# Task: Design Word Problems Using Trigonometry

**Student Text Pages**
226

**Suggested Timing**
80 min

**Materials and Technology Tools**
- computer with *The Geometer's Sketchpad*® (optional)

**Related Resources**
- BLM T–2 *The Geometer's Sketchpad*® 3
- BLM T–3 *The Geometer's Sketchpad*® 4
- BLM 4–16 Chapter 4 Task Rubric: Design Word Problems Using Trigonometry

**Accommodations**

**Spatial**–have students use computers with dynamic geometry software to construct the triangles

**Motor**–provide students with triangles that have already been constructed and measured

**Ongoing Assessment**
- Use **BLM 4–16 Chapter 4 Task Rubric: Design Word Problems Using Trigonometry** to assess student achievement.

## Specific Expectations

1.01, 1.04, 1.05

## Teaching Suggestions

- Have students read the entire Task. Discuss the Task and ensure students understand what they are being asked to do.
- As a class, review the Sample Problem. Have students suggest other problems that could be represented by the triangle shown.
- If students are using *The Geometer's Sketchpad*®, have students work in pairs to construct and measure the triangles.

## Hints for Evaluating a Response

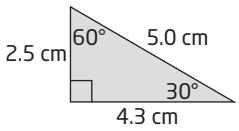
Student responses are being assessed for the level of mathematical understanding they represent. As you assess each response, consider these questions:
- How much assistance did the student need to construct and measure a right triangle and an acute triangle?
- How much assistance did the student need to write two word problems for each triangle?
- Which parts of the Task did the student complete/not complete?
- Did the student present work that was clear and easy to follow?
- Did the student demonstrate an understanding of the trigonometric ratios, the sine law, and the cosine law?

## Level 3 Notes

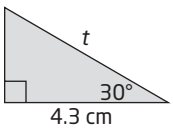
- Student demonstrates understanding of the trigonometric ratios, the sine law, and the cosine law.
- Student creates word problems with appropriate contexts and levels of difficulty.
- Student uses mathematical language effectively.
- Student chooses appropriate types of triangles; triangle are correctly constructed and measured.
- Student's solution may contain minor errors.

**Level 3 Sample Response**

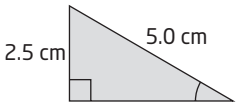
**a)**




**b)** **Question 1:** Half of the roof of a tent forms a right triangle. The fly of the tent covers a horizontal distance of 4.3 m and makes an angle of 30° with the ground. What is the length of the fly?

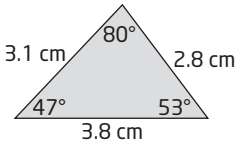


**Question 2:** A ramp has length 5.0 m and height 2.5 m. What is the angle of inclination from the bottom to the top of the ramp?

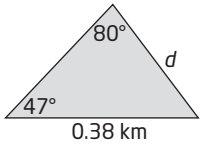



**c)** Question 1: $t = 5.0$ m. Question 2: angle of inclination $= 30°$.

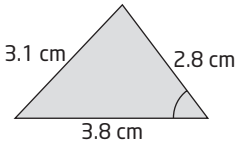
**d)**




**e)** **Question 1:** Three neighbourhood roads form a triangle. The length of one side is 0.38 km and the measure of the angle opposite this side is 80°. How long is the side with the opposite angle equal to 47°?




**Question 2:** A student cut out a triangle from a piece of paper. She measured the sides, which were 2.8 cm, 3.1 cm, and 3.8 cm. Without the use of a protractor, determine the measure of the angle opposite the 3.1-cm side.




**f)** Question 1: $d = 0.28$ km. Question 2: angle $= 53°$.

## What Distinguishes Level 2

- Student demonstrates some understanding of the trigonometric ratios, the sine law, and the cosine law.
- Student creates word problems with somewhat appropriate contexts and levels of difficulty.
- Student uses mathematical language somewhat effectively.
- Student chooses appropriate types of triangles; student has some difficulty constructing and/or measuring triangles.
- Student's solution may contain some significant errors.

