EDUCATION
MADE SIMPLE

Geometry

# The exterior angle of a triangle

Extend one side of a triangle and you get an exterior angle. Two rules are enough for every exercise: exterior angle + adjacent interior angle = 180°, and exterior angle = sum of the two non-adjacent interior angles.

In this video we see why, with an animation, and solve 3 exercises step by step: a general triangle, an isosceles triangle and a problem with fractions.

## The method

$$\hat{C}_e = 180^\circ - \hat{C}$$

$$\hat{C}_e = \hat{A} + \hat{B}$$

## Worked examples

### Exercise 1

In triangle ABC the exterior angle at A is 128° and the interior angle B is 49°. How big are the interior angles A and C?

**Data:** $\hat{A}_e = 128^\circ \cdot \hat{B} = 49^\circ$

1. **Interior and exterior are adjacent: together they make 180°**

$$\hat{A} = 180^\circ - 128^\circ = 52^\circ$$

**Result:** $\hat{A} = 52^\circ$

2. **Exterior = sum of the two non-adjacent angles**

$$\hat{A}_e = \hat{B} + \hat{C}$$

$$\hat{C} = 128^\circ - 49^\circ = 79^\circ$$

**Result:** $\hat{C} = 79^\circ$

---

**✓ Check**

$$52^\circ + 49^\circ + 79^\circ = 180^\circ \checkmark$$

## Exercise 2

In an isosceles triangle, the exterior angle next to a base angle is 127°. How big is the vertex angle?

**Data:** $AC = BC \cdot \hat{B}_e = 127^\circ$

1. **Base angle = 180° − exterior angle**

$$\hat{B} = 180^\circ - 127^\circ = 53^\circ$$

**Result:** $\hat{B} = 53^\circ$

2. **In an isosceles triangle the base angles are equal**

$$\hat{A} = \hat{B} = 53^\circ$$

**Result:** $\hat{A} = 53^\circ$

3. **Vertex = exterior angle − the other base angle**

$$\hat{C} = \hat{B}_e - \hat{A} = 127^\circ - 53^\circ = 74^\circ$$

💡 Or: 180° − 53° − 53° = 74°. Same result!

**Result:** $\hat{C} = 74^\circ$

✓ **Check**

$$53^\circ + 53^\circ + 74^\circ = 180^\circ \checkmark$$

## Exercise 3

An exterior angle of a triangle is 76°. The two interior angles far from it are one 10/9 of the other. How big are the three interior angles?

**Data:** $\hat{C}_e = 76^\circ \cdot \hat{A} = \frac{10}{9}\hat{B}$

1. **Exterior = sum of the two non-adjacent angles**

$$\hat{A} + \hat{B} = \hat{C}_e = 76^\circ$$

2. **"A is 10/9 of B": B = 9 parts, A = 10 parts**




$$9 + 10 = 19 \text{ parts}$$

3. **One part = 76° : 19**

$$1 \text{ part} = 76^\circ : 19 = 4^\circ$$

**Result:** $1 \text{ part} = 4^\circ$

4. **Each angle = number of parts × one part**

$$\hat{A} = 10 \times 4^\circ = 40^\circ$$

$$\hat{B} = 9 \times 4^\circ = 36^\circ$$

**Result:** $\hat{A} = 40^\circ \quad \hat{B} = 36^\circ$

5. **The third angle is adjacent to the exterior angle**

$$\hat{C} = 180^\circ - 76^\circ = 104^\circ$$

**Result:** $\hat{C} = 104^\circ$

**✔ Check**

$$40^\circ + 36^\circ = 76^\circ \checkmark$$

$$40^\circ + 36^\circ + 104^\circ = 180^\circ \checkmark$$

. .

© Education Made Simple