1.6 Start Thinking

In Section 1.5, you learned that a straight angle is an angle with a measure of 180°. Imagine the straight angle you are measuring is the x-axis of a coordinate plane and the origin is the center of the angle. If you "pull down" the negative x-axis side so that it is in Quadrant III, how could you find the measure of the angle going counterclockwise?

1.6 Warm Up

Solve.

1. $4x - 0 = 12$

2. $7 = -11c - 4$

3. $11 = -19x - 8$

4. $7 = 5n + 5 - 4n$

5. $3x + 2 + 8 = 2x - 5$

6. $x + 5 + 6x + 17 = x - 2$

1.6 Cumulative Review Warm Up

Write the sentence as an equation and solve.

1. The difference between a number and 14 is 8.

2. Twice the difference between 5 times a number and 6 is 18.

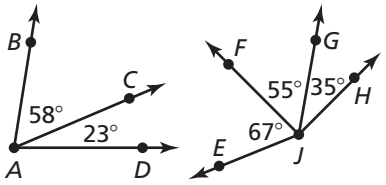
3. Fourteen is 7 times the difference between a number and 2.

4. Four consecutive odd integers such that 2 times the last integer is 5 more than the sum of the first 3 integers.

Name _____ Date _____

1.6 Practice A

In Exercises 1–3, use the figures.



1. Name a pair of adjacent complementary angles.
2. Name a pair of nonadjacent complementary angles.
3. Name a pair of nonadjacent supplementary angles.

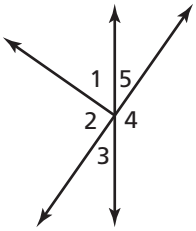
In Exercises 4 and 5, find the angle measure.

4. $\angle 1$ is a complement of $\angle 2$, and $m\angle 2 = 36°$. Find $m\angle 1$.
5. $\angle 3$ is a supplement of $\angle 4$, and $m\angle 4 = 75°$. Find $m\angle 3$.

In Exercises 6 and 7, find the measure of each angle.

6. $\angle WXY$ and $\angle YXZ$ are supplementary angles, $m\angle WXY = (6x + 59)°$, and $m\angle YXZ = (3x - 14)°$.
7. $\angle ABC$ and $\angle CBD$ are complementary angles, $m\angle ABC = (3x + 6)°$, and $m\angle CBD = (4x - 14)°$.

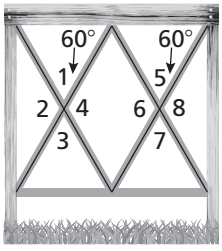
In Exercises 8–10, use the figure.



8. Identify the linear pairs that include $\angle 5$.
9. Are $\angle 3$ and $\angle 5$ vertical angles? Explain your reasoning.
10. Are $\angle 2$ and $\angle 4$ vertical angles? Explain your reasoning.

In Exercises 11–13, write and solve an algebraic equation to find the measure of each angle based on the given description.

11. Two angles form a linear pair. The measure of one angle is $24°$ more than the measure of the other angle.
12. The measure of an angle is three times the measurement of its complement.
13. The measure of one angle is 15 less than half the measurement of its supplement.
14. The figure shows the design on an outdoor fence.

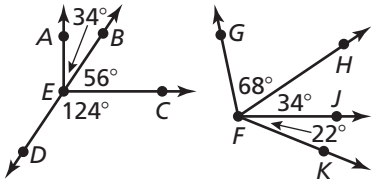


   a. Name a pair of adjacent supplementary angles.
   b. Name a pair of nonadjacent supplementary angles.
   c. Identify the linear pairs that include $\angle 5$.
   d. Find $m\angle 3$. Explain your reasoning.

Name_____ Date _____

1.6 Practice B

In Exercises 1–3, use the figures.



1. Name a pair of adjacent complementary angles.
2. Name a pair of nonadjacent complementary angles.
3. Name a pair of nonadjacent supplementary angles.

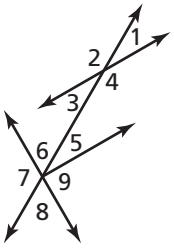
In Exercises 4 and 5, find the angle measure.

4. $\angle 1$ is a complement of $\angle 2$, and $m\angle 2 = 71°$. Find $m\angle 1$.
5. $\angle 3$ is a supplement of $\angle 4$, and $m\angle 4 = 26.7°$. Find $m\angle 3$.

In Exercises 6 and 7, find the measure of each angle.

6. $\angle ABC$ and $\angle CBD$ are supplementary angles, $m\angle ABC = 7x°$ and $m\angle CBD = 8x°$.
7. $\angle WXY$ and $\angle YXZ$ are complementary angles, $m\angle WXY = (2x + 5)°$, and $m\angle YXZ = (8x - 5)°$.

In Exercises 8–11, use the figure.



8. Identify the linear pair(s) that include $\angle 2$.
9. Identify the linear pair(s) that include $\angle 8$.
10. Are $\angle 6$ and $\angle 8$ vertical angles? Explain your reasoning.
11. Are $\angle 7$ and $\angle 9$ vertical angles? Explain your reasoning.

