

## Angle Sum Property and Exterior Angle Property

### A. Fill in the Blanks

1. The sum of the angles in any triangle is always \_\_\_\_\_.
2. An exterior angle of a triangle is equal to the sum of its two \_\_\_\_\_ interior angles.
3. Each angle in an equilateral triangle measures \_\_\_\_\_.
4. In a right-angled triangle, the two acute angles are \_\_\_\_\_ (their sum is  $90^\circ$ ).
5. A triangle cannot have more than one \_\_\_\_\_ angle.

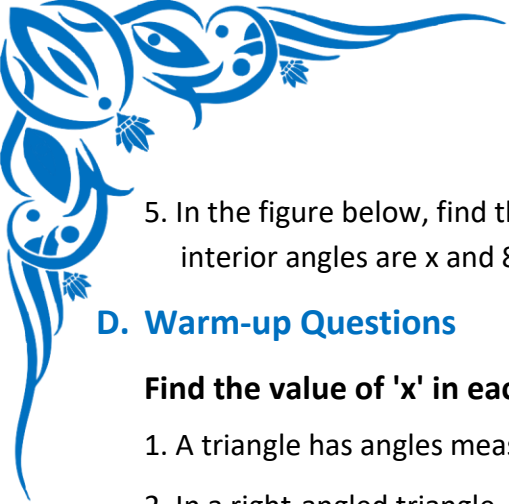
### B. Match the Following;

Column A	Column B
1. A triangle with angles $30^\circ$ , $90^\circ$ , $x$ .	A. $120^\circ$
2. An isosceles triangle with a vertex angle of $80^\circ$ . The base angle is $x$ .	B. $60^\circ$
3. An exterior angle is $x$ , and the opposite interior angles are $50^\circ$ and $70^\circ$ .	C. $40^\circ$
4. A triangle with angles in the ratio $1:1:1$ . One angle is $x$ .	D. $50^\circ$
5. An exterior angle is $100^\circ$ . One opposite interior angle is $60^\circ$ . The other is .	E. $70^\circ$

### C. Practice Problems

**Solve for the unknown angle(s) in each problem. Show your work.**

1. In  $\triangle XYZ$ ,  $\angle X = x$ ,  $\angle Y = 2x$ , and  $\angle Z = 3x$ . Find the value of  $x$  and the measure of each angle.
2. Find the value of  $x$  in the triangle below. (A triangle with angles:  $(x + 10)^\circ$ ,  $(x + 20)^\circ$ , and  $30^\circ$ )
3. One angle of a triangle is  $100^\circ$ . The other two angles are equal. Find the measure of each of the equal angles.
4. Find the value of the exterior angle ' $y$ '. (A triangle with interior angles  $75^\circ$  and  $40^\circ$ . ' $y$ ' is the exterior angle opposite to these two.)



5. In the figure below, find the value of  $x$ . (A triangle with an exterior angle of  $125^\circ$ . The two opposite interior angles are  $x$  and  $80^\circ$ .)

#### D. Warm-up Questions

**Find the value of 'x' in each of the following figures.**

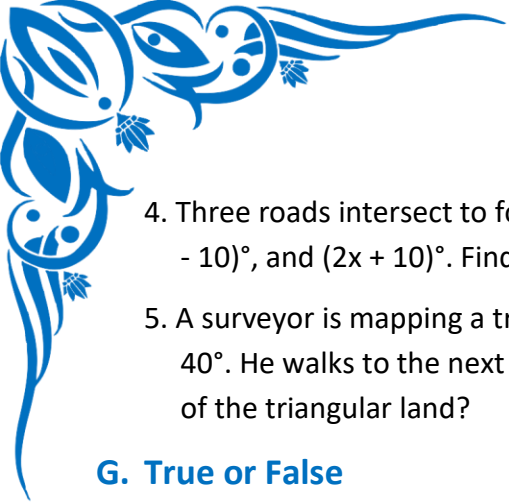
1. A triangle has angles measuring  $50^\circ$  and  $70^\circ$ . What is the third angle,  $x$ ?
2. In a right-angled triangle, one of the acute angles is  $45^\circ$ . What is the other acute angle,  $x$ ?
3. An exterior angle of a triangle is  $x$ . The two opposite interior angles are  $60^\circ$  and  $65^\circ$ . Find  $x$ .
4. An exterior angle of a triangle is  $110^\circ$ . One of the opposite interior angles is  $50^\circ$ . Find the other opposite interior angle,  $x$ .
5. In  $\triangle PQR$ ,  $\angle P = 80^\circ$ ,  $\angle Q = 40^\circ$ . Find  $\angle R$  (represented by  $x$ ).

