2.5 Using the Sine and Cosine Ratios to Calculate Lengths

Lesson Focus

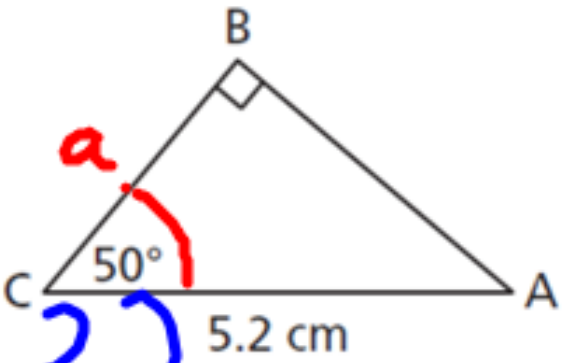
Apply the sine and cosine ratios to calculate side lengths indirectly

$$\sin\boldsymbol{\theta} = \frac{\boldsymbol{opposite}}{\boldsymbol{hypotenuse}} \qquad \cos\boldsymbol{\theta} = \frac{\boldsymbol{adjacent}}{\boldsymbol{hypotenuse}}$$

*To do this it is **very important** to know what side you're given, and what side you're looking for*

Example

Determine the length of BC to the nearest tenth of a centimetre.



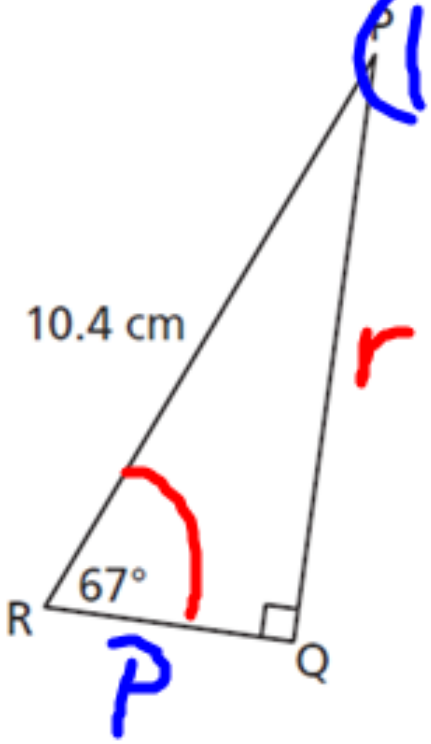
$(5.2)\cos 50^\circ = \frac{a}{5.2}(5.2)$

$(5.2)\cos 50^\circ = a$

$3.3\text{ cm} = a$

Example – Your Turn

Determine the length of PQ to the nearest tenth of a centimetre.



$(10.4)\sin 67^\circ = \frac{r}{10.4}(10.4)$

$9.6\text{cm} = r$

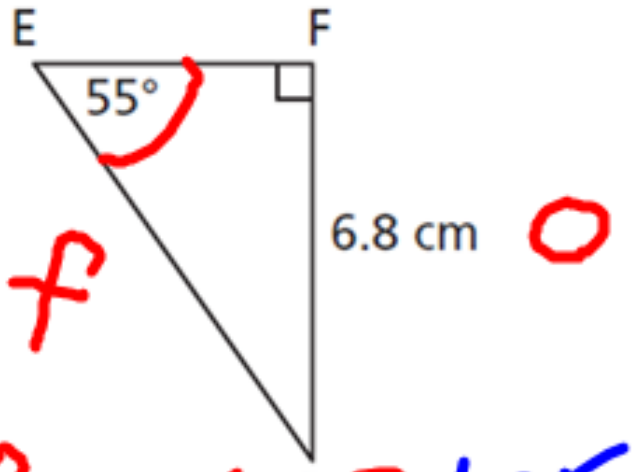
What is the length of RQ?

$(10.4)\cos 67^\circ = \frac{P}{10.4}(10.4)$

$4.1\text{ cm} = P$

Example

Determine the length of DE to the nearest tenth of a centimetre.

