Use the cube to name each of the following.

1. all lines that are parallel to \( \overline{BC} \)
   \( \overline{AD}, \overline{EH}, \overline{FG} \)

2. a pair of parallel planes
   Example: planes \( \overline{ABF} \) and \( \overline{OCG} \)

3. all lines that are skew to \( \overline{AE} \)
   \( \overline{BC}, \overline{FG}, \overline{DC}, \overline{HG} \)

Identify all pairs of each type of angles in the diagram.

4. corresponding angles \( (\_\_\_\_\_\_\_) \)
   \( \angle 7 \approx \angle 5, \angle 8 \approx \angle 3 \)

5. alternate interior angles \( (\_\_\_\_\_\_\_) \)
   \( \angle 2 \approx \angle 4, \angle 1 \approx \angle 3, \angle 8 \approx \angle 2 \)

6. same-side interior angles \( (\_\_\_\_\_\_\_) \)
   \( \angle 2 \approx \angle 3, \angle 1 \approx \angle 4, \angle 1 \approx \angle 5, \angle 4 \approx \angle 5, \angle 7 \approx \angle 8 \)

7. alternate exterior angles \( (\_\_\_\_\_\_\_) \)
   \( \angle 7 \approx \angle 6 \)

8. vertical angles
   \( \angle 5 \approx \angle 4 \)

9. linear pairs
   None

The map at the right shows the intersection of Maple Street and Oak Street by Main Street. Name the angle pairs (CA, AIA, AEA, SSIA) represented by the locations listed below.

10. school and library \( \triangle CA \)

11. library and post office \( \triangle AEA \)

12. school and gas station \( \triangle AIA \)

Find \( m\angle 1 \) and \( m\angle 2 \). State the theorems or postulates (CA, AIA, AEA, SSIA) that justify your answers.

13. \( m\angle 1 = 134^\circ \) \( \triangle SSIA \)
    \( m\angle 2 = 46^\circ \) \( \triangle AIA \)

14. \( m\angle 1 = 125^\circ \) \( CA \)
    \( m\angle 2 = 55^\circ \) \( SSIA \)

15. \( m\angle 1 = 58^\circ \) \( \triangle AIA \)
    \( m\angle 2 = 123^\circ \) \( SSIA \)

16. \( m\angle 1 = 64^\circ \) \( \triangle AIA \)
    \( m\angle 2 = 116^\circ \) \( SSIA \)

17. \( m\angle 1 = 103^\circ \) \( CA \)
    \( m\angle 2 = 103^\circ \) \( AEA \)

18. \( m\angle 1 = 82^\circ \) \( SSFA \)
    \( m\angle 2 = 82^\circ \) \( AEA \)
Find the value of each variable. Then find the measure of each labeled angle.

19. \[ \begin{align*}
\text{\text{AFA}} & \quad \text{\text{SSIA}} \\
(2x-30) & \quad (3x-44) \\
X+2x & = 180 \\
4x & = 180 \\
x & = 45 \\
\end{align*} \]

20. \[ \begin{align*}
\text{\text{SSIA}} & \quad \text{\text{AIA}} \\
(3x-35) & \quad (3y-35) \\
3(2x)+4y & = 180 \\
6x+4y & = 180 \\
4x & = 90 \\
4y & = 90 \\
x & = 22.5 \\
y & = 22.5 \\
\end{align*} \]

21. \[ \begin{align*}
\text{\text{SSIA}} & \quad \text{\text{AIA}} \\
(3x+34) & \quad (3y-35) \\
3x+34 & = 170 \\
3x & = 136 \\
x & = 45.33 \\
\end{align*} \]

22. Error Analysis. Which solution for the figure at the right is incorrect? Explain.

\[ \begin{align*}
2x-40 & = x+10 \\
x & = 50 \\
3x-30 & = 180 \\
x & = 70
\end{align*} \]

The one on the right is incorrect because the angles in the diagram are AIA, so they are congruent, not supplementary.