#### E. Challenge Questions

1. In the figure, line  $AB$  is parallel to line  $DE$ . Find the value of  $x$ . (A diagram showing parallel lines  $AB$  and  $DE$ . A transversal intersects  $AB$  at  $C$  and  $DE$  at  $D$ , forming  $\triangle CDE$ .  $\angle BAC$  is given as  $60^\circ$ .  $\angle CDE = 70^\circ$ . ' $x$ ' is  $\angle DCE$ .)
2. Find the values of  $x$ ,  $y$ , and  $z$  in the given figure. (A diagram showing two intersecting lines, forming two vertically opposite triangles. In the top triangle, angles are  $45^\circ$ ,  $65^\circ$ , and  $x$ . ' $x$ ' and ' $y$ ' are vertically opposite angles. In the bottom triangle, angles are  $y$ ,  $80^\circ$ , and  $z$ .)
3. In  $\triangle PQR$ , the angle bisector of  $\angle P$  and  $\angle Q$  meet at point  $O$ . If  $\angle R = 70^\circ$ , find  $\angle POQ$ .
4. Find the value of  $x$  in the complex figure below. (A large triangle  $ABC$ . A point  $D$  is on  $BC$ . A line segment  $AD$  is drawn. In  $\triangle ABD$ , angles are  $40^\circ$  and  $x$ . In  $\triangle ADC$ , angles are  $30^\circ$  and  $y$ .  $\angle ADB$  and  $\angle ADC$  are on a straight line. The angle  $\angle BAC$  is  $(40+30)=70^\circ$ . We need to find  $x$  in  $\triangle ABC$  where angles are  $70^\circ$ ,  $x$ , and  $y$ .) Let's rephrase this for clarity: In  $\triangle ABC$ ,  $\angle B = 60^\circ$  and  $\angle C = 40^\circ$ .  $AD$  is a line segment from  $A$  to  $BC$  such that  $AD$  is perpendicular to  $BC$ . Find  $\angle BAD$ .
5. The exterior angle at vertex  $C$  of  $\triangle ABC$  is  $130^\circ$ . If the interior opposite angles are in the ratio  $2:3$ , find all the angles of the triangle.

#### F. Word Problems & Application

1. A triangular park has two angles measuring  $55^\circ$  and  $65^\circ$ . What is the measure of the third angle?
2. A ladder is leaning against a wall. The ladder makes an angle of  $60^\circ$  with the ground. Assuming the wall is perpendicular to the ground (forms a  $90^\circ$  angle), what is the angle the ladder makes with the wall?
3. Sarah is flying a kite. The kite string, the ground, and the vertical line from the kite to the ground form a right-angled triangle. If the string makes a  $35^\circ$  angle with the ground, what is the angle at the kite?



4. Three roads intersect to form a triangular plot of land. The angles at the vertices of the plot are  $(3x)^\circ$ ,  $(4x - 10)^\circ$ , and  $(2x + 10)^\circ$ . Find the measure of the largest angle of the plot.
5. A surveyor is mapping a triangular piece of land. He stands at one corner and measures the angle to be  $40^\circ$ . He walks to the next corner and finds the exterior angle of his path is  $110^\circ$ . What is the third angle of the triangular land?

#### G. True or False

1. A triangle can have two obtuse angles. \_\_\_\_\_
2. The sum of the two interior opposite angles is always less than the exterior angle. \_\_\_\_\_
3. The sum of the three exterior angles of a triangle is  $360^\circ$ . \_\_\_\_\_
4. If the angles of a triangle are  $2x$ ,  $3x$ , and  $4x$ , then the value of  $x$  is  $20^\circ$ . \_\_\_\_\_
5. An exterior angle of a triangle can be a right angle. \_\_\_\_\_