, what is the probability that a turtle chosen at random will weigh more than the median turtle weight? (SB 12)

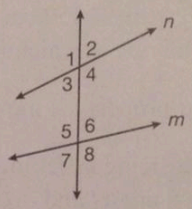
6. **Algebra** The area of a rectangle is 54 cm^2. The side lengths are $2x + 1$ and $x + 2$. What is the measure of each side? (8)

7. **Analyze** Can a line be intersected at the same point with two different perpendicular lines? Explain why or why not. (5)

8. How far does a jogger travel to reach the midpoint between a jogging track and a parking lot that are 0.25 miles apart? (2)

9. Find the next item in the pattern. 2, 4, 8, 16, 32, ... (7)

10. **Multiple Choice** Which pair of angles are congruent? (6)



A $\angle 1$ and $\angle 8$ B $\angle 2$ and $\angle 3$
C $\angle 1$ and $\angle 2$ D $\angle 5$ and $\angle 6$

11. **Multiple Choice** Which pair of angles are a linear pair? (6)

A $\angle 5$ and $\angle 6$ B $\angle 6$ and $\angle 7$
C $\angle 1$ and $\angle 4$ D $\angle 4$ and $\angle 6$

12. Name all the pairs of supplementary angles formed by line m. (6)

13. **Write** Karl wrote that any three points define a plane. Is his statement true? If not, rewrite his statement so that it is true. (4)

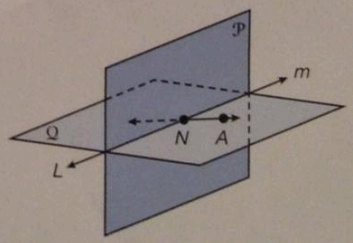
14. **Verify** A rectangle has side lengths of 30 meters and 36 meters. If the side lengths of the rectangle are doubled, verify that the perimeter also doubles. (8)

15. **Error Analysis** A student has solved the equation for Pythagorean Theorem in the following way. It is given that $a = 5$ and $b = 12$. (8)

$$\begin{aligned} a^2 + b^2 &= c^2 \\ (a + b)^2 &= c^2 \\ (5 + 12)^2 &= c^2 \\ 17^2 &= c^2 \\ \sqrt{289} &= \sqrt{c^2} \\ 17 &= c \end{aligned}$$

Where did the student make an error? What is the actual answer?

16. Identify the intersection between planes $\mathcal{P}$ and $\mathcal{Q}$. (4)



17. Name the two rays that make $\angle LNA$. (3)

18. What figure is formed at the intersection of two lines? (1)

19. **Multiple Choice** Which of the following terms cannot describe lines? (5)

A perpendicular B congruent
C skew D parallel

20. Evaluate the expression $\frac{x + (3x)^2 + x}{2}$ for $x = \sqrt{2}$. Express the answer in simplified radical form. (SB 14)

21. (SB 22) **Music** Musical notes are identified by their frequencies, which are recorded in hertz (Hz). Middle C is denoted as C_4 and has a frequency of 261.63 Hz. What is the frequency of the C_3 note, which is one octave below C_4? (Frequency doubles when going up an octave.)

22. (8) Find the perimeter of a triangle if each side length is 136 millimeters.

23. (SB 17) If $f(x) = 3x + x^2$, what does $f(2)$ equal?

24. (SB 11) **Statistics** What is the mode of the following set? {A, B, M, M, H, H, J, P}

25. (3) What is the angle between two opposite rays?

26. (7) **Biology** In a lab experiment, there is a culture that contains 25 bacteria at 2:00. At 2:15, there are 50 bacteria. At 3:15, there are 800 bacteria. Make a conjecture about the rate at which the bacteria increases.

27. (2) By what property is the statement $AB = AB$ justified?

28. (SB 22) **Banking** King is baking a recipe that serves 6 and calls for 1.5 cups of flour. He expects 8 guests and decides to increase the recipe so that it can serve 8. How much flour will he need to make the larger recipe?

29. (8) **Building** A housing developer wants to build a fence around the backyard of a house. If the backyard forms a square and one side is bounded by the house, what formula could the developer use to calculate the amount of fence required?