Refer to the diagram at the right. Use the given information to determine which lines, if any, must be parallel. If any lines are parallel, use a theorem or postulate to tell why.

23. \( \angle 9 \equiv \angle 14 \) None

24. \( \angle 1 \equiv \angle 9 \) \( AB \parallel CD \) CONVERSE

25. \( \angle 2 \) is supplementary to \( \angle 3 \) \( AB \parallel CD \) CONVERSE

26. \( \angle 7 \equiv \angle 10 \) None

27. \( m\angle 6 = 60, m\angle 13 = 120 \) \( AB \parallel CD \) CONVERSE

28. \( \angle 4 \equiv \angle 13 \) None

29. \( \angle 3 \) is supplementary to \( \angle 10 \) None

30. \( \angle 10 \equiv \angle 15 \) \( AB \parallel CD \) CONVERSE

31. \( \angle 1 \equiv \angle 8 \) \( AB \parallel CD \) CONVERSE

Find the value of \( x \) for which \( a \parallel b \).

32. \[ \begin{align*}
\text{\text{AFA}} & \quad \text{\text{SSIA}} \\
(5x+2) & \quad (6x) \\
5x+3 & = 63 \\
x & = 12
\end{align*} \]

33. \[ \begin{align*}
\text{\text{SSIA}} & \quad \text{\text{AIA}} \\
(3x-27) & \quad (2x) \\
2x+17 & = 3x-27 \\
x & = 44
\end{align*} \]

34. \[ \begin{align*}
\text{\text{SSIA}} & \quad \text{\text{AIA}} \\
(2x) & \quad (104) \\
2x+104 & = 180 \\
x & = 37
\end{align*} \]
Which lines or line segments are parallel? Justify your answers.

35. \( \overline{AB} \parallel \overline{CD} \)
\[ \text{AAE Converse} \]

36. \( \overline{WX} \parallel \overline{YZ} \)
\[ \text{AAE Converse} \]

37. Find the value of \( x \) that makes \( \overline{WX} \parallel \overline{YZ} \).
\[
12x - 6 = 90 \\
12x = 96 \\
\boxed{x = 8}
\]

In #38-39, \( a, b, c, \) and \( d \) are distinct lines in the same plane. Draw and label a picture to represent each situation. For each combination of relationships, tell how \( a \) and \( c \) are related to each other. Justify your answer with a theorem, postulate, or property.

38. \( a \perp b; \ b \perp c \)

39. \( a \perp b; \ b \parallel c \)

In #40-42, find the value of the variable(s).

40. \[ 130^\circ, 2x, 3y \]
\[ \text{ext=int=int} \]
\[ 130 = 4y + 34 \]
\[ 3y = 4y \]
\[ x = 25 \]
\[ y = 9 \]

41. \( (x+8)^\circ, 45^\circ \)
\[ (x-3)^\circ \]
\[ 2x + 50 = 180 \]
\[ 2x = 130 \]
\[ x = 65 \]

42. \( 68^\circ, 3y, 141^\circ \)
\[ 3y = 141 \]
\[ 3y + 141 = 180 \]
\[ 3y = 39 \]
\[ x = 73 \]
\[ y = 13 \]
In #43-45, find $\angle 1$. 

43. 

$$m \angle 1 = \frac{60^\circ}{60^\circ}$$

44. 

$$m \angle 1 = \frac{90^\circ}{51.7^\circ}$$

45. 

$$m \angle 1 = \frac{104^\circ}{56^\circ}$$

$$59^\circ + 60^\circ = 119^\circ$$

$$180^\circ - 119^\circ$$

$$q_1 + q_2 = 143^\circ$$

$$180^\circ - 143^\circ = 37^\circ$$

46. The measure of one angle of a triangle is $56^\circ$. The measures of the other two angles are in a ratio of 2:3. Find the measures of the unknown angles.

