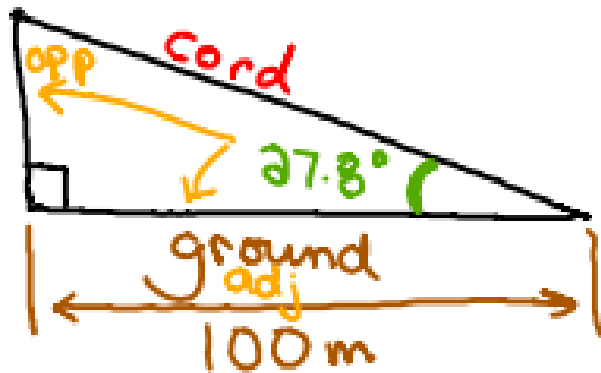# Section 7.4

The Tangent Ratio

Lesson 19:

Tangent Ratio Applications

Example:

A mast is held in place by a cord attached to its top. The angle of elevation to the top of the mast from where the cord is pegged on the ground is 27.8°. If this point is 100 m away from the mast, calculate the height of the mast to the nearest tenth of a metre.
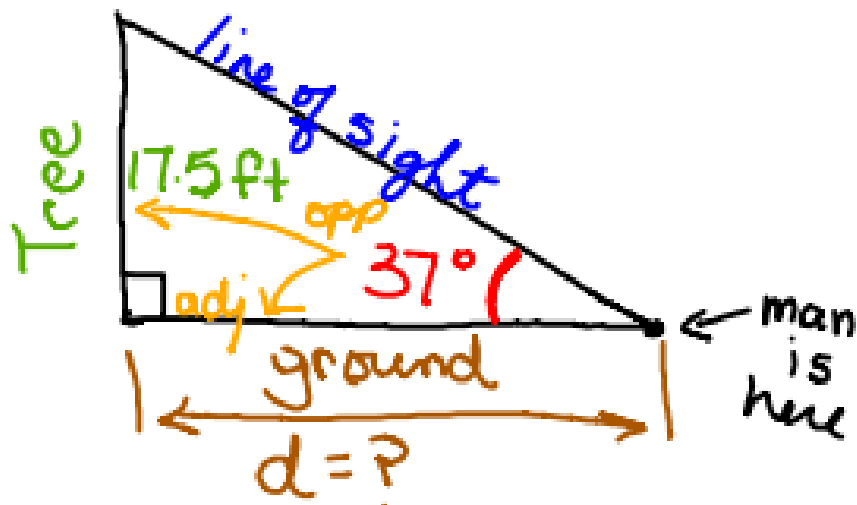
$$\tan A = \frac{opp}{adj}$$

$$100 \cdot \tan 27.8° = \frac{m}{100} \cdot 100$$

$$m = 100 \cdot \tan 27.8°$$

$$m = 52.724\ldots \approx 52.7\ m$$

mast = opp = ?

opp

cord

27.8°

ground
adj
100 m

Example:

A man is standing on the ground looking up at the top of a tree. The angle of elevation is 37°. If the tree is 17.5 ft tall, how far away from the base of the tree is the man standing?

Tree

line of sight

17.5 ft

opp

37°

adj

ground

d = ?

man is here

$$\tan A = \frac{opp}{adj}$$

$$\tan 37° = \frac{17.5}{d}$$

$$d = \frac{17.5}{\tan 37°} = 23.223\ldots$$

$$\approx 23.2 \text{ ft}$$

Example:

A young girl is standing at the edge of a cliff and gazing down at a horse that is running in a pasture below her. The angle of depression to the horse is 35°. The height of the cliff is 48 m. How far away from the base of the cliff is the horse?

girl

cliff

48m

∠35°

55°

adj

opp

pasture

$\rightarrow p = ? \rightarrow$

horse
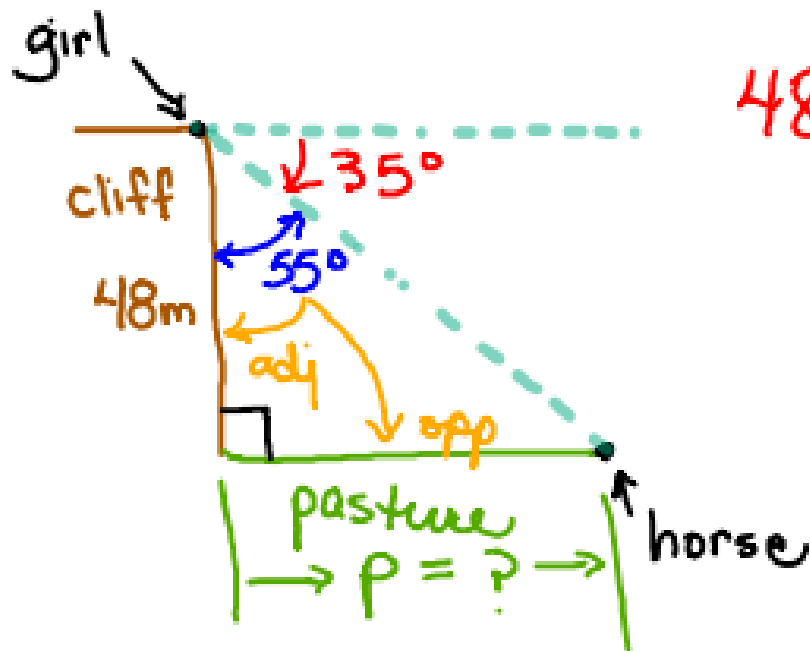
$$48 \cdot \tan 55° = \frac{p}{48} \cdot 48$$

