Altitudes of Triangles and Types of Triangles

A. Fill in the Blanks

1. The point where the three altitudes of a triangle intersect is called the _____.

2. In a(n) _____ triangle, two of the altitudes are the legs (sides) of the triangle.

3. An altitude is a line segment from a vertex that is _____ to the opposite side.

4. In an obtuse triangle, the orthocenter is located _____ the triangle.

5. A triangle with two equal sides is called a(n) _____ triangle.

B. Match the Following;

| Column A	Column B
1. Acute Triangle	A. The orthocenter is located on one of its vertices.
2. Altitude	B. The orthocenter is located outside the triangle.
3. Obtuse Triangle	C. A perpendicular segment from a vertex to the opposite side.
4. Right Triangle	D. The orthocenter is located inside the triangle.
5. Equilateral Triangle	E. All three altitudes are equal in length.

C. Practice Problems

Apply your knowledge to solve these problems. Draw diagrams where needed.

1. The orthocenter of a triangle lies on one of its vertices. What kind of triangle must it be? Explain your reasoning.

2. In an isosceles triangle ΔXYZ, XY = XZ and ∠Y = 55°. If XA is the altitude to the side YZ, what is the measure of ∠YXA? (This is a multi-step problem!)

3. Can an altitude of a triangle be longer than one of the sides of the triangle? If yes, draw an example.

4. In any triangle, the longest side is opposite the largest angle. What can you say about the altitude drawn to the longest side compared to the other two altitudes? (Is it the longest, shortest, or in between?)

5. If a triangle is equilateral, what is special about its orthocenter? (Hint: Think about other special points in a triangle, like the centroid, circumcenter, and incenter).

D. Warm-up Questions

1. A triangle with all three sides of equal length is called a(n) _____ triangle.
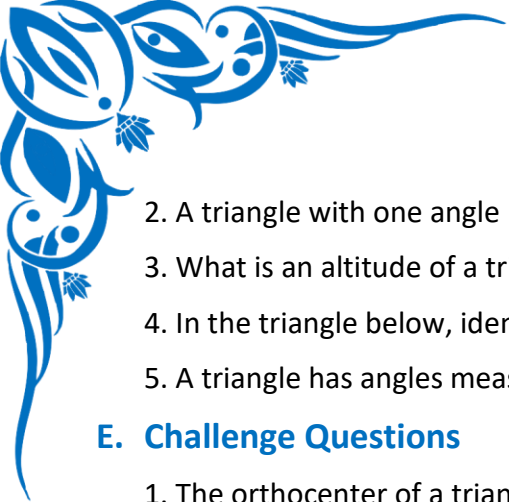
2. A triangle with one angle measuring 95° is called a(n) _____ triangle.

3. What is an altitude of a triangle?

4. In the triangle below, identify the line segment that represents an altitude.

5. A triangle has angles measuring 40°, 50°, and 90°. What type of triangle is this based on its angles?

E. Challenge Questions

1. The orthocenter of a triangle lies on one of its vertices. What kind of triangle must it be? Explain your reasoning.

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3. Can an altitude of a triangle be longer than one of the sides of the triangle? If yes, draw an example.

4. In any triangle, the longest side is opposite the largest angle. What can you say about the altitude drawn to the longest side compared to the other two altitudes? (Is it the longest, shortest, or in between?)

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F. Word Problems & Application

1. The front view of a camping tent is an isosceles triangle. A vertical zipper runs from the top corner down to the exact middle of the bottom edge. In geometric terms, this zipper represents an altitude, a median, and an angle bisector. Why is it all three?

2. A sailor is looking at her triangular sail. The sail forms a right triangle. She wants to measure the height of the sail using the bottom edge as the base. What part of the sail is she measuring?

3. A city park is shaped like an obtuse triangle. The city wants to install a fountain at the park's orthocenter. Will the fountain be located inside the park's boundary? Explain.

4. A construction worker leans a 10-foot ladder against a wall, forming a triangle with the wall and the ground. If the wall is perpendicular to the ground, what two parts of this setup represent the altitudes of the triangle?

5. A triangular garden has side lengths of 15m, 20m, and 25m. What type of triangle is this by its sides?

G. True or False

1. An altitude of a triangle must always be inside the triangle. _____

2. An equilateral triangle is also an acute triangle. _____

3. An altitude connects a vertex to the midpoint of the opposite side. _____

4. Every triangle has exactly three altitudes. _____

5. The orthocenter of a right triangle is at the midpoint of its hypotenuse. _____