$$\Delta x \quad 3x$$

$$5x + 56 = 180^\circ$$

$$5x = 124^\circ$$

$$x = 24^\circ$$

$$\angle (24^\circ, 5) = \left( \frac{49}{6} \right)^\circ$$

$$\angle (34^\circ, 5) = \left( \frac{74}{4} \right)^\circ$$

47. The measures of the angles of a triangle are in the extended ratio of 3:4:6. Find the measures of the angles of the triangle.

$$13x = 180^\circ$$

$$x = \left( \frac{13}{13} \right)^\circ$$

Complete the following proofs.

48. Given: $\ell \parallel m; a \parallel b$

Prove: $\angle 1 \equiv \angle 5$

**Statements**

1. $\ell \parallel m$
2. $\angle 2$ and $\angle 3$ are supplementary
3. $\angle 1 \equiv \angle 2$
4. $\angle 1$ and $\angle 3$ are supplementary
5. $a \parallel b$
6. $\angle 4$ and $\angle 3$ are supplementary
7. $\angle 1 \equiv \angle 4$
8. $\angle 4 \equiv \angle 5$
9. $\angle 1 \equiv \angle 5$

**Reasons**

1. Given
2. SSA
3. Vertical Angles
4. Congruent Supplements
5. Given
6. SSA
7. Congruent Supplements
8. Vertical Angles
9. Transitive Property
49. **Given**: $\angle 1$ and $\angle 2$ are supplementary
   **Prove**: $\ell \parallel m$

**Statements**
1. $\angle 1$ and $\angle 2$ are supplementary
2. $\angle 3$ and $\angle 2$ are supplementary
3. $\angle 1 \equiv \angle 3$
4. $\ell \parallel m$

**Reasons**
1. Given
2. Linear Pair Postulate
3. Congruent Supplements
4. AEA Converse

50. **Given**: $\ell \parallel m, a \parallel b, a \perp \ell$
   **Prove**: $b \perp m$

**Statements**
1. $\ell \parallel m$
2. $a \parallel b$
3. $a \perp \ell$
4. $a \perp m$
5. $b \perp m$

**Reasons**
1. Given
2. Given
3. Given
4. $\perp$ Transversal
5. $\perp$ Transversal

51. **Given**: $a \parallel b, a \perp \ell, b \perp m$
   **Prove**: $\ell \parallel m$

**Statements**
1. $a \parallel b$
2. $a \perp \ell$
3. $b \perp \ell$
4. $b \perp m$
5. $\ell \parallel m$

**Reasons**
1. Given
2. Given
3. $\perp$ Transversal
4. Given
5. $\perp$ Theorem

Complete each of the following constructions.

52. Construct a line parallel to a given line through a point not on the line.

53. Construct a perpendicular to a given line through a given point not on the line.
54. Construct a perpendicular to a given line at a given point on the line.

55. Construct a square with side length $2a$. 

56. Construct a rectangle with sides $b$ and $a$. 

Write an equation in slope-intercept form using the given information.

57. $M(-2, 4), N(5, -8)$  \[ y = \frac{4-8}{-2-5} \cdot x + \frac{11}{7} \]

58. Slope 7, passes through $(1, -2)$  \[ y + 2 = 7(x - 1) \]

Write an equation for the line parallel to the given line through the given point.

59. $y = -\frac{1}{5}x, (5, -8)$  \[ y + 8 = -\frac{1}{5}(x - 5) \]

60. $y = \frac{1}{2}x + 3, (6, 3)$  \[ y - 3 = \frac{1}{2}(x - 6) \]

Write an equation for the line perpendicular to the given line through the given point.

61. $y = 2x + 2, (3, 2)$  \[ m = -1 \]  \[ y - 2 = -1(x - 3) \]

62. $y = \frac{1}{3}x - \frac{2}{5}, (5, -1)$  \[ m = -\frac{1}{3} \]  \[ y + 1 = -\frac{1}{3}(x - 5) \]
1. Find the values of \( x \) and \( y \).

