

Solve. Show ALL work!

$$1) 2x + 5 = 20 - 3x$$


2.5

Reason Using Properties from Algebra

Goal • Use algebraic properties in logical arguments.

*When you *solve an equation*, you use properties of real numbers.

*Segment lengths and angle measures are real numbers, so you can also use these properties to write logical arguments about geometric figures.



1) $2x + 5 = 20 - 3x$

Explain what you did in each step:

KEY CONCEPT*For Your Notebook***Algebraic Properties of Equality**

Let a , b , and c be real numbers.

Addition Property If $a = b$, then $a + c = b + c$.

Subtraction Property If $a = b$, then $a - c = b - c$.

Multiplication Property If $a = b$, then $ac = bc$.

Division Property If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$.

Substitution Property If $a = b$, then a can be substituted for b in any equation or expression.

EXAMPLE 1 Write reasons for each step

Solve $2x + 5 = 20 - 3x$. Write a reason for each step.

Equation	Explanation	Reason
$2x + 5 = 20 - 3x$	Write original equation.	Given
$2x + 5 + 3x = 20 - 3x + 3x$	Add $3x$ to each side.	Addition Property of Equality
$5x + 5 = 20$	Combine like terms.	Simplify.
$5x = 15$	Subtract 5 from each side.	Subtraction Property of Equality
$x = 3$	Divide each side by 5.	Division Property of Equality

► The value of x is 3.

KEY CONCEPT*For Your Notebook***Distributive Property** $a(b + c) = ab + ac$, where a , b , and c are real numbers.

Distribute.

a) $3(4x + 2)$

b) $-7(-2x - 3)$

EXAMPLE 2 Use the Distributive Property

Solve $-4(11x + 2) = 80$. Write a reason for each step.

EXAMPLE 3 Use properties in the real world

HEART RATE When you exercise, your target heart rate should be between 50% to 70% of your maximum heart rate. Your target heart rate r at 70% can be determined by the formula $r = 0.70(220 - a)$ where a represents your age in years. Solve the formula for a .

Solution

Equation	Explanation	Reason
$r = 0.70(220 - a)$	Write original equation.	Given
$r = 154 - 0.70a$	Multiply.	Distributive Property
$r - 154 = -0.70a$	Subtract 154 from each side.	Subtraction Property of Equality
$\frac{r - 154}{-0.70} = a$	Divide each side by -0.70 .	Division Property of Equality

Let's Try a couple more.

Solve the equation. Write a reason for each step.

$$6(2y + 7) = 36$$

Solve the equation for y . Write a reason for each step.

$$3y + 4x = 5$$

Reflexive:

$$a = a$$

Symmetric:

$$a = b, \text{ then } b = a$$

Transitive:

$$\text{If } a = b \text{ and } b = c, \text{ then } a = c.$$

KEY CONCEPT*For Your Notebook***Reflexive Property of Equality**

- Real Numbers** For any real number a , $a = a$.
- Segment Length** For any segment \overline{AB} , $AB = AB$.
- Angle Measure** For any angle $\angle A$, $m\angle A = m\angle A$.

Symmetric Property of Equality

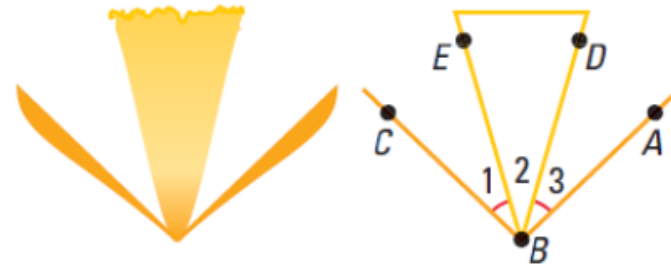
- Real Numbers** For any real numbers a and b , if $a = b$, then $b = a$.
- Segment Length** For any segments \overline{AB} and \overline{CD} , if $AB = CD$, then $CD = AB$.
- Angle Measure** For any angles $\angle A$ and $\angle B$, if $m\angle A = m\angle B$, then $m\angle B = m\angle A$.

