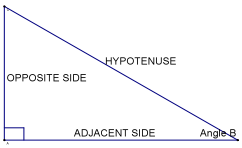
IM3 Unit 5 Lesson 2 - Applications of Right Triangle Trigonometry

Integrated Math 3 – Santowski

Levels of Performance - RTT

- Level 1 ➔ You can successfully get through geometric & applied problems wherein only ONE triangle is present (below grade level)
- Level 2 ➔ You get through geometric & applied problems wherein TWO triangles are present (at grade level), but success is occasional OR some assistance is required
- Level 3 ➔ You can successfully get through geometric & applied problems wherein TWO triangles are present (at grade level)

(A) Review of Right Triangles



- In a right triangle, the primary trigonometric ratios (which relate pairs of sides in a ratio to a given reference angle) are as follows:
- sine A = opposite side/hypotenuse side
- cosine A = adjacent side/hypotenuse side
- tangent A = opposite/adjacent side side
- recall **SOHCAHTOA** as a way of remembering the trig. ratio and its corresponding sides

(A) Basics – Solve for Side – Level 1

Find the missing side. Round to the nearest tenth.

1) 

2) 

3) 

4) 

5) 

6) 

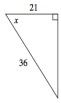
(A) Basics – Solve for Angle – Level 1

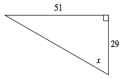
Skills

1. For the following right triangles, find the measure of each angle, x, to the nearest degree:

(a) 

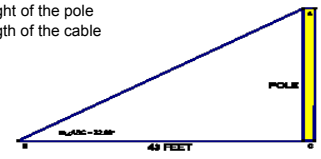
(b) 

(c) 

(d) 

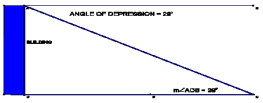
Examples – RTT – Level 1

- A support cable runs from the top of the telephone pole to a point on the ground 43 feet from its base. If the cable makes an **angle of elevation** of 33° with the ground, find (rounding to the nearest tenth of a foot):
  - a. the height of the pole
  - b. the length of the cable



Examples – RTT – Level 1

- Mr Santowski stands on the top of his apartment building and views Mr Smith at a 29º **angle of depression**. If the building I stand upon is 200 m tall, how far is Mr Smith from the foot of the building?



Examples – RTT – Level 1

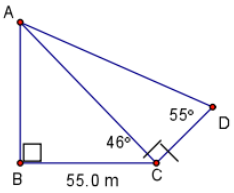
- For more Level 1 work, go to any/some/all of the following links to continue practicing:
- (a) Link #1 & work through Q on pg 5-6
- (b) Link #2 & work through Q on pg 2-5
- (c) Link #3 & work through Q on pg 1-3

Guidelines for PROPER Presentation of Solutions

- Your solution MUST have:
- (1) properly labeled diagram
- (2) state what triangle you are working in and what you are hoping to determine in that triangle
- (3) your actual working should in the very least show (i) correct substitution into eqn showing what trig ratio(s) you are working in and (ii) the answer for that triangle
- (4) repeat steps 2 & 3 for your second triangle
- (5) your final answer, coming from your working in the two triangles

Examples – RTT – L2/L3

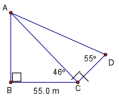
3. Find the length of AD. Show the steps of your solution.



Examples – RTT – L2/L3

- (1) Diagram (already done)
- (2) In ΔABC, find mAC
- (3) cos(46)=55.0/AC ➔ mAC = 79.1756 m
- (4) in ΔACD, find mAD
- (4) sin(55) = 79.1756/AD ➔ mAD = 96.7 m
- (5) conclusion ➔ mAD is 96.7 m

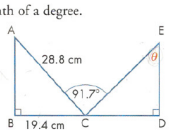
3. Find the length of AD. Show the steps of your solution.



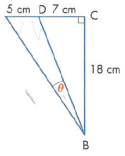
Examples – RTT – L2/L3

4. Find the measure of $\angle\theta$, to the nearest tenth of a degree.

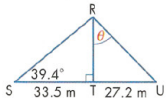
- a)



b)

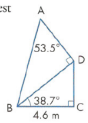


c)

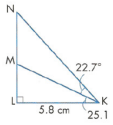


Examples – RTT – L2/L3

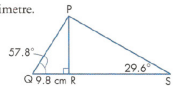
- **5.** Find AB, to the nearest tenth of a metre.



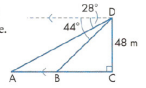
9. Find MN, to the nearest tenth of a centimetre.



6. Find RS, to the nearest tenth of a centimetre.



10. Find AB, to the nearest metre.

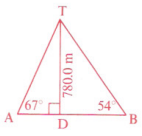


Examples – RTT – L2

- To determine the width of a river, a surveyor marks a point on the bank of the river, A. Her partner is standing directly across the river from her at point C. The surveyor then walks 100 m downstream to point B, where she now has a line of sight to her partner at an angle of 58º relative to the river bank. Determine the width of the river.
- (L2 because YOU need to put together the diagram)

Examples – RTT – L2/L3

4 The angles of elevation from a point A and a point B to the top of a mountain 780.0 m high are 67° and 54° as shown. Based on the information in the diagram, how long would a tunnel be from A to B?