2. Name all pairs of corresponding angles.
   Name all pairs of alternate exterior angles.
   Name all pairs of alternate interior angles.
   Name all pairs of consecutive interior angles.

3. GIVEN: \( \angle 1 \) and \( \angle 3 \) are supplementary.
   PROVE: \( j \parallel k \)

   **Statements**
   1. \( \angle 1 \) and \( \angle 3 \) are supplementary.
   2. \( \angle 1 \cong \angle 2 \)
   3. \( \angle 2 \) and \( \angle 3 \) are supplementary.
   4. \( j \parallel k \)

   **Reasons**
   1. Given
   2. Vertical Angles
   3. Congruent Supplements
   4. SSA Converse

4. (Proof) Complete the proof.
   GIVEN \( \angle 1 \) and \( \angle 2 \) are supplementary.
   PROVE \( l_1 \parallel l_2 \)

   **Statements**
   1. \( \angle 1 \) and \( \angle 2 \) are supplementary.
   2. \( \angle 1 \) and \( \angle 3 \) are a linear pair.
   3. \( \angle 2 = \angle 3 \) (Are supplementary)
   4. \( \angle 2 \cong \angle 3 \)
   5. \( l_1 \parallel l_2 \)

   **Reasons**
   1. Given
   2. Definition of linear pair
   3. Linear Pair Postulate
   4. Congruent Supplements Theorem
   5. CA Converse
5. GIVEN \( a \parallel b, \angle 1 \cong \angle 2 \)  
PROVE \( c \parallel d \)

Statements | Reasons
---|---
1. \( a \parallel b \) | 1. Given
2. \( \angle 1 \cong \angle 2 \) | 2. Given
3. \( \angle 1 \) is supplementary to \( \angle 3 \) | 3. SSA
4. \( \angle 2 \) is supplementary to \( \angle 3 \) | 4. Congruent Supplements
5. \( c \parallel d \) | 5. SSA Converse

6. **Developing Proof** Complete the proof of the Consecutive Interior Angles Theorem.

GIVEN \( p \parallel q \)  
PROVE \( \angle 1 \) and \( \angle 2 \) are supplementary.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( _______ \parallel q )</td>
<td>1. Given</td>
</tr>
<tr>
<td>2. ( \angle 1 \cong \angle 3 )</td>
<td>2. ( _______ \parallel _______ _______ )</td>
</tr>
<tr>
<td>3. ( _______ \parallel _______ _______ )</td>
<td>3. Definition of congruent angles</td>
</tr>
<tr>
<td>4. ( _______ ) and ( _______ ) are a linear pair</td>
<td>4. Definition of linear pair</td>
</tr>
<tr>
<td>5. ( m\angle 3 + m\angle 2 = 180^\circ )</td>
<td>5. Def. Supplementary</td>
</tr>
<tr>
<td>6. ( _______ + _______ &lt; 180^\circ )</td>
<td>6. Substitution prop. of equality</td>
</tr>
<tr>
<td>7. ( \angle 1 ) and ( \angle 2 ) are supplementary.</td>
<td>7. ( _______ ) Def. Supplementary</td>
</tr>
</tbody>
</table>

7. **Categorizing** Tell whether the statement is **sometimes**, **always**, or **never true**.

- Two lines that are parallel to the same line are parallel to each other. **always**
- In a plane, two lines that are perpendicular to the same line are parallel to each other. **always**
- Two noncoplanar lines that are perpendicular to the same line are parallel to each other. **never**
- Through a point not on a line you can construct a parallel line. **always**

Please note that although they are using this step here, I will not be requiring this step in any of your proofs on the test. They are also missing a step.

(1a) \( \angle 2 \) and \( \angle 3 \) are supplementary. **Linear Pair Postulate**