Transitive Property of Equality

- Real Numbers** For any real numbers a , b , and c , if $a = b$ and $b = c$, then $a = c$.
- Segment Length** For any segments \overline{AB} , \overline{CD} , and \overline{EF} , if $AB = CD$ and $CD = EF$, then $AB = EF$.
- Angle Measure** For any angles $\angle A$, $\angle B$, and $\angle C$, if $m\angle A = m\angle B$ and $m\angle B = m\angle C$, then $m\angle A = m\angle C$.

EXAMPLE 4 Use properties of equality

LOGO You are designing a logo to sell daffodils. Use the information given. Determine whether $m\angle EBA = m\angle DBC$.



Solution

Equation

$$m\angle 1 = m\angle 3$$

Explanation

Marked in diagram.

Reason

Given

$$m\angle EBA = m\angle 3 + m\angle 2$$

Add measures of adjacent angles.

Angle Addition Postulate

$$m\angle EBA = m\angle 1 + m\angle 2$$

Substitute $m\angle 1$ for $m\angle 3$.

Substitution Property of Equality

$$m\angle 1 + m\angle 2 = m\angle DBC$$

Add measures of adjacent angles.

Angle Addition Postulate

$$m\angle EBA = m\angle DBC$$

Both measures are equal to the sum of $m\angle 1 + m\angle 2$.

Transitive Property of Equality

EXAMPLE 5 Use properties of equality

In the diagram, $AB = CD$. Show that $AC = BD$.



Solution

**GUIDED PRACTICE** for Examples 4 and 5

Name the property of equality the statement illustrates.

4. If $m\angle 6 = m\angle 7$, then $m\angle 7 = m\angle 6$.

5. If $JK = KL$ and $KL = 12$, then $JK = 12$.

6. $m\angle W = m\angle W$

Assignment Day 1:

2.5 ws

LESSON
2.5**Practice***For use with pages 104–111***Complete the logical argument by giving a reason for each step.**

1. $5(2x - 1) = 9x + 2$

$10x - 5 = 9x + 2$

$10x = 9x + 7$

$x = 7$

Given

a. ?**b.** ?**c.** ?

2. $8x - 5 = -2x - 15$

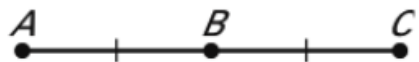
$10x - 5 = -15$

$10x = -10$

$x = -1$

Given

a. ?**b.** ?**c.** ?



3. $AB = BC$

$$AC = AB + BC$$

$$AC = AB + AB$$

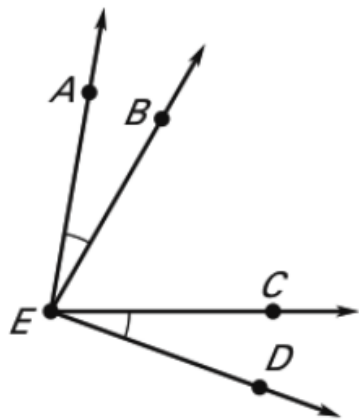
$$AC = 2(AB)$$

Given

a. ?

b. ?

c. ?



4.

$$m\angle AEB = m\angle CED$$

$$m\angle BEC = m\angle BEC$$

$$m\angle AEB + m\angle BEC = m\angle CED + m\angle BEC$$

$$m\angle AEC = m\angle AEB + m\angle BEC$$

$$m\angle BED = m\angle CED + m\angle BEC$$

$$m\angle AEC = m\angle BED$$

Given

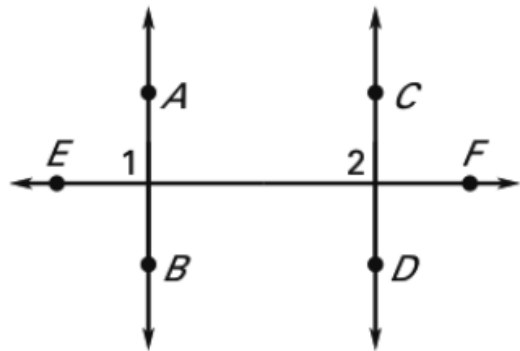
a. ?

b. ?

c. ?

d. ?

e. ?



