Name: _____ Date: _____

UNIT 4

1.4.4 — Angles in Triangles

Triangle Angle Sum • Isosceles Triangles • Exterior Angles • Algebraic Reasoning • Applications

A. TRIANGLE ANGLE FACTS

Complete the statements. Use precise angle language.

1. The three interior angles of every triangle add to _____ .
2. $\angle A + \angle B + \angle C = 180^\circ$
3. In an isosceles triangle, equal sides have _____ .
4. An exterior angle equals _____ .
5. The exterior angle and the adjacent interior angle form a _____ .

B. FIND THE MISSING ANGLE

Show an equation before each answer.

1. 48°, 67°, x: x = _____
2. 90°, 34°, y: y = _____
3. 105°, 28°, z: z = _____
4. Isosceles triangle with base angles 72° and 72°: vertex angle = _____
5. Isosceles triangle with vertex angle 38°: each base angle = _____
6. The three angles are x°, (x + 20)° and (2x + 10)°. Find x and all three angles.

   $x + (x + 20) + (2x + 10) = 180^\circ$

   _____

Name: _____ Date: _____

UNIT 4

1.4.4 — Angles in Triangles

Triangle Angle Sum • Isosceles Triangles • Exterior Angles • Algebraic Reasoning • Applications

C. ISOSCELES AND EXTERIOR ANGLES

1. In isosceles triangle ABC, AB = AC and ∠A = 44°. Find ∠B and ∠C.

_____

2. An isosceles triangle has equal base angles of 67°. Find its vertex angle.

_____

3. An exterior angle is 126°. One remote interior angle is 52°. Find the other remote interior angle.

_____

4. An exterior angle is 141°. Find the adjacent interior angle. If one remote angle is 64°, find the other.

_____

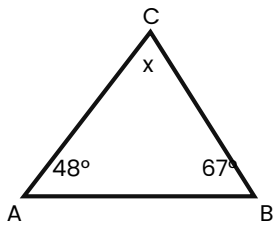
exterior angle = sum of the two remote interior angles

D. DIAGRAM EVIDENCE AND ERROR ANALYSIS

1. Use the diagram to find x. State the fact used.

_____

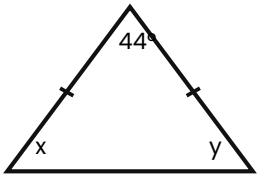
_____



2. The two marked sides are equal. Find x and y.

_____

_____



3. A student says: "Because AB = AC, angles A and C must be equal." Explain the error and write the correct equal-angle statement.

_____

_____

Name: _____ Date: _____

UNIT 4

1.4.4 — Angles in Triangles

Triangle Angle Sum • Isosceles Triangles • Exterior Angles • Algebraic Reasoning • Applications

E. APPLICATIONS AND ALGEBRAIC ANGLES

Translate each context into an angle equation.

1. A roof truss forms a triangle with angles 48° and 67°. Find the third angle. _____
2. A bicycle-frame support is an isosceles triangle with vertex angle 52°. Find each base angle.

   _____
3. A triangular sign has an exterior angle of 132°. One remote interior angle is 57°. Find the other remote interior angle. _____
4. The interior angles are (2x + 10)°, (x + 15)° and (3x - 25)°. Find x and all three angles.

5. An exterior angle is (5x + 20)°. The two remote interior angles are (2x + 10)° and (x + 40)°. Find x and all three named angles.

   $(5x + 20)^\circ = (2x + 10)^\circ + (x + 40)^\circ$

F. REASONING AND CLASSIFICATION

1. Can 95°, 40° and 50° be the interior angles of a triangle? Explain.

   _____
2. Can 40°, 65° and 75° be the interior angles of a triangle? Explain.

   _____
3. Write one possible set of integer angle measures for an isosceles triangle whose base angles are larger than its vertex angle. _____
4. The largest angle in a triangle is opposite the longest side. For a triangle with angles 38°, 61° and 81°, which side is longest? Explain using labels of your choice.

   _____

Name: _____ Date: _____

UNIT 4

1.4.4 — Angles in Triangles

Triangle Angle Sum • Isosceles Triangles • Exterior Angles • Algebraic Reasoning • Applications

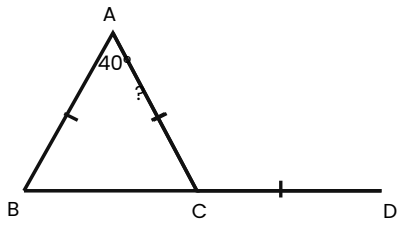
G. EXTENDED PROBLEMS — MULTI-STEP ANGLE CHASING

These problems require more than one angle fact. Label each step.

1. **Exterior algebra.** In triangle ABC, $\angle A = (2x + 5)°$, $\angle B = (x + 20)°$, and the exterior angle at C is $(4x + 15)°$. Find x and all three interior angles.

2. **Isosceles + exterior.** ABC is isosceles with AB = AC. Side BC is extended through C to D, and exterior angle $\angle ACD = 126°$. Find $\angle A$, $\angle B$ and $\angle C$.