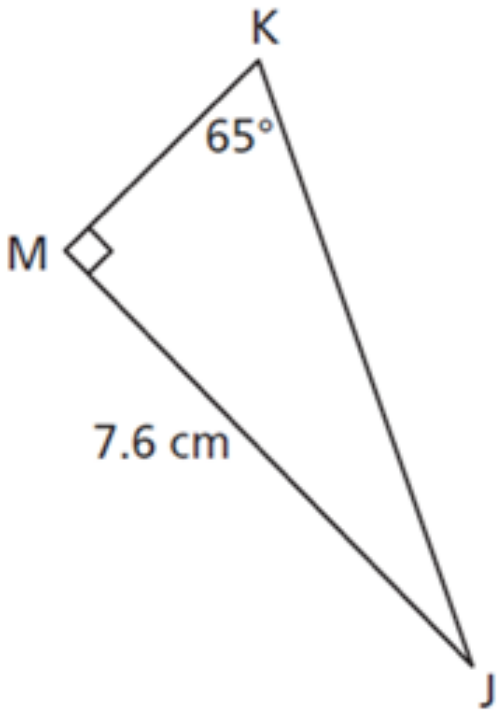


H f O

$$\frac{(f)\sin 55^\circ}{\sin 55^\circ} = \frac{6.8}{\sin 55^\circ} = 8.3\text{cm}$$

Example – Your Turn

Determine the length of JK to the nearest tenth of a centimetre.



Homework

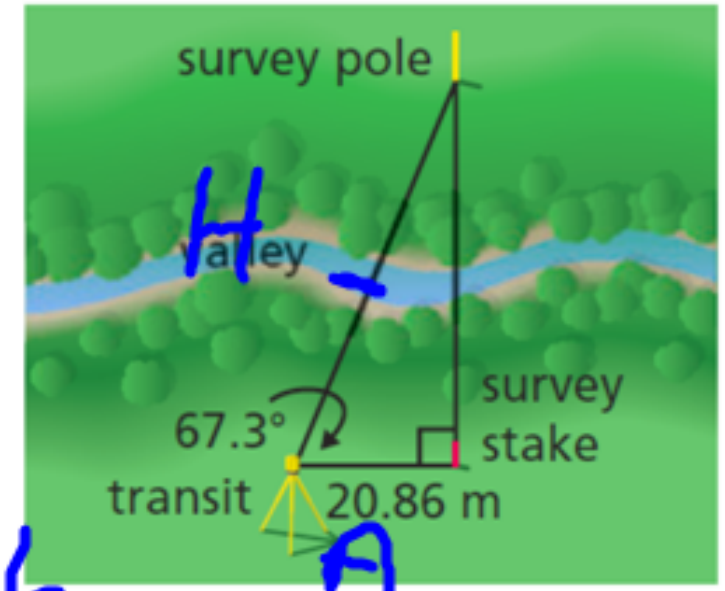
P. 101-102

 # 3, 4, 5

The transit is 54.05 m from the survey pole.

Example

A surveyor made the measurements shown in the diagram. How could the surveyor determine the distance from the transit to the survey pole to the nearest hundredth of a metre?

