1. The transversal of two parallel lines forms same-side interior angles and same-side exterior angles that are supplementary. It forms alternate interior angles, alternate exterior angles, and corresponding angles that are congruent. If lines form a triangle, then the sum of its interior angles is 180° and the measure of each exterior angle equals the sum of the measures of the corresponding remote interior angles. The slopes of parallel lines are always equal, and the product of slopes of perpendicular lines is -1.

2. Angles that are outside the space between parallel lines and that lie on the same side of the transversal are **same-side exterior angles.**

3. A **transversal** intersects coplanar lines in distinct points.

4. Two angles inside a triangle that correspond to the nonadjacent exterior angle are the **remote interior angles.**

5. **Corresponding angles** lie on the same side of a transversal of parallel lines and are in corresponding positions relative to the parallel lines.

6. Angles between parallel lines that are nonadjacent and that lie on opposite sides of a transversal are **alternate interior angles.**

7. Angles between parallel lines that are on the same side of a transversal are **same-side interior angles.**

8. **a.** Since the $\angle 1$ and $\angle 2$ are same-side exterior angles, $\angle 1$ is supplementary to $\angle 2$. Thus,

$$138^{\circ} + m\angle 1 = 180^{\circ}$$
$$m\angle 1 = 42^{\circ}$$

b. Since $\angle 1$ and $\angle 3$ are vertical angles, they are also congruent. Therefore,

$$m\angle 3 = m\angle 1$$
$$m\angle 3 = 42^{\circ}$$

c. $\angle 2$ and $\angle 4$ are congruent by the Alternate Interior Angles Theorem. Thus,

$$m\angle 4 = m\angle 2$$
$$m\angle 4 = 138^{\circ}$$

9. According to the Converse of the Same-Side Exterior Angles Postulate, $\angle 1$ and $\angle 5$ must be supplementary in order for $l \parallel m$. Use this information to write an equation to solve for x:

$$m\angle 1 + m\angle 5 = 180$$
$$3x - 3 + 7x + 23 = 180$$
$$10x = 160$$
$$x = 16$$

10. By the Corresponding Angle Theorem, $\angle 1 \cong \angle 2$. Thus,

$$3x - 7 = 2x + 12$$
$$x = 19$$

Using the value of x to solve for the measure of each angle, we have:

$$m\angle 1 = (3 \times 19 - 7)^\circ = 50^\circ$$

$$m\angle 2 = (2 \times 19 + 12)^\circ = 50^\circ$$

11. By the Triangle Angle-Sum Theorem, $x^\circ + 50 + 74 = 180$.

So $x = 56^\circ$

12. Use the Exterior angle theorem to solve for x:

$$x^\circ = 72 + 63$$
$$x^\circ = 135^\circ$$

13. Use the Exterior angle theorem to solve for x:

$$103 + x^\circ = 152$$
$$x^\circ = 49^\circ$$

14. Use the Exterior angle theorem to solve for x:

$$x^\circ + 40 = 66$$
$$x^\circ = 26^\circ$$

15. Use the Exterior angle theorem and let x be the angle formed by the tree. Solve for x.

$$x^\circ = 90^\circ + 52^\circ$$
$$x^\circ = 142^\circ$$

16. By Theorem 2-13, two lines are parallel if their slopes are equal. First, find the values of the slopes of lines p and q:

Looking at the graph, we can see that line q passes through $(9, 3)$ and $(8, 0)$.

The slope of line q is $\frac{3-0}{9-8} = \frac{3}{1} = 3$.

Looking at the graph, we can see that line p passes through $(0, 1)$ and $(5, 2)$.

The slope of line p is $\frac{5-1}{2-0} = \frac{4}{2} = 2$.

Since their slopes are not equal, lines p and q are not parallel.

17. By Theorem 2-14, two lines are perpendicular if the product of the two slopes is equal to -1. First, find the values of the slopes of lines w and t:

The slope of line w is $\frac{5-3}{5-(-1)} = \frac{2}{6} = \frac{1}{3}$.

The slope of line t is $\frac{5-0}{5-7} = -\frac{5}{2}$.

Take the product of the two slopes, and find that $\left(\frac{1}{3}\right) \times \left(-\frac{5}{2}\right) = -\frac{5}{6} \neq -1$

So lines w and t are not perpendicular.

18. Vertical lines have an undefined slope. An undefined value can't be multiplied by a value that is defined.

19. Given the line equation $y = -3x - 6$ and pass through point $(2, 7)$, start by finding the equation of a parallel line. By Theorem 2-13, two lines are parallel if their slopes are equal. Thus, we know the slope of the parallel line is $m = -3$. Use the slope to calculate the y-intercept value of the parallel line.

$$7 = -3 \times 2 + b$$
$$b = 13$$

The equation for the parallel line is $y = -3x + 13$.

Next, find the equation of the perpendicular line. By Theorem 2-14, two lines are perpendicular if the product of the two slopes is equal to -1. The slope of the perpendicular line is $\frac{1}{3}$ since: $-3 \times \left(\frac{1}{3}\right) = -1$

Use the slope to calculate the y-intercept value of the perpendicular line.

$$7 = \frac{1}{3} \times 2 + b$$
$$b = 7 - \frac{2}{3}$$
$$b = \frac{19}{3}$$

The equation for the perpendicular line is $y = \frac{1}{3}x + \frac{19}{3}$.