1.2 Solve Problems Using Trigonometric Ratios

Student Text Pages
16–23

Suggested Timing
70 min

Tools
- protractors
- straws
- string
- tape
- small weights or paper clips
- metre sticks
- measuring tapes
- calculators

Related Resources
BLM 1-4 Section 1.2 Solve Problems Using Trigonometric Ratios
BLM 1-5 Section 1.2 Make Your Own Clinometer

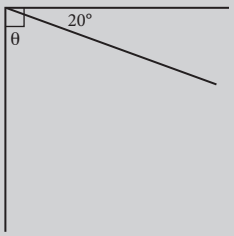
Link to Prerequisite Skills

Students should complete all the Prerequisite Skills questions before proceeding with this section.

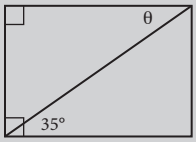
Warm-Up

1. Find the measure of $\angle \theta$.

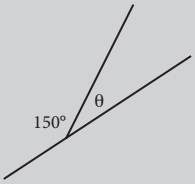
a)



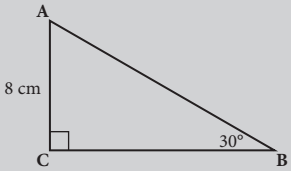
b)



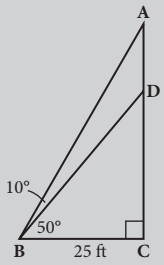
c)



2. a) Find the length of side AB.



b) Find the length of AD to the nearest tenth of a foot.



Warm-Up Answers

1. a) 70° **b)** 35° **c)** 30°
2. a) 16 cm **b)** 2.5 ft

Teaching Suggestions

Warm-Up

- Write the Warm-Up questions on the board or on an overhead. Have students complete the questions independently. Then, discuss the solutions as a class.

Section Opener

- Discuss other situations where someone might use trigonometry. Brainstorm with the class. Situations might include finding the distance across a river, determining if a ramp elevation is safe for wheelchair access, finding the height of school building, etc.
- To learn more about clinometers, go to the McGraw-Hill Ryerson Web-site at *www.mcgrawhill.ca/books/foundations11* and follow the links.

Investigate

- Supply students with **BLM 1-5 Section 1.2 Make Your Own Clinometer**.
- Have students work in pairs to complete the Investigate and discuss their results.
- In Part A, students should notice that as they get farther away, the angle of elevation decreases. Have students think about standing about 3 m directly in front of their partner as they both look up at where the ceiling meets the wall. Can they say whose angle of elevation would be greater?
- After Part B, ask students whose angle of elevation would be greater: a person 198 cm tall or a person 175 cm tall. Suggest both people are standing the same distance away from the base of the CN tower and both are looking at the top of the tower.
- You can use these questions for additional practice.
  1. The top of a 7-m ladder makes an angle of 15° with the wall. How far away from the wall is the base of the ladder? (1.81 m)
  2. A 30-m high communication tower is located 50 m away from another tower which is 20 m high. Determine the angle of depression from the top of the taller tower to the top of the shorter tower. (11°)
  3. A team of hikers notice they are 13° east off their planned path after walking 12 km. How far do they need to walk to return to their path? (2.7 km)
  4. A 5-m long ramp is placed on the end of a pick-up truck tailgate which is 1.3 m above the ground. Calculate the angle of elevation of the ramp. (15°)
  5. An observer 50 m away from the launch pad of a model rocket notices the rocket when it is at an altitude of 100 m. Calculate the angle of elevation from the observer. (63°)

Investigate Answers (pages 16-18)

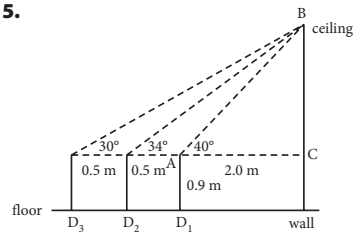
Answers may vary. Sample answers:

Part A

1.–4.

