

## 3.2 Right triangles and non-right triangles

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 13 marks

**KEY WORDS** hypotenuse

### Objective

Right triangles and non-right triangles. Supported SL concept preparation; original classroom practice, not an official IB paper or assessed learner work.

### 1 Key knowledge and worked examples

#### ■ Which side does the ladder need?

- A ladder reaches a height of 4 m while its foot is 3 m from a wall. Which sides are known, and which angle do we need?
- This lesson studies **hypotenuse** : The side opposite the right angle in a right-angled triangle.

#### ■ Choose the mathematical structure

- In a right triangle  $a^2 + b^2 = c^2$ ;  $\sin\theta = \text{opposite/hypotenuse}$ ,  $\cos\theta = \text{adjacent/hypotenuse}$  and  $\tan\theta = \text{opposite/adjacent}$ . For other triangles, use the sine or cosine rule, or  $\text{area} = ab \sin C/2$ .
- State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

#### ■ Work through a checked case

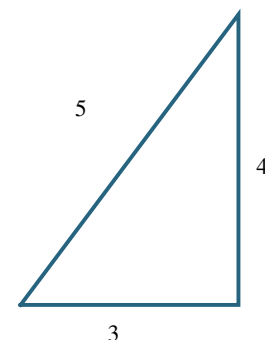
$$a^2 + b^2 = c^2, \quad \tan\theta = \frac{\text{opposite}}{\text{adjacent}}$$

- Check the result against the starting quantities. Substitute into the original relation, or compare the graph and numerical answer where appropriate.

#### Example:

The ladder length is  $c = \sqrt{(3^2 + 4^2)} = 5$  m. Its angle to the ground satisfies  $\tan\theta = 4/3$ , so  $\theta \approx 53.1^\circ$ . With two sides 6 and 8 enclosing  $60^\circ$ ,  $c^2 = 6^2 + 8^2 - 2 \times 6 \times 8 \cos 60^\circ = 52$ .

Label the known sides before choosing a rule



#### ■ Test a tempting shortcut

- Label sides relative to the chosen angle. Pythagoras needs a right angle. A calculator angle mode error can produce a plausible but wrong result. Keep unrounded values for later steps.
- When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

#### Warn:

Pythagoras applies to every triangle, including triangles without a right angle. This claim is false. Explain which definition or assumption it violates.

#### ■ Interpret a new situation

- Use a plan or elevation for a three-dimensional problem before applying a triangle rule. Explain why the chosen triangle contains the required length or angle.
- A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

#### ■ Use this in your course

- Current first-assessment-2021 Applications and Interpretation SL. This is authored concept support; the full guide is needed to certify every objective.
- Give the method before the final answer, and use the paper's calculator and formula rules. Review a wrong answer by locating the first invalid step.

#### Key:

The side opposite the right angle in a right-angled triangle. Choose the relationship, show the method, check its assumptions and interpret the result.

## 2 Practice

**2.1** Find the hypotenuse when the legs are 3 and 4. Show the relation, substitution and units. [2]

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**2.2** Find  $\sin\theta$  when opposite=3 and hypotenuse=5. Show the relation, substitution and units. [2]

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**2.3** Two sides 6 and 8 enclose  $90^\circ$ . Find their area. Show the relation, substitution and units. [2]

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**2.4** Decide whether this claim is true and justify: Pythagoras applies to every triangle, including triangles without a right angle. [2]

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**2.5** Which description correctly defines hypotenuse? Choose one answer.

- **A** The side opposite the right angle in a right-angled triangle.
- **B** A numerical answer that needs no assumptions or interpretation
- **C** A rule that remains valid even when its required conditions fail

[1]

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## 3 Exam-style questions

**3.1** A triangle has sides  $a=7$ ,  $b=10$  and angle  $A=30^\circ$ . Determine how many triangles are possible and give the possible B angles. [4]

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