3. **Connected isosceles triangles.** ABC is isosceles with AB = AC and $\angle A = 40°$. BC is extended to D, and ACD is isosceles with AC = CD. Find $\angle CAD$.



H. EXTENDED PROBLEMS — GENERALISE AND PROVE

4. **Three exterior angles.** One exterior angle is formed at each vertex of a triangle by extending a side. Prove that the three exterior angles sum to 360°.

$(180^\circ - a) + (180^\circ - b) + (180^\circ - c) = 360^\circ$

5. **Construct and justify.** Is it possible for an isosceles triangle to have a 90° exterior angle? Give a labelled set of interior angles or prove it is impossible.

6. **Always, sometimes or never?** "If a triangle has two equal angles, then its third angle is the largest." Classify the statement and justify with examples or a counterexample.

ANSWER KEY

Name: _____ Date: _____

UNIT 4

ANSWER KEY — 1.4.4 Angles in Triangles

Teachers: accept equivalent labelled equations, diagrams and logically correct angle arguments.

A. TRIANGLE ANGLE FACTS

1. **180°**.
2. The displayed equation states **∠A + ∠B + ∠C = 180°**.
3. **equal opposite angles**.
4. **the sum of the two remote interior angles**.
5. **straight line (180°)**.

B. FIND THE MISSING ANGLE

1. x = 180 − 48 − 67 = **65°**.
2. y = 180 − 90 − 34 = **56°**.
3. z = 180 − 105 − 28 = **47°**.
4. 180 − 72 − 72 = **36°**.
5. Base angles are equal: (180 − 38) ÷ 2 = **71° each**.
6. 4x + 30 = 180, so **x = 37.5**. Angles: **37.5°, 57.5°, 85°**.

Name: _____ Date: _____

UNIT 4

ANSWER KEY — 1.4.4 Angles in Triangles

Teachers: accept equivalent labelled equations, diagrams and logically correct angle arguments.

C. ISOSCELES AND EXTERIOR ANGLES

1. AB = AC, so ∠B = ∠C. (180 − 44) ÷ 2 = **68° each**.
2. 180 − 67 − 67 = **46°**.
3. 126 = 52 + x, so **x = 74°**.
4. Adjacent interior = 180 − 141 = **39°**. Other remote = 141 − 64 = **77°**.

D. DIAGRAM EVIDENCE AND ERROR ANALYSIS

1. x = 180 − 48 − 67 = **65°**; triangle interior angles sum to 180°.
2. Equal side marks mean the base angles are equal: x = y = (180 − 44) ÷ 2 = **68°**.
3. AB = AC means the angles *opposite* those sides are equal, so **∠B = ∠C**, not ∠A = ∠C.

E–F. APPLICATIONS, ALGEBRA AND REASONING

1. Roof truss: **65°**.
2. Bicycle frame: (180 − 52) ÷ 2 = **64° each**.
3. Exterior angle: 132 − 57 = **75°**.
4. 6x = 180, so **x = 30**; angles are **70°, 45°, 65°**.
5. 5x + 20 = 3x + 50, so **x = 15**. Exterior = **95°**; remote angles = **40° and 55°**.
6. 95 + 40 + 50 = 185, so **no**.
7. 40 + 65 + 75 = 180, so **yes**.
8. Example: **70°, 70°, 40°** (many answers possible).
9. The side opposite **81°** is longest.

Name: _____ Date: _____

UNIT 4

ANSWER KEY — 1.4.4 Angles in Triangles

Teachers: accept equivalent labelled equations, diagrams and logically correct angle arguments.

G. MULTI-STEP ANGLE CHASING — WORKED ANSWERS

1. Exterior theorem: $4x + 15 = (2x + 5) + (x + 20)$, so **$x = 10$**. $\angle A$ = **25°**, $\angle B$ = **30°**, exterior at C = 55°, hence $\angle C$ = **125°**.
2. $\angle C = 180 - 126$ = **54°**. Since AB = AC, $\angle B = \angle C$ = **54°**. Therefore $\angle A = 180 - 108$ = **72°**.
3. ABC is isosceles, so base angles B and C are $(180 - 40) \div 2$ = **70°**. The exterior angle ACD is 110°. In isosceles triangle ACD, AC = CD, so the two base angles at A and D are $(180 - 110) \div 2$ = **35°**. Thus $\angle CAD$ = **35°**.

H. GENERALISE AND PROVE — WORKED ANSWERS

4. If the interior angles are a, b and c, the chosen exterior angles are 180 - a, 180 - b and 180 - c. Their sum is $540 - (a + b + c) = 540 - 180$ = **360°**.
5. **Yes.** Put the 90° exterior angle at the vertex. The adjacent interior vertex angle is 90°, leaving two equal base angles of 45°. A valid triangle is **45°, 45°, 90°**.
6. **Sometimes.** Example where true: 50°, 50°, 80° (third is largest). Counterexample: 70°, 70°, 40° (third is smallest). Therefore two equal angles do not determine whether the third is largest.

EXTENSION NOTE

The extended set deliberately moves from direct substitution to angle chasing, algebra, counterexamples and generalisation. It is designed to support MYP-style reasoning and communication while remaining grounded in the lesson's three central facts: triangle sum, isosceles equality and the exterior-angle theorem.