30. (SB 2) **Verify** Show that the Commutative and Associative Properties of Addition are true when adding the linear functions $f(x) = 3x + 2$, $g(x) = -2x + 3$, and $h(x) = 0$. The first line of each is given below.

Associative Property of Addition

$$[f(x) + g(x)] + h(x) = f(x) + [g(x) + h(x)]$$

Commutative Property of Addition

$$f(x) + g(x) = g(x) + f(x)$$

LESSON 9

Finding Length: Distance Formula

Warm Up

1. (SB 1) **Vocabulary** The distance of a number from zero on the number line is the _____ of that number.

2. (SB 13) In what quadrant is the point $(5, -3)$ on the coordinate plane?

3. (SB 14) Evaluate the expression $\frac{|5x - 8|}{2}$ for $x = 3$.

New Concepts

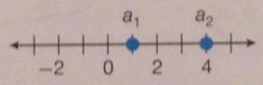
Often, the length of a segment can be measured using a ruler. At other times, it may be necessary to find length by looking at a number line or a coordinate plane.

Hint

An absolute value is used to determine distance and length because it is impossible for something to have a negative length, or for the distance between two points to be negative.

To find the distance between two points on a number line, take the absolute value of the difference between those points' coordinates.

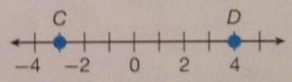
$$d = |a_2 - a_1|$$



The distance between points a_1 and a_2 is $|4 - 1| = 3$.

Example 1 Distance Between Two Points on a Line

Find the distance between the points on the number line.



SOLUTION

Use the formula:

$$\begin{aligned} d &= |a_2 - a_1| \\ &= |4 - (-3)| \\ &= |7| \\ &= 7 \end{aligned}$$

On a coordinate plane, the distance between two points can be found using the distance formula.

Distance Formula

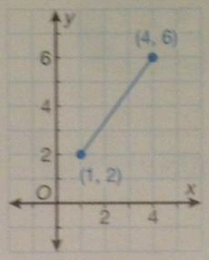
In a coordinate plane, the distance d between two points (x_1, y_1) and (x_2, y_2) is given by the formula:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Online Connection
www.SaxonMathResources.com

Example 2 Using the Distance Formula

Find the distance between the two points.



SOLUTION

First, choose one point's coordinates to be (x_1, y_1). The other point will be (x_2, y_2). It does not matter which point is chosen.

Let $(1, 2)$ be (x_1, y_1) and $(4, 6)$ be (x_2, y_2).

Substitute into the distance formula.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$d = \sqrt{(4 - 1)^2 + (6 - 2)^2}$$
$$d = \sqrt{3^2 + 4^2}$$
$$d = \sqrt{25}$$
$$d = 5$$

It does not matter which ordered pair is chosen to be (x_1, y_1). It is important, however, that x_1 and y_1 come from the same ordered pair.

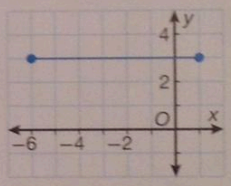
When two points share the same x-value or y-value, the distance formula can be simplified as shown in the next example.

Math Reasoning

Verify Since the diagram shows a horizontal line, an easy way to verify the result of the distance formula is to simply count the number of unit squares the line crosses. Would the result be any different if you flipped the x and y coordinates of these points?

Example 3 Distance Between Points That Share One Coordinate

Find the distance between the two points.



SOLUTION

Since $y_1 = y_2$, we can substitute and simplify.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_2)^2}$$
$$d = \sqrt{(x_2 - x_1)^2 + 0^2}$$
$$d = \sqrt{(x_2 - x_1)^2}$$

The square root and the square cancel, so with the two identical y-values, the distance formula becomes:

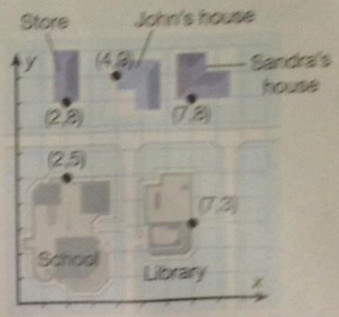
$$d = |x_2 - x_1|$$

An absolute value is used because squaring and then taking the square root of a number always results in a positive number. The resulting formula is identical to the one used to find distance on a number line.

$$d = |x_2 - x_1|$$
$$d = |-6 - 1|$$
$$d = |-7|$$
$$d = 7$$

Example 4 Application: Navigation

Use the following map for each question. The distance is measured from the dot on each building.



a. What is the distance from John's house to the school if each unit on the coordinate plane represents 100 meters? Round to the nearest hundredth.