5. $\overleftrightarrow{AB} \perp \overleftrightarrow{EF}, \overleftrightarrow{CD} \perp \overleftrightarrow{EF}$
 $m\angle 1 = 90^\circ$
 $m\angle 2 = 90^\circ$
 $m\angle 1 = m\angle 2$

Given

a. ?

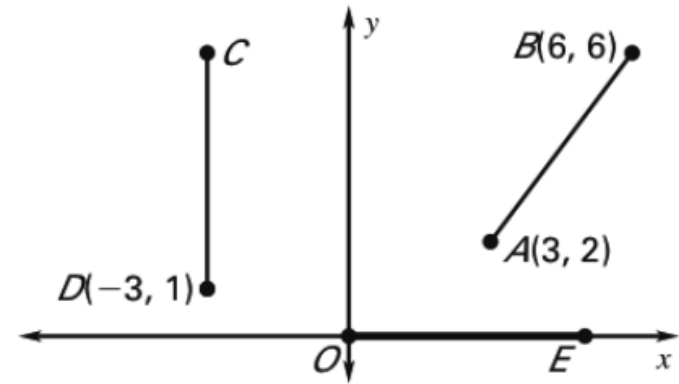
b. ?

c. ?

Use the property to complete the statement.

6. Reflexive Property of Angle Measure: $m\angle B = \underline{\quad? \quad}$.
7. Transitive Property of Equality: If $CD = GH$ and $\underline{\quad? \quad} = RS$, then $\underline{\quad? \quad}$.
8. Addition Property of Equality: If $x = 3$, then $14 + x = \underline{\quad? \quad}$.
9. Symmetric Property of Equality: If $BC = RL$, then $\underline{\quad? \quad}$.
10. Substitution Property of Equality: If $m\angle A = 45^\circ$, then $3(m\angle A) = \underline{\quad? \quad}$.
11. Multiplication Property of Equality: If $m\angle A = 45^\circ$, then $\underline{\quad? \quad}(m\angle A) = 15^\circ$.

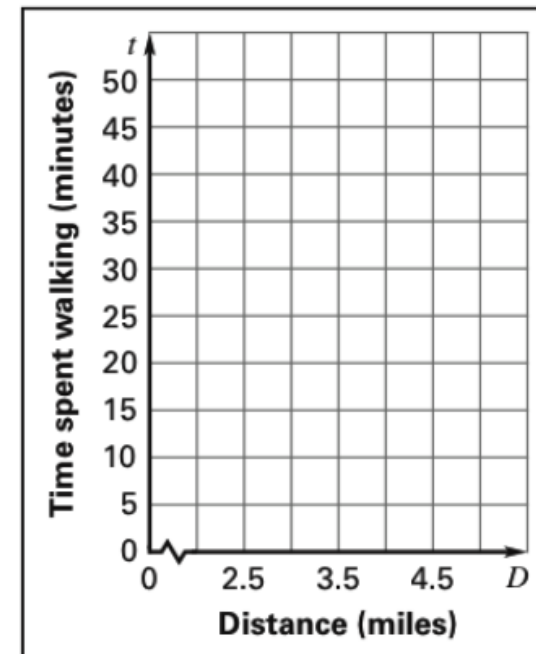
12. Distance You are given the following information about the diagram at the right: $AB = CD$, $CD = OE$. Find the coordinates of points C and E . *Explain* your reasoning.



In Exercises 13–15, use the following information.

Treadmill Mark works out for 45 minutes on a treadmill. He spends t minutes walking and the rest of the time running. He walks 0.06 mi/min and runs 0.11 mi/min. The total distance (in miles) he travels is given by the function $D = 0.06t + 0.11(45 - t)$.