$$p = 48 \cdot \tan 55°$$

$$p = 68.5511...$$

$$\approx 68.6 \, m$$

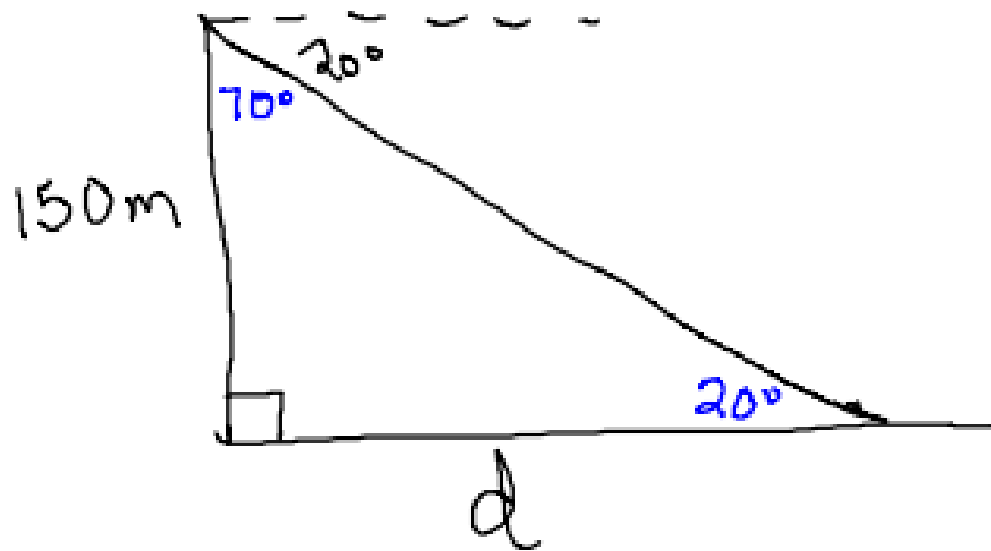# Check your understanding:

Build Your Skills
pg. 321
#2, 3

Practice your new skills:

pg. 321 - 323
#1, 2, 3, 4, 5, 6

2. The angle of depression to a boat from the top of a 150-metre cliff is 20°. How far is the boat from the base of the cliff?

$$\tan 20° = \frac{150}{d}$$

$$d \cdot \tan 20° = \frac{150}{d} \cdot d$$

$$d \cdot \tan 20° = 150$$

$$\frac{d \cdot \tan 20°}{\tan 20°} = \frac{150}{\tan 20°}$$

$$d = 412.12161 \dots$$

The boat is approximately 412 m from the base of the cliff.
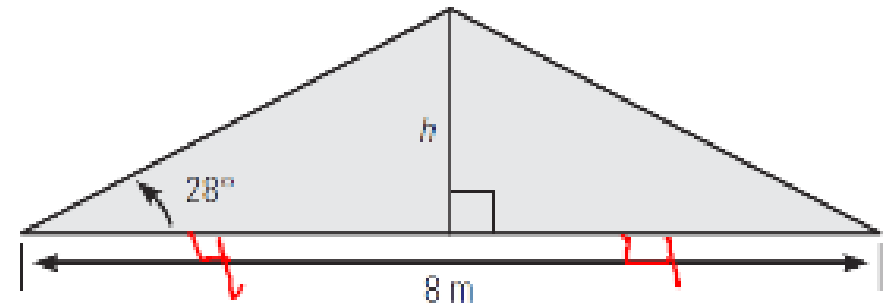
3. When sand is piled onto a flat surface, it forms a cone. If the pile is 8 m wide, and the angle between the ground and the slope of the pile is 28°, what is the height of the pile?