SOLUTION

John's house is at (4, 9) and the school is at (2, 5).

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$d = \sqrt{(4 - 2)^2 + (9 - 5)^2}$$
$$d = \sqrt{2^2 + 4^2}$$
$$d = \sqrt{20}$$
$$d \approx 4.4721$$

Since each unit represents 100 meters, multiply the answer by 100. The distance from John's house to the school is about 447.21 meters.

b. What is the distance from Sandra's house to the store?

SOLUTION

Sandra's house and the store have the same y-coordinate, so the formula for distance on a number line can be used.

$$d = |x_2 - x_1|$$
$$d = |7 - 2|$$
$$d = 5$$

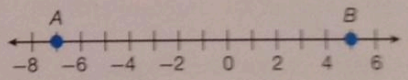
Since each unit represents 100 meters, the distance from Sandra's house to the store is 500 m.

Math Reasoning

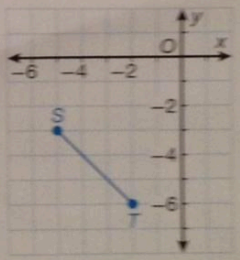
Analyze Can you find a particular route on the map where the distance you would have to walk between two buildings is not accurately expressed by applying the distance formula? Why does the distance formula not work in these situations?

Lesson Practice

(Ex 1) **a.** Find AB.



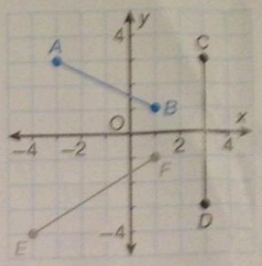
(Ex 2) **b.** What is the distance between points S and T? Round to the nearest hundredth.



(Ex 3) **c.** Find the distance between the points (2, 3) and (2, −4).

(Ex 4) **d.** The peak of a mountain is located at the coordinate (120, 0). The hiker starts at the bottom of the trail at coordinate (0, 125). If each unit on the coordinate plane represents 10 meters, how far will the hiker walk if he gets to the peak? Round to the nearest tenth.

Practice Distributed and Integrated



1. What is the approximate distance between points A and B in the coordinate grid at right? (9)

2. **Verify** What is the approximate distance between the points E and F? Is the answer the same if you find the distance between the points F and E? (9)

3. Factor $(9x^2 - 18x - 7)$. (SB 18)

4. **Coordinate Geometry** Calculate the distance between the points (9, 14) and (−5, 13) to the nearest hundredth. (9)

5. **Clocks** What is the angle between the hands of a clock when it is exactly 4 o'clock? (3)

6. If an angle is obtuse, must its supplement be acute, obtuse, right, or none? (6)

7. **Error Analysis** A student calculated the formula for the perimeter (P) of a regular dodecagon, where n is the side length. (SB 22)

   $P = 10n$

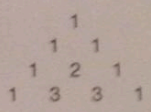
   Is the student correct? Explain.

8. Evaluate this expression: $\frac{2(2+4)}{6} - |-2|$. (SB 1)

9. Is the following statement sometimes, always, or never true? (4)

   Two planes intersect at a point.

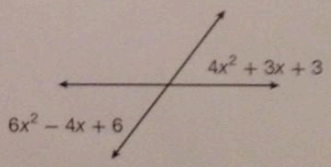
10. Make a conjecture about the pattern at right and find the next line in the pattern. (7)



11. **Maps** On a map, the Tropic of Capricorn is parallel to the equator, and the Tropic of Cancer is also parallel to the equator. Do the two tropics ever meet? How do you know? (5)

12. **Write** Describe the difference between a postulate and a theorem. (4)

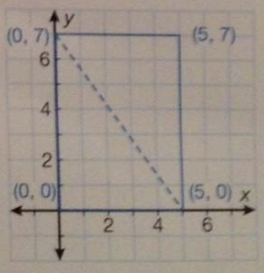
13. **Algebra** Find the value of x in the diagram at right. (6)