## What Distinguishes Level 4

- Student demonstrates thorough understanding of the trigonometric ratios, the sine law, and the cosine law.
- Student creates word problems with highly appropriate contexts and levels of difficulty.
- Student uses mathematical language very effectively.
- Student chooses appropriate types of triangles; triangle are correctly constructed and measured.
- Student's solution contains very few or no errors.

# Task: Roof Truss

**Student Text Pages**
227

**Suggested Timing**
40 min

**Related Resources**
- BLM 4–17 Chapter 4 Task Rubric: Roof Truss

**Accommodations**

**Gifted and Enrichment**–challenge students to solve △APQ, △BPR, and △RQC

**Visual**–provide students with an enlarged copy of the diagram

**Ongoing Assessment**

- Use **BLM 4–17 Chapter 4 Task Rubric: Roof Truss** to assess student achievement.

## Specific Expectations

1.04, 1.05

## Teaching Suggestions

- Have students read the entire Task. Discuss the Task and ensure students understand what they are being asked to do.
- Discuss strategies and review necessary skills and concepts to solve this problem.

## Hints for Evaluating a Response

Student responses are being assessed for the level of mathematical understanding they represent. As you assess each response, consider these questions:

- How much assistance did the student need to determine the side lengths?
- Which parts of the Task did the student complete/not complete?
- Did the student present work that was clear and easy to follow?
- Did the student demonstrate an understanding of angle properties, triangle properties, and trigonometry?

## Level 3 Notes

- Student demonstrates understanding of angle properties, triangle properties, and trigonometry.
- Student demonstrates understanding of problem solving techniques.
- Student uses mathematical language effectively.
- Student's solution is clearly organized and choices are justified.
- Student's solution contains minor errors.

**Level 3 Sample Response**

Triangle ABC is equilateral, so $\angle BAC = \angle ABC = \angle ACB = 60°$.

In △PQR, let $\angle PQR = y$.

$\angle PRQ = 180 - 60 - (120 - y)$
$= 120 - y$

Since $\triangle PQR \cong \triangle PAQ$,
$\angle APQ = 120 - y$
$\angle AQP = y$ $\quad RP = AP \quad PQ = PQ \quad RQ = AQ$

$\angle APB$ is straight, so
$\angle BPR = 180 - 2(120 - y)$
$= 2y - 60$

$\angle AQC$ is straight, so
$\angle CQR = 180 - 2y$

The sum of the interior angles of a triangle is 180°, so
$\angle CRQ = 180 - 60 - (180 - 2y)$
$= 2y - 60$
$\angle BRP = 180 - 60 - (2y - 60)$
$= 180 - 2y$

$\triangle RQC \cong \triangle PRB$
$QC = BR = 1$ m
$PB = RC = 2$ m

**a)** $AP = 3 - PB$
$= 3 - 2$
$= 1$
The length of AP is 1 m.

**b)** $AQ = 3 - QC$
$= 3 - 1$
$= 2$
The length of AQ is 2 m.

**c)** $PQ^2 = AP^2 + AQ^2 - 2(AP)(AQ)\cos 60°$
$PQ^2 = 1^2 + 2^2 - 2(1)(2)(0.5)$
$PQ^2 = 3$
$PQ = \sqrt{3}$
$PQ \doteq 1.732$
The length of PQ is $\sqrt{3}$ m or approximately 1.73 m.

## What Distinguishes Level 2

- Student demonstrates some understanding of angle properties, triangle properties, and trigonometry.
- Student demonstrates some understanding of problem solving techniques.
- Student uses mathematical language somewhat effectively.
- Student's solution is somewhat organized and choices are partially or ineffectively justified.
- Student's solution contains some significant errors.

## What Distinguishes Level 4

- Student demonstrates thorough understanding of angle properties, triangle properties, and trigonometry.
- Student demonstrates thorough understanding of problem solving techniques.
- Student uses mathematical language very effectively.
- Student's solution is highly organized and choices are clearly justified.
- Student's solution contains very few or no errors.