Distance From Wall (m)	Height to Eye Level (m)	Angle of Elevation, θ (°)	tan θ	Height of Wall (m)
2.0	0.9	40	0.84	2.58
2.5	0.9	34	0.67	2.58
3.0	0.9	30	0.58	2.64

5.

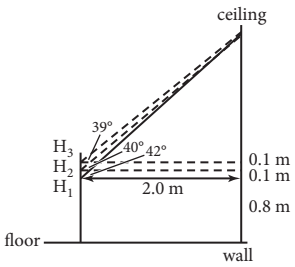


Part B

6.–9.

Distance From Wall (m)	Height to Eye Level (m)	Angle of Elevation, θ (°)	tan θ	Height of Wall (m)
2.0	0.8	42	0.90	2.60
2.0	0.9	40	0.84	2.58
2.0	1.0	39	0.81	2.61

10.



11. The angle of elevation decreased.

12. 2.60 m

13. The results were always within 5 cm of the actual height.

Examples

- Have students work through the Examples as a class before proceeding to the Discuss the Concepts.
- It is important that students understand the difference between the angle of elevation and the angle of depression. Have students draw the angle of depression and label the angle properly. Use the diagram provided in the text. Have students illustrate a non-example of an angle of depression.

Key Concepts

- Have students draw the angles of elevation and depression in their notebooks and label them correctly.

Discuss the Concepts

- For question D1, draw a right triangle with just the measure of one side. Ask students to solve it.
- Model question D2 with a metre stick against the wall.

Discuss the Concepts Suggested Answers (page 21)

D1. No; need the measures of two sides, or one side and one of the acute angles.

D2. Answers may vary.

Practise (A)

- Encourage students to refer to the Investigate and the Examples before asking for assistance.
- For **questions 2** and **3**, supply diagrams if students need assistance.

Apply (B)

- For **questions 6, 8 to 10, 12,** and **13**, supply diagrams if students need assistance.
- **Question 9** links to the Chapter Problem. Remind students to keep the solution to this question handy as the methods they used may help them with the Chapter Problem Wrap-Up.
- **Question 10** is a Literacy Connect. You may wish to assign this question as a journal entry or to discuss the question as a class. Literacy Connect questions offer the opportunity to explore literacy issues in the mathematics classroom and within the context of mathematics.

Common Errors

- Some students may think the angle of depression is between the vertical and line of sight because they may not remember vertical and horizontal are different.

R_x Have student make memory aid diagrams for angle of elevation and angle of depression emphasising the line of sight and the horizontal.

Accommodations

Perceptual—provide concrete materials, such as wooden sticks, to enable students to build models of the triangles

Gifted and Enrichment—have students research a topic different from the ones presented in the Practise and design a problem about this topic that involves the use of the trigonometric ratios

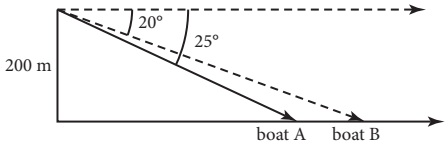
Language—provide diagrams to accompany some of the problems

Motor—have a partner assist with drawing diagrams to accompany the problems

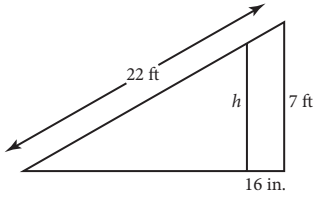
Extend (C)

- Assign the Extend questions to students who are not being challenged by the questions in Apply.
- Students can work in pairs.
- Supply students with these diagrams for **questions 15** and **16** if they need assistance.

15.



16.



Mathematical Process Expectations

Process Expectation	Questions
Problem Solving	6, 9, 12, 15, 16
Reasoning and Proving	11
Reflecting	n/a
Selecting Tools and Computational Strategies	1–10, 12–16
Connecting	10, 11, 14, 16
Representing	2, 3, 8, 9, 10, 12, 15
Communicating	7, 10, 11, 15

Extra Practice

- You may wish to use **BLM 1-4 Section 1.2 Solve Problems Using Trigonometric Ratios** for remediation or extra practice.