14. What two objects intersect at a line? Explain. (4)

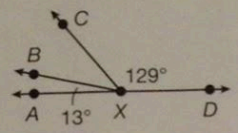
15. **Analyze** Solve the Pythagorean Theorem for c. How is it like the distance formula? Explain your reasoning. (8)

16. **Fencing** If Sven has a rectangular yard with the corners given in the diagram, to the nearest hundredth meter, how much fencing will he need to divide the yard into two triangles? Each unit on the grid represents one meter. (9)



17. There are six bananas, two oranges, and seven apples in a bag. At random, pieces of fruit are chosen from the bag. What is the probability that an apple is chosen first and an orange is chosen second? (SB 12)

18. What is the measure of $\angle BXC$?
(3)



19. Multiple Choice Which of the following is not a formula?
(8)

A distance formula
B perimeter formula
C Pythagorean Theorem
D protractor formula

20. Find the product of $(2x - 2)$ and $(x + 1)$.
(SB 18)

21. What property justifies this statement?
(2)

If $\overline{AB} \cong \overline{XY}$ *and* $\overline{CD} \cong \overline{XY}$, *then* $\overline{AB} \cong \overline{CD}$.

22. Explain Can two noncoplanar lines intersect? Explain.
(1)

23. **Shopping** If a carton of eggs costs \$2.05 with tax included, how many cartons can you buy with \$10? Explain how you estimated the answer.
(SB 22)

24. Multiple Choice Which of the following is not a pair of angles?
(6)

A supplementary
B adjacent
C right
D vertical

25. Algebra If B is the midpoint of $\overline{AC}$, and $AB = \frac{5}{2}x + 12$ and $AC = 12x - 4$, what is the length of $\overline{BC}$?
(2)

26. What is the domain of the function $f(x) = \sqrt{x}$?
(SB 17)

27. How does the distance formula simplify when finding the distance between two points which are directly above each other on a coordinate grid?
(9)

28. Solve $-3w + 2 < 4w + 16$ for w.
(SB 15)

29. A line is perpendicular to another line. Classify the supplementary angles it creates. Are they congruent?
(5)

30. What is the difference between a conjecture and a theorem?
(7)

LESSON 10

Using Conditional Statements

Warm Up

1. (7) **Vocabulary** _____ reasoning is the process of reasoning in which a rule or statement is considered true because specific cases are true.

2. (4) Melissa notices that all the flowers in her yard bloom during the spring. Based on this observation, she says, "All flowers bloom in the spring." Is this an example of a postulate, a theorem, or a conjecture?

3. (SB 15) Solve the equation $2x + 7 = 4$.

New Concepts

A **conditional statement** is a statement in the form, "If p, then q," where p is the hypothesis and q is the conclusion. For example:

If it is morning, then the sun is in the east.

The **hypothesis** of a conditional statement is the part of the statement that is between the words *if* and *then*. In the statement above, the hypothesis, p, is "it is morning." The **conclusion** of a conditional statement is the part of the statement that follows the word *then*. In the statement above, the conclusion, q, is "the sun is in the east."

Example 1 Identifying the Hypothesis and Conclusion

Identify the hypothesis and conclusion of each conditional statement.

a. *If $2x + 1 = 5$, then $x = 2$.*

SOLUTION

Hypothesis: $2x + 1 = 5$

Conclusion: $x = 2$

b. *If a plant is growing, then it needs water.*

SOLUTION

Hypothesis: *A plant is growing.*

Conclusion: *It needs water.*



Online Connection
www.SaxonMathResources.com

Some conditional statements are true and some are false. This is called the **truth value** of a conditional statement. A statement is only false when the hypothesis is true and the conclusion is false. For example:

If a rectangle has a width of 5 feet and a height of 4 feet, then its area is 30 square feet.

The hypothesis is true, but the conclusion of this statement is false. Since the hypothesis is true but the conclusion is false, the statement's truth value is false.

Math Reasoning

Connect Using the formula you learned in Lesson 9, write the sample statement so it is true.