$$\tan 28° = \frac{h}{4}$$

$$4 \cdot \tan 28° = \frac{h}{4} \cdot 4$$

$$4 \cdot \tan 28° = h$$

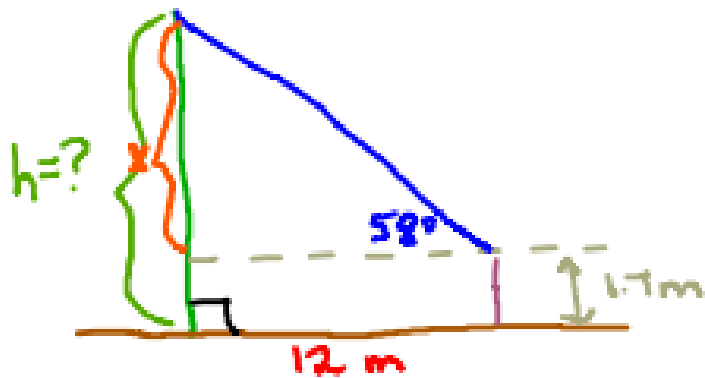$$2.12683 \ldots = h$$

The pile is approximately 2.13 m in height.

1. A 1.7-metre tall man stands 12 m from the base of a tree. He views the top of the tree at an angle of elevation of 58°. How tall is the tree?
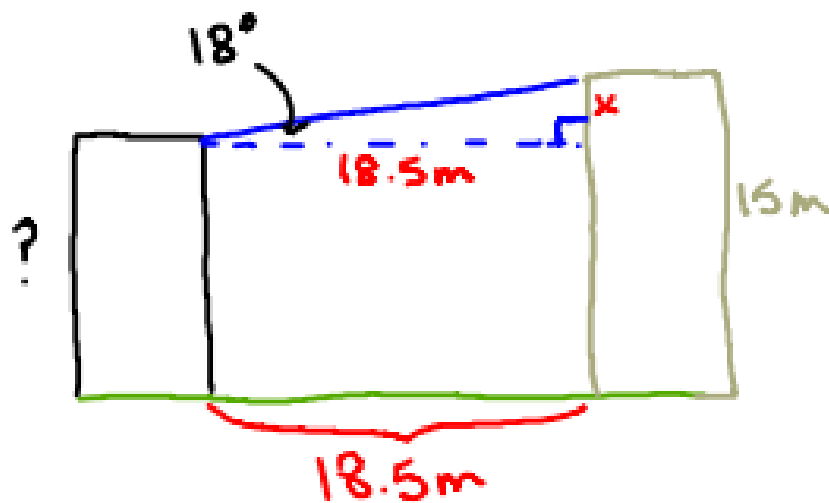
$$12 \times \tan 58° = \frac{x}{12} \times 12$$

$$12 \times \tan 58° = x$$

$$19.204\ldots = x$$

Height of tree $= x + 1.7$

Height of the tree $= 19.2 + 1.7$

$$= 20.9 \text{ m}$$

$h = ?$

58°

1.7m

12 m

2. Two buildings are 18.5 metres apart. The angle of elevation from the top of one building to the top of the other is 18°. If the taller building is 15 metres tall, how tall is the shorter building?
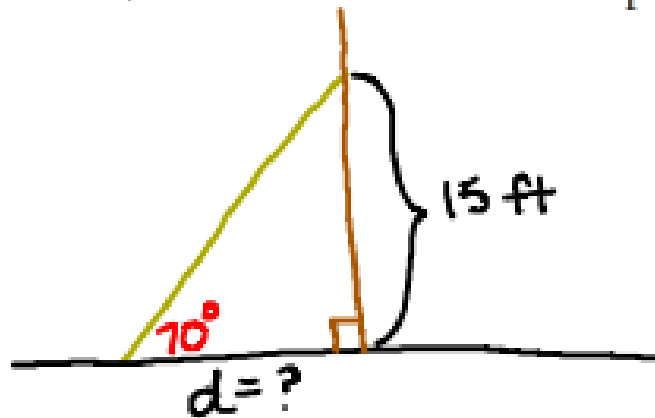
$$18.5 \tan 18° = \frac{x}{18.5} \cdot 18.5$$

$$18.5 \tan 18° = x$$

$$6.011... = x$$

Shorter building = 15m − x
= 15m − 6m
= 9m

3. How far from the base of the house is the foot of a ladder if the angle of elevation is 70° and it reaches 15 feet up the side of the house?
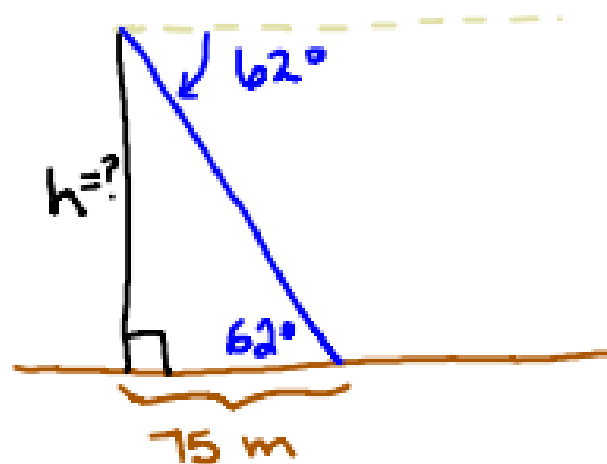
$$d \times \tan 70° = \frac{15}{d} \times d$$