In Exercises 12–14, write and solve an algebraic equation to find the measure of each angle based on the given description.

12. The measure of an angle is 9 more than twice its complement.
13. Two angles form a linear pair. The measure of one angle is four times the measure of the other angle.
14. Two angles form a linear pair. The measure of one angle is $51°$ more than $\frac{1}{2}$ the measure of the other angle.

In Exercises 15 and 16, tell whether the statement is *always*, *sometimes*, or *never* true. Explain your reasoning.

15. The sum of the measures of a linear pair of angles is $90°$.
16. The sum of the measures of a pair of vertical angles is $180°$.

Name _____ Date _____

1.6 Enrichment and Extension

Complementary and Supplementary Angles

A *radian* is a standard unit of measure used to measure angles. The conversion from degrees to radians is $180° = \pi$ radians.

Example 1: Convert the sum of complementary and supplementary angles into radians.

Solution: $90° \bullet \frac{\pi \text{ radians}}{180°} = \frac{\pi}{2} \text{ radians}$ Complementary angles sum to $\frac{\pi}{2}$ radians.

$180° \bullet \frac{\pi \text{ radians}}{180°} = \pi \text{ radians}$ Supplementary angles sum to π radians.

Example 2: Determine if the two angles are *complementary*, *supplementary*, or *neither*: $\frac{3\pi}{8}$ and $\frac{\pi}{4}$

Solution: $\frac{\pi}{4} \bullet \left(\frac{2}{2}\right) = \frac{2\pi}{8}$ Multiply by an identity to get the LCD.

$\frac{2\pi}{8} + \frac{3\pi}{8} = \frac{5\pi}{8}$ Add the two measurements.

The sum of $\frac{5\pi}{8}$ does not equal $\frac{\pi}{2}$ or π, so the final answer is *neither*.

Determine if the two angles are *complementary, supplementary*, or *neither.*

1. $\frac{3\pi}{7}, \frac{4\pi}{7}$ **2.** $\frac{\pi}{4}, \frac{\pi}{4}$ **3.** $\frac{5\pi}{18}, \frac{5\pi}{9}$

4. $\frac{\pi}{8}, \frac{7\pi}{8}$ **5.** $\frac{\pi}{3}, \frac{\pi}{4}$ **6.** $\frac{6\pi}{15}, \frac{\pi}{10}$

If possible, find the angle complementary and supplementary to the given angle.

7. $\frac{12\pi}{15}$ **8.** $\frac{23\pi}{42}$ **9.** $\frac{3\pi}{17}$

10. $\frac{2\pi}{5}$ **11.** $\frac{17\pi}{42}$ **12.** $\frac{7\pi}{8}$

Name_____ Date _____

1.6 Puzzle Time

Why Did The Student Eat His Math Exam?

A	B	C	D	E	F
G	H	I	J		

Complete each exercise. Find the answer in the answer column. Write the word under the answer in the box containing the exercise letter.

152° NOTES	36° SAID
58° KEYS	34° SAME
41° BECAUSE	40° OF
61° THE	92° CALLED
126° PIECE	65° GOT
134° DOOR	33° TEACHER
78° WAS	48° SHE
54° A	63° ARE
50° CAKE	149° IT
82° THE	173° HER

Find the angle measure.

A. $\angle 1$ is a complement of $\angle 2$ and $m\angle 1 = 49°$. Find $m\angle 2$.

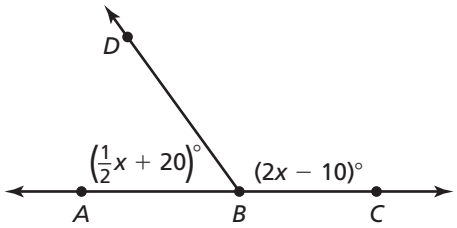
B. $\angle 3$ is a supplement of $\angle 4$ and $m\angle 3 = 119°$. Find $m\angle 4$.

C. $\angle 5$ and $\angle 6$ are vertical angles and $m\angle 5 = 33°$. Find $m\angle 6$.

D. $\angle 7$ and $\angle 8$ are linear angles and $m\angle 7$ is 4 times that of $m\angle 8$. Find $m\angle 8$.

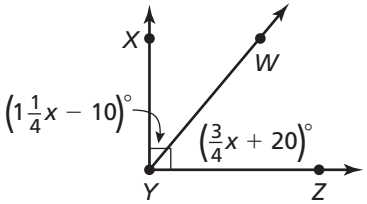
E. $\angle 1$ is a supplement of $\angle 2$ and $m\angle 2 = 31°$. Find $m\angle 1$.

F. $\angle 3$ is a complement of $\angle 4$ and $m\angle 3 = 12°$. Find $m\angle 4$.



G. Find $m\angle ABD$.

H. Find $m\angle DBC$.



I. Find $m\angle XYW$.

J. Find $m\angle WYZ$.