If a conditional statement's hypothesis is false, then the statement could still be true. For example, consider the statement, "If Ai wins the lottery, he will take a vacation." The hypothesis is false if Ai does not win the lottery, but the statement is still true, because the statement only applies if Ai does win the lottery.

Example 2 Evaluating the Truth Value of a Conditional Statement

Determine whether each statement is true or false. If it is false, explain your reasoning.

a. *If an angle is obtuse, it measures 120°.*

SOLUTION

The hypothesis of this statement is true, but the conclusion is false. An obtuse angle can measure anything greater than 90° and less than 180°. Any obtuse angle that is not 120° could be used to contradict this statement. Therefore, the statement is false.

b. *If two parallel lines intersect, then they form acute angles.*

SOLUTION

The hypothesis of this statement is false because parallel lines are defined as lines that never intersect. When the hypothesis of a conditional statement is false, the conditional statement as a whole has a truth value of "true." The statement cannot be said to be false unless a situation exists where the hypothesis is true.

Math Reasoning

Analyze What is the result of taking the converse of a converse statement?

The **converse** of a statement is the statement formed by exchanging the hypothesis and conclusion. The converse of a statement "if p, then q" has the form "if q, then p." Consider the following conditional statement.

If it is morning, then the sun is in the east.

The converse of this statement is,

If the sun is in the east, then it is morning.

Even if a conditional statement is true, the converse of that statement is not necessarily true. For example:

If an animal is a duck, then it can fly.

The converse of this statement is,

If an animal can fly, then it is a duck.

This statement is not true. There are many animals that can fly that are not ducks.

Example 3 Stating Converses

Write the converse of each statement and determine whether the converse is true.

(a.) *If an animal is a dog, then it has four legs.*

SOLUTION

Converse: *If an animal has four legs, then it is a dog.*

The converse is not true. We can prove it is not true by finding an untrue example. For example, a cat is also an animal with four legs, but it is not a dog.

(b.) *If $x = 4$, then $3x + 7 = 19$.*

SOLUTION

Converse: *If $3x + 7 = 19$, then $x = 4$.*

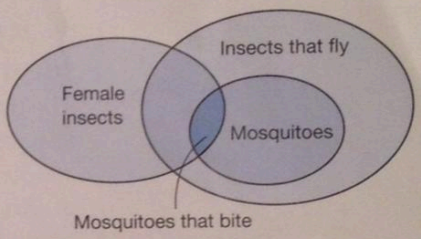
The converse is also true.

Example 4 Application: Biology

Hint

For more about Venn diagrams, see the Skills Bank at the back of this textbook.

Write the converse of each conditional statement. Use the Venn diagram to determine if the converse is true.



(a.) *If an insect is a mosquito, then it can fly.*

SOLUTION

Converse: *If an insect can fly, then it is a mosquito.*

There are many flying insects besides mosquitoes, so the converse is false.

(b.) *If a mosquito bites, then it is female.*

SOLUTION

Converse: *If a mosquito is female, then it bites.*

We see from the diagram that the entire region indicating "female mosquitoes" overlaps completely with "mosquitoes that bite," so the converse of this statement is also true.

Lesson Practice

Identify the hypothesis and conclusion of each statement.

(Ex 1)

a. *If $x = 4$ and $y = 2$, then $2x + 3y = 14$.*

b. *If an apple is a golden delicious apple, then it is yellow in color.*

c. Determine whether the statement is true or false.

(Ex 2) *If two points are collinear, then they are also coplanar.*

Find the converse of each statement and determine whether it is true.

(Ex 3)

d. *If $x^2 = 9$, then $x = 3$ or -3.*

e. *If it is Thanksgiving Day, then it is Thursday.*

f. *If a cardinal is a male, then it is bright red.*

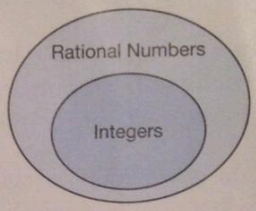
Practice Distributed and Integrated

1. (2) **Driving** Three cities lie on a straight highway. Dawson City is between Orangebourgh and Danteville. If the distance from Dawson City to Danteville is 19 miles and the distance from Orangebourgh to Danteville is 32 miles, what is the distance from Orangebourgh to Dawson City? Name a theorem or postulate that justifies your answer.