$$\frac{d \times \tan 70°}{\tan 70°} = \frac{15}{\tan 70°}$$

$$d = \frac{15}{\tan 70°} = 5.459\ldots$$

The foot of the ladder is approx. 5.5 ft. from the base of the house.

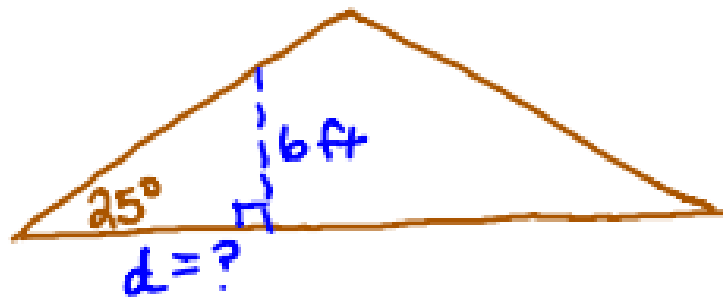4. About how tall is a tower if the angle of depression from its top to a point 75 metres from the base is 62°?

$h = ?$

$62°$

$62°$

75 m

$75 \times \tan 62° = \dfrac{h}{75} \times 75$

$75 \cdot \tan 62° = h$

$141.054\ldots = h$

The tower is approx. 141m tall.

5. A rafter's angle of elevation with the horizontal is 25°. How far from the corner could a 6-foot man stand up straight?
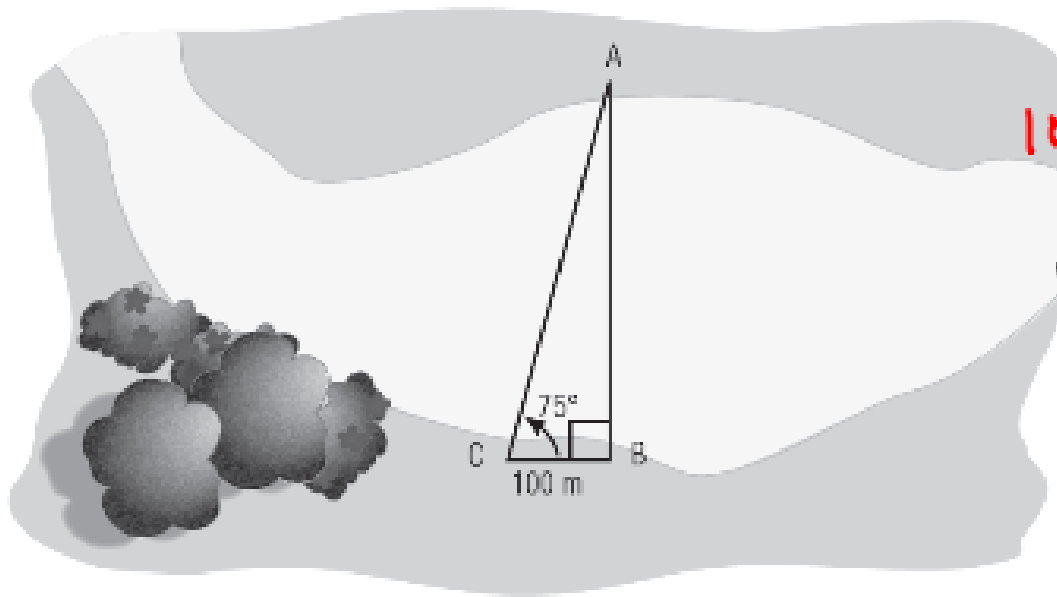
$$d \cdot \tan 25° = \frac{6}{d} \cdot d$$

$$\frac{d \cdot \tan 25°}{\tan 25°} = \frac{6}{\tan 25°}$$

$$d = \frac{6}{\tan 25°} = 12.867...$$

The man could stand approx 12.9 ft from the corner.

6. Determine the distance, AB, across the river, given the following measurements.

$$100 \cdot \tan 75° = \frac{AB}{100} \cdot 100$$

$$100 \cdot \tan 75° = AB$$

$$373.205\ldots = AB$$

The distance across the river is approx. 373.2 m.