Geometry 3.2 Answer Key

1. Both theorems refer to two pairs of congruent angles that are formed when two parallel lines are cut by a transversal, and the angles that are congruent are on opposite sides of the transversal. However with the Alternate Interior Angles Theorem (Thm. 3.2), the congruent angles lie between the parallel lines, and with the Alternate Exterior Angles Theorem (Thm. 3.3), the congruent angles lie outside the parallel lines.

2. $m\angle 2$ and $m\angle 3$; These are consecutive interior angles, which are supplementary. The other three are pairs of congruent angles.

3. $m\angle 1 = 117°$ by Vertical Angles Congruence Theorem (Thm. 2.6); $m\angle 2 = 117°$ by Alternate Exterior Angles Theorem (Thm. 3.3)

4. $m\angle 1 = 150°$ by Corresponding Angles Theorem (Thm. 3.1); $m\angle 2 = 150°$ by Alternate Exterior Angles Theorem (Thm. 3.3)

5. $m\angle 1 = 122°$ by Alternate Interior Angles Theorem (Thm. 3.2); $m\angle 2 = 58°$ by Consecutive Interior Angles Theorem (Thm. 3.4)

6. $m\angle 1 = 140°$ by Alternate Interior Angles Theorem (Thm. 3.2); $m\angle 2 = 40°$ by Consecutive Interior Angles Theorem (Thm. 3.4)

7. $64;\ 2x^\circ = 128^\circ$

$x = 64$

8. $12;\ 72^\circ + (7x + 24)^\circ = 180^\circ$

$7x + 96 = 180$

$7x = 84$

$x = 12$

9. $12;\ m\angle 5 = 65^\circ$

$65^\circ + (11x - 17)^\circ = 180^\circ$

$11x + 48 = 180$

$11x = 132$

$x = 12$

10. $7;\ 118^\circ + (8x + 6)^\circ = 180^\circ$

$8x + 124 = 180$

$8x = 56$

$x = 7$

11. $m\angle 1 = 100^\circ$, $m\angle 2 = 80^\circ$, $m\angle 3 = 100^\circ$; Because the 80° angle is a consecutive interior angle with both $\angle 1$ and $\angle 3$, they are supplementary by the Consecutive Interior Angles Theorem (Thm. 3.4). Because $\angle 1$ and $\angle 2$ are consecutive interior angles, they are supplementary by the Consecutive Interior Angles Theorem (Thm. 3.4).

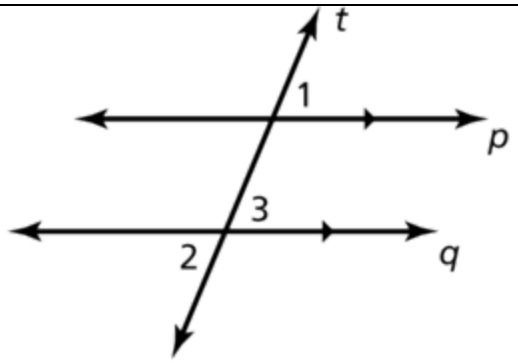
12. $m\angle 1 = 47°$, $m\angle 2 = 133°$, $m\angle 3 = 47°$; Because $\angle 1$ is a consecutive interior angle with the angle that is a vertical angle with the 133° angle, they are supplementary by the Consecutive Interior Angles Theorem (Thm. 3.4). The vertical angle is also 133° by the Vertical Angles Congruence Theorem (Thm. 2.6). Because the 133° angle and $\angle 2$ are alternate interior angles, they are congruent by the Alternate Interior Angles Theorem (Thm. 3.2). Because the 133° angle and $\angle 3$ are consecutive interior angles, they are supplementary by the Consecutive Interior Angles Theorem (Thm. 3.4).

13. In order to use the Corresponding Angles Theorem (Thm. 3.1), the angles need to be formed by two parallel lines cut by a transversal, but none of the lines in this diagram appear to be parallel; $\angle 9$ and $\angle 10$ are corresponding angles.

14. **a.** $\angle ADB \cong \angle CBD$ and $\angle CAD \cong \angle ACB$ by the Alternate Interior Angles Theorem (Thm. 3.2).