- 13.** Solve the formula for t and write a reason for each step.
- 14.** Make a table that shows the time spent walking for the following distances traveled:
2.7, 3, 3.7, 4.3, and 4.5.
- 15.** Use the table from Exercise 14 to graph the time spent walking as a function of the distance traveled. What happens to the time spent walking as distance increases?



In Exercises 16–18, use the following information.

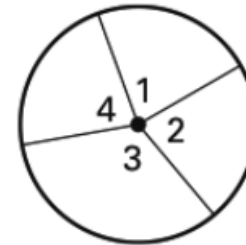
Statistics The students at a school vote for one of four candidates for class president. The circle graph below shows the results of the election. Each sector on the graph represents the percent of the total votes that each candidate received. You know the following about the circle graph.

$$m\angle 1 + m\angle 2 + m\angle 3 + m\angle 4 = 360^\circ$$

$$m\angle 2 + m\angle 3 = 200^\circ$$

$$m\angle 1 = m\angle 4$$

$$m\angle 2 = m\angle 4$$



- 16.** Find the angle measure for each sector.
- 17.** What percent of the vote did each candidate receive?
- 18.** How many votes did each candidate receive if there were a total of 315 votes?

Properties from yesterday:

KEY CONCEPT

Algebraic Properties of Equality

Let a , b , and c be real numbers.

Addition Property If $a = b$, then $a + c = b + c$.

Subtraction Property If $a = b$, then $a - c = b - c$.

Multiplication Property If $a = b$, then $ac = bc$.

Division Property If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$.

Substitution Property If $a = b$, then a can be substituted for b in any equation or expression.

KEY CONCEPT

For Your Notebook

Reflexive Property of Equality

Real Numbers For any real number a , $a = a$.

Segment Length For any segment \overline{AB} , $AB = AB$.

Angle Measure For any angle $\angle A$, $m\angle A = m\angle A$.

Symmetric Property of Equality

Real Numbers For any real numbers a and b , if $a = b$, then $b = a$.

Segment Length For any segments \overline{AB} and \overline{CD} , if $AB = CD$, then $CD = AB$.

Angle Measure For any angles $\angle A$ and $\angle B$, if $m\angle A = m\angle B$, then $m\angle B = m\angle A$.

Transitive Property of Equality

Real Numbers For any real numbers a , b , and c , if $a = b$ and $b = c$, then $a = c$.

Segment Length For any segments \overline{AB} , \overline{CD} , and \overline{EF} , if $AB = CD$ and $CD = EF$, then $AB = EF$.

Angle Measure For any angles $\angle A$, $\angle B$, and $\angle C$, if $m\angle A = m\angle B$ and $m\angle B = m\angle C$, then $m\angle A = m\angle C$.

Extra Example 4

The city is planning to add two stations between the beginning and end of a commuter train line. Use the information given. Determine whether $RS = TU$.

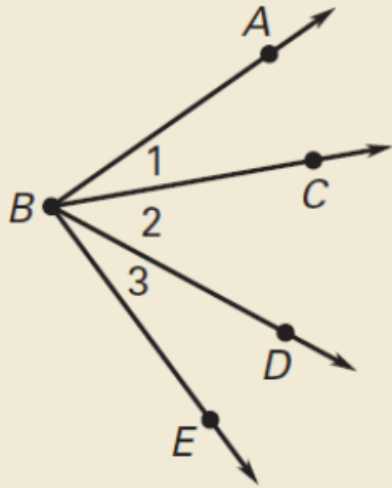


Statements:

Reasons:

Extra Example 5

In the diagram $m\angle ABD = m\angle CBE$.
Show that $m\angle 1 = m\angle 3$.



Statements:

Reasons:

Day 2 Assignment:

p. 108 (3-18 mult. of 3, 21-29 all, 39-42 all)