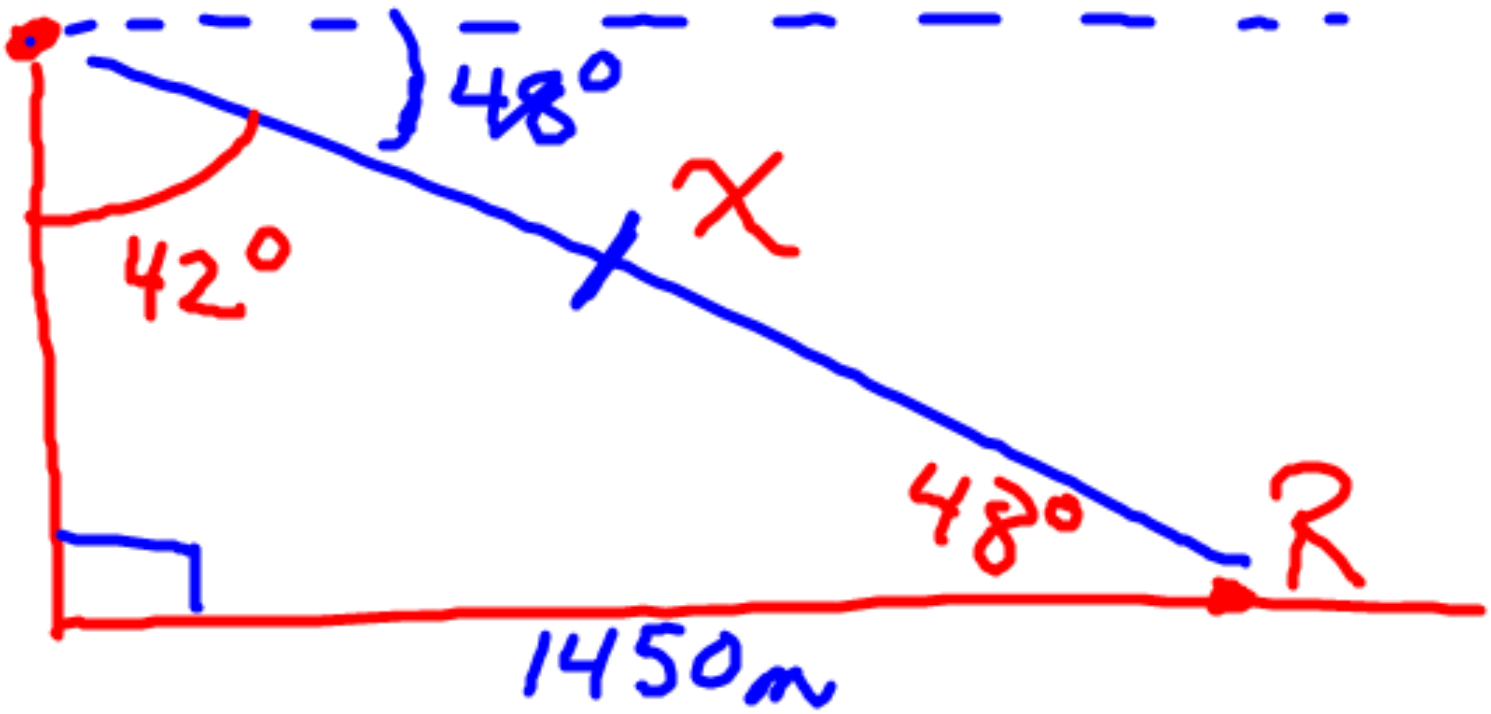


$$\frac{h}{\cos 67.3^\circ} = \frac{20.86}{\cos 67.3^\circ}$$

$$h = 54.05 \text{ m}$$

Example – Your Turn

An airplane flying at a constant altitude spots a radar station below at an angle of depression of 48°. The horizontal distance from the plane to the radar station is 1450m. To the nearest metre, what is the distance from the plane to the radar station?



$$(x)\ \sin 42^\circ = \frac{1450}{x}$$

$$x = \frac{1450}{\sin 42^\circ}$$

$$x = 2166\text{m}$$

The plane is 2166m from radar station.

Homework

P. 101-102

 # 6, 7, 9, 12*

Handout

Solving Right Angled Word Problems

1. A rectangle has a length of 12 cm and a width of 5 cm. What is the size of the angle formed by the length of the rectangle and a diagonal of the rectangle? Give your answer to the nearest tenth.

2. A wheel chair ramp needs to be built to the front door of a house. If the bottom of the door opening is 65 cm above ground level and if the angle of elevation of the ramp must be $10°$, how far from the house must the bottom of the ramp be located. Give your answer to the nearest cm. Assume that the house is perpendicular to the ground.

3. The angle of depression of a ski slope is $14°$. How far directly down the slope of the hill must you ski in order to reduce your altitude by 300 m? Give your answer to the nearest metre.

4. A ladder of length 6 m leans against a vertical wall. If the base of the ladder rests on level ground and is 1.7 m from the wall, what angle does the ladder make with the wall? Give your answer to the nearest tenth of a degree.

5. What is the angle of elevation of the sun if a 13.2 m vertical pole casts a shadow 51.6 m long on level ground? Give your answer to the nearest tenth of a degree.

6. A submarine begins a dive descending at an angle of depression of $8°$. If the submarine continues along a straight line path and travels 8 km/h along its path of decent, how far below the surface will it be after 45 minutes. Give your answer to the nearest metre. (Recall: $d = vt$)

7. The angle of depression from the top of an apartment building to the base of a fountain in a nearby park is $72°$. If the building is 78 m tall, what is the horizontal distance from the building to the fountain.? Give your answer to the nearest foot.

Answers

1. $22.6°$ 2. 369 cm 3. 1240 m 4. $16.5°$ 5. $14.3°$ 6. 835 m 7. 25.3 m