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Triangles

Solutions & Answer Key

Full worked solutions, marking scheme & answer key

IGCSE Mathematics

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Companion to the *Student Worksheet*

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Note

About this booklet. These are the complete solutions to every question in the *Triangles — Student Worksheet*. Question numbers match exactly: types of triangles Y1–Y6, angle properties N1–N7, the exterior angle theorem E1–E5, area R1–R8, Pythagoras' Theorem P1–P8, the converse V1–V5, the triangle inequality I1–I6, applications A1–A6, the Mixed Review MR1–MR10, and the examination questions Q1–Q8 of Part III.

Each solution names the property or theorem being applied and works one step at a time. Part V collects the common mistakes to watch for, and Part VI is a quick answer key for fast marking.

A note on accuracy. Most answers here are exact whole numbers or surds; where a decimal is required, working is carried out at full accuracy and rounded only at the final step. Units are included throughout — students should be expected to do the same.

4 Part IV — Complete Solutions

Note

Each solution names the rule being applied and shows the steps in order, exactly as the notes recommend. Depth is scaled to difficulty — brief for basic questions, fuller for the harder ones.

4.1 Solutions — Types of Triangles

Solution Y1

(a) All three sides are equal ⇒ $\boxed{\text{equilateral}}$.

(b) Exactly two sides are equal ⇒ $\boxed{\text{isosceles}}$.

(c) All three sides are different ⇒ $\boxed{\text{scalene}}$.

Solution Y2

(a) $40 + 65 + 75 = 180$ ✓, and every angle is less than $90°$ ⇒ $\boxed{\text{acute}}$.

(b) One angle is exactly $90°$ ⇒ $\boxed{\text{right-angled}}$.

(c) One angle is greater than $90°$ ⇒ $\boxed{\text{obtuse}}$. (It is also isosceles, since two angles are equal.)

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Solution Y3

$$\text{Third angle} = 180^\circ - 90^\circ - 45^\circ = \boxed{45^\circ}.$$

Two of the angles are equal, so the sides opposite them are equal too. The triangle is therefore

$$\boxed{\text{right-angled and isosceles}}.$$

Solution Y4

$AB = AC$, so the triangle is isosceles and the base angles at B and C are equal. Let each be x:

$$34 + x + x = 180$$

$$2x = 146$$

$$x = \boxed{73^\circ}$$

Each base angle is 73°. **Check:** $34 + 73 + 73 = 180$ ✓

Solution Y5

$DE = DF$, so D is the apex and the base angles are those at E and F. Both equal 57°:

$$D = 180^\circ - 57^\circ - 57^\circ = \boxed{66^\circ}$$

Solution Y6

Equilateral and obtuse is impossible. In an equilateral triangle all three sides are equal, so all three angles are equal. Since they must total 180°, each is $180 \div 3 = 60^\circ$. An obtuse triangle needs an angle greater than 90°, and 60° is not. Indeed, three angles of more than 90° each would already exceed 180°.

$$\boxed{\text{Every equilateral triangle is acute.}}$$

Right-angled and isosceles is possible. If the right angle is at the apex, the two remaining angles are equal and share the remaining 90°:

$$\boxed{90^\circ,\ 45^\circ,\ 45^\circ}$$

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