*** 2.** (8) **Signs** What is the perimeter of a regular, triangular yield sign with a side length of 15 inches?

3. (4) **Justify** If two lines are parallel, are they contained in a plane? Why or why not?

*** 4.** (10) Use the Venn diagram to write a conditional statement.



5. (SB 18) Factor: $x^2 - 4x - 21$.

6. (SB 1) Can the expression $\frac{|x^2 - 4x + 3|}{2}$ ever be a negative number? Explain.

***7.** (9) **Multiple Choice** The point (4, 7) is an endpoint of a line segment. The segment is 5 units long. Which point is a possible second endpoint of the line?

A (1, 4) **B** (1, 11)
C (−1, 6) **D** (0, 3)

8. (3) **Write** What is the difference between the Ruler Postulate and the Protractor Postulate?

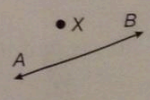
*** 9.** (10) **Write** A certain conditional statement's conclusion is always true when its hypothesis is true, so the conditional statement is always true. Can you determine for certain that the statement's converse will always be true? Explain and give an example to support your answer.

***10.** (10) **Life Span** If an animal is a loggerhead sea turtle, then its expected life span is approximately 70 years. Is this a conditional statement? If it is not, rewrite it as a conditional statement. If so, write its converse.

11. (SB 10) An experiment designed to find the speed of sound shows that it is 768 miles per hour. If the speed of sound is actually 770 miles per hour, what is the experiment's percent error, to the nearest hundredth?

12. (SB 16) Transform the formula $E = mc^2$ to solve for m.

13. (5) **Model** Copy the figure at right and draw a line through the point that is parallel to $\overleftrightarrow{AB}$. Try to draw a different line through the point that is also parallel to $\overleftrightarrow{AB}$. Is it possible to draw a second line? Why or why not?



***14.** (9) Find the distance between the two points (2, 3) and (−4, 1) to the nearest hundredth.

*15. (9) The length of a line segment is 7. Its endpoints are (1, 3) and (k, 3). Solve for k. Is there more than one solution? Explain.

16. (6) **Model** Is it possible to draw two intersecting lines where the vertical angles are not equal? Why or why not?

17. (6) Two streets intersect and are not perpendicular. Two different corners of the streets are at angles that have equal measures. What is another term to describe the angle pair?

18. (SB 9) Is it possible to compare two quantities that are recorded in different units of measure? Explain how.

19. (SB 7) Give an example of a situation in which scientific notation is commonly used.

20. (2) **Justify** What property justifies the statement $x = x$?

*21. (8) **Gardening** A gardener wants to split a rectangular bed of flowers diagonally to make two separate triangular beds. What is the area of one of the right triangles the gardener will form if the diagonal is 13 feet and one side is 12 feet?

22. (7) Find the next number in this pattern: 3, 9, 27, 81, ...

23. (SB 7) Evaluate the expression mc^2 for $m = 1$ and $c = 3 \times 10^8$. Express your answer in scientific notation.

*24. (10) **Algebra** Complete the conditional statement.

If $2x + 7 = 13$, *then* $x =$ ____.

*25. (10) **Error Analysis** Kareem wrote the following statement.

If the measures of three angles combined equal 180°, then the angles are all acute.

Use an example to disprove Kareem's conditional statement, then write a true conditional statement.

26. (SB 18) **Error Analysis** A student multiplied the binomial below. Explain where the student made an error. Multiply the binomial correctly.

$(x + 2)(x - 3) = x^2 + x - 6$

27. (SB 3) List all the sets of numbers to which -2.8 belongs.

28. (SB 1) **Analyze** Find the value of the expression $|3 + (-4) + 6|$. Now find the value of the expression $|3| + |-4| + |6|$. Why are the answers different?

29. (6) **Multiple Choice** Which pair of terms is equivalent?

A supplementary angles and vertical angles

B vertical angles and complementary angles

C linear pair and adjacent, supplementary angles

D linear pair and adjacent angles

*30. (10) Draw a Venn diagram to show the relationship in the conditional statement.

If a number is a natural number, then it is a whole number.