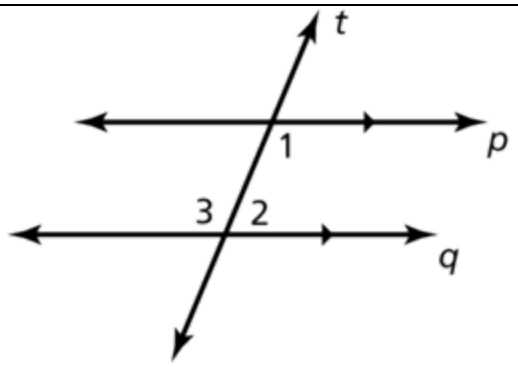
b. $\angle BAD$ and $\angle CDA$ are supplementary, as well as $\angle ABC$ and $\angle DCB$, by the Consecutive Interior Angles Theorem (Thm. 3.4).

15.



STATEMENTS	REASONS
1. $p \parallel q$	**1.** Given
2. $\angle 1 \cong \angle 3$	**2.** Corresponding Angles Theorem (Thm. 3.1)
3. $\angle 3 \cong \angle 2$	**3.** Vertical Angles Congruence Theorem (Thm. 2.6)
4. $\angle 1 \cong \angle 2$	**4.** Transitive Property of Congruence (Thm. 2.2)

16.



STATEMENTS	REASONS
1. $p \parallel q$	**1.** Given
2. $\angle 1 \cong \angle 3$	**2.** Alternate Interior Angles Theorem (Thm. 3.2)
3. $m\angle 1 = m\angle 3$	**3.** Definition of congruent angles
4. $m\angle 2 + m\angle 3 = 180°$	**4.** Linear Pair Postulate (Post. 2.8)
5. $m\angle 2 + m\angle 1 = 180°$	**5.** Substitution Property of Equality
6. $\angle 1$ and $\angle 2$ are supplementary angles.	**6.** Definition of supplementary angles

17. $m\angle 2 = 104°$; Because the trees form parallel lines, and the rope is a transversal, the 76° angle and $\angle 2$ are consecutive interior angles. So, they are supplementary by the Consecutive Interior Angles Theorem (Thm. 3.4).

18. **a.** $m\angle 2 = 70^\circ$, $m\angle 3 = 110^\circ$

b. $\angle 1$ and $\angle 2$ are congruent by the Alternate Interior Angles Theorem (Thm. 3.2). $\angle 1$ and $\angle 3$ are supplementary by the Consecutive Interior Angles Theorem (Thm. 3.4). By substitution, $\angle 2$ and $\angle 3$ are supplementary. So, $\angle ABC$ is a straight angle.

c. yes; $m\angle 2$ will be 60° and $m\angle 3$ will be 120°. The opening of the box will be more steep because $\angle 1$ is smaller.

19. yes; If two parallel lines are cut by a perpendicular transversal, then the consecutive interior angles will both be right angles.

20. no; It is impossible to have parallel lines in spherical geometry. Because all lines are circles with the same diameter, any two lines will always intersect in two points.

21.
$$19x - 10 = 180$$
$$14x + 2y - 10 = 180; \quad x = 10, y = 25$$

22.
$$2x + 2y + 12 = 180$$
$$4x + y + 6 = 180; \quad x = 30, y = 54$$

23. no; In order to make the shot, you must hit the cue ball so that $m\angle 1 = 65^\circ$. The angle that is complementary to $\angle 1$ must have a measure of 25° because this angle is an alternate interior angle with the angle formed by the path of the cue ball and the vertical line drawn.

24. $60°$; $\angle 1 \cong \angle 5$ by the Corresponding Angles Theorem (Thm. 3.1), $\angle 2 \cong \angle 4$ by the Alternate Interior Angles Theorem (Thm 3.2), $\angle 2 \cong \angle 3$ by the definition of angle bisector, and $\angle 4 \cong \angle 5$ is given. So, by the Transitive Property of Congruence (Thm. 2.2), all five of the angles labeled must be congruent to each other. From the diagram, $m\angle 1 + m\angle 2 + m\angle 3 = 180°$, and because they all have the same measure, it must be that they each have a measure of $\frac{180°}{3} = 60°$.

25. If two angles are congruent, then they are vertical angles; false

26. If you see a tiger, then you went to the zoo; false

27. If two angles are supplementary, then they form a linear pair; false

28. If we go to the park, then it is warm outside; false