Examples – RTT – L2/L3

5 A forest ranger in a tower 128.0 m high sights two fires in the same line of sight with angles of depression 42° and 61°. How far apart are the fires?

6 From a window 26.0 m above the ground, the angle of elevation of the top of a building is 39°, while the angle of depression to the bottom of the building is 29°. How high is the building?

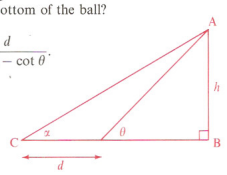
7 A helicopter, directly above a building, sights a position, A, on the ground at an angle of depression of 38°. The helicopter then rises vertically above the building, a distance of d, in metres, and sights position A, now at an angle of depression of 52°. If point A is 352.0 m from the building, how far has the helicopter risen?

Examples – RTT – L2/L3

8 The angle of elevation of the top of a building from a point, A, 56.0 m from the building is 58°. A flagpole is on top of the building. The angle of elevation from point A to the top of the flagpole is 62°. What is the length of the flagpole?

9 Two spotlights are placed 10.0 m apart on the same line of sight. The blue spotlight makes an angle of elevation of 45° and hits the bottom of a mirrored ball. The white spotlight makes an angle of elevation of 70° and hits the same area. What is the height of the bottom of the ball?

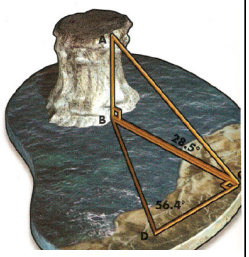
10 For the diagram, prove that $h = \dfrac{d}{\cot \alpha - \cot \theta}$.



Examples – RTT – L2/L3

EXAMPLE 5 Rock Pillars

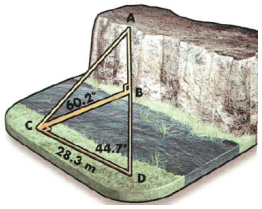
Rock pillars are interesting geological features found in several national parks in Ontario. Rock pillars, found in rivers and lakes, have been sculpted by wind and water. A geologist wanted to determine the height of a rock pillar in a river. The geologist set up a theodolite at C and measured ∠ACB to be 28.5°. A baseline CD was marked off, perpendicular to BC. The length of CD is 10 m, and ∠CDB = 56.4°. If the height of the theodolite is 1.6 m, what is the height of the rock pillar, to the nearest tenth of a metre?



Examples – RTT – L2/L3

B

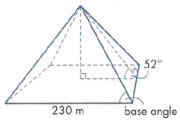
13. **Surveying** A surveyor measured the height of a vertical rock face by determining the measurements shown. If the surveyor's theodolite had a height of 1.7 m, find the height of the rock face, AB, to the nearest tenth of a metre.



Examples – RTT – L2/L3

C

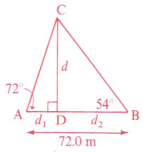
19. **Great Pyramid** The Great Pyramid of Khufu has a square base with a side length of about 230 m. The four triangular faces of the pyramid are congruent and isosceles. The altitude of each triangular face makes an angle of 52° with the base. Find the measure of each base angle of the triangular faces, to the nearest degree.



Examples – RTT – L3

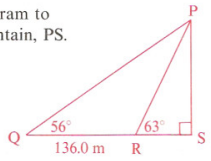
3 An engineer wishes to find the distance across a canyon. She takes a sighting from A and then a sighting from B to a point C on the opposite side of the canyon. The measurements are given on the diagram.

Find distance d across the canyon.



Examples – RTT – L3

1 Use the information in the diagram to calculate the height of the mountain, PS.



Examples – RTT – L3

- While driving towards a mountain, Mr S notices that the angle of elevation to the peak is 3.5º. He continues to drive to the mountain and 13 miles later, his second sighting of the mountain top is 9º. Determine the height of the mountain.

Examples – RTT – L3

- For further examples of problems at Level 3, follow this link and work through the Q on pages 2-6

ANSWERS

- S6: (a) 27.9 m (b) 51.3 m
- S7: 361 m
- S12: (4a) 49.4° (4b) 12.4° (4c) 44.7°
- S13: (5) 7.33 m (6) 27.4 m (9) 3.68 cm (10) 40.6 m
- S14: 160 m
- S15: 898 m
- S16: (5) 44.3 m (6) 64.0 m (7) 175.5 m
- S17: (8) 15.7 m (9) 38.3 m
- S18: 8.17 m
- S19: 50.6 m
- S20: 58.4°
- S21: 75.8 m
- S22: 500 m
- S23: 1.30 miles