Tangent Ratio

Word Problems
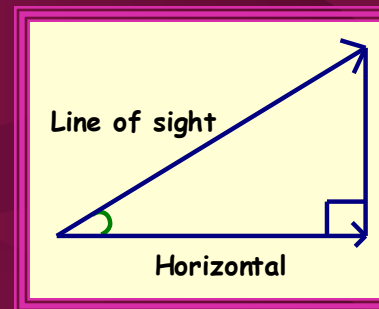
Key Points

Solving Word Problems:

- Using the tangent ratio to calculate unknown sides.
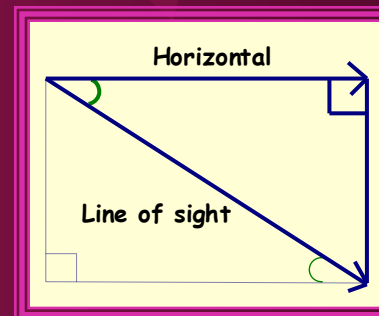
Angle of Elevation (Inclination):

- The angle formed between the horizontal and the line of sight when looking upward.

Line of sight

Horizontal

Angle of Depression:

- The angle formed between the horizontal and the line of sight when looking downward.

Horizontal

Line of sight

Example 1:

From the top of a lighthouse, a jet ski is sighted on the water at an angle of depression of 47°. If the lighthouse is 42.0 m high, how far is the jet ski from the base of the lighthouse?

Let x represent how far the jet ski is from the base of the lighthouse.

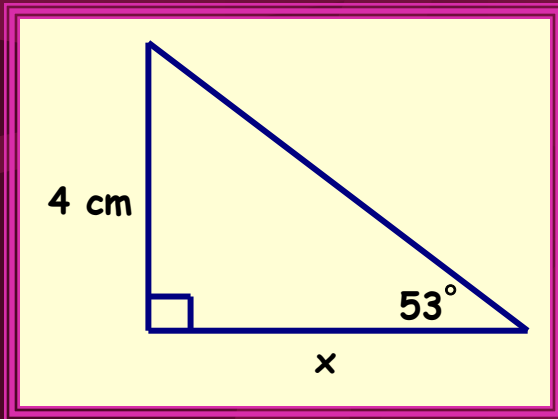$$tan\ 47° = \frac{42.0}{x}$$
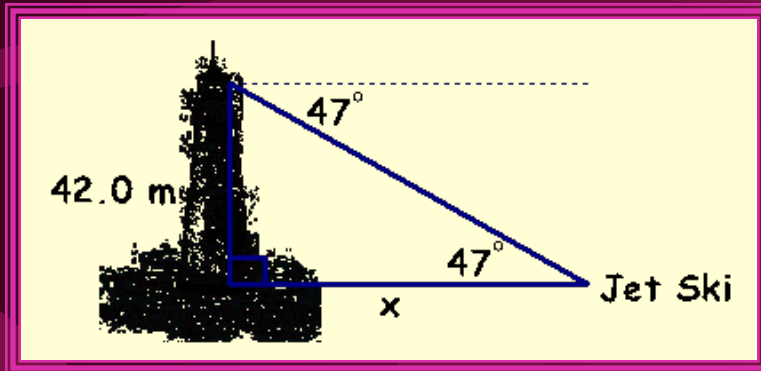
$$x = \frac{42.0}{tan\ 47°}$$

$$x \approx 39$$

Therefore, the jet ski is approximately 39 m from the lighthouse.

Please refer to the handout for the remaining examples.

Example 2:

In a right triangle, the side opposite the 53° angle is 4 cm long. How long is the side adjacent to the 53° angle, to the nearest centimetre?

4 cm

53°

x

$$\tan 53° = \frac{4}{x}$$

$$x = \frac{4}{\tan 53°}$$

$$x \approx 3.0$$

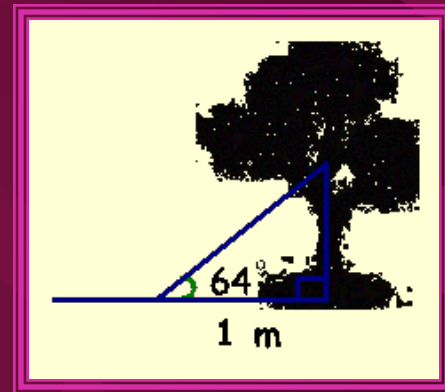Therefore, the adjacent side is 3 cm long.

Example 3:

When a ladder is rested against a tree, the foot of the ladder is 1 m from the base of the tree and forms an angle of 64º with the ground. How far up the tree does the ladder reach, to the nearest tenth of a metre?

$$tan\ 64° = \frac{x}{1}$$

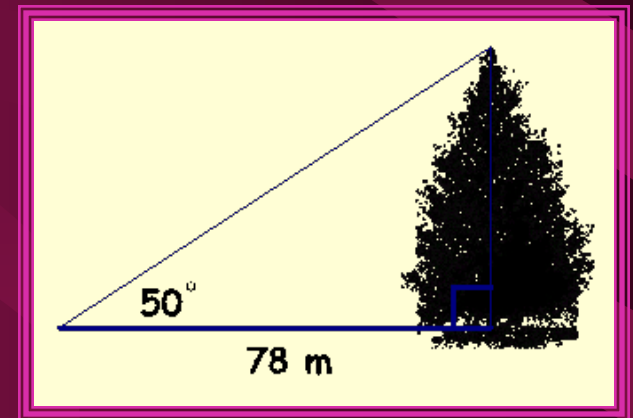$$tan\ 64° = x$$

$$x \approx 2.1$$

Therefore, the ladder reaches 2.1 m up the tree.

Example 4:

One of Canada's tallest trees is a Douglas fir on Vancouver Island. The angle of elevation measured by an observer who is 78 m from the base of the tree is 50°. How tall is this tree to the nearest metre?
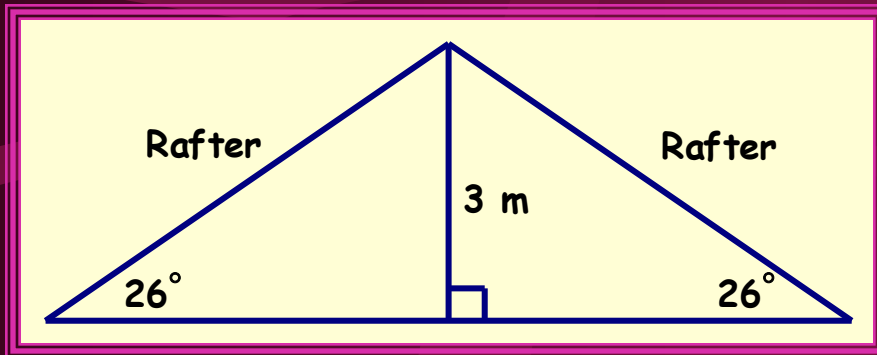
$$\tan 50° = \frac{x}{78}$$

$$78(\tan 50°) = x$$

$$x \approx 93$$

Therefore, this tree is 93 m tall.

Example 5:

The angle of inclination of the rafters of the roof of a house is 26o. The roof support is 3 m high. How wide is the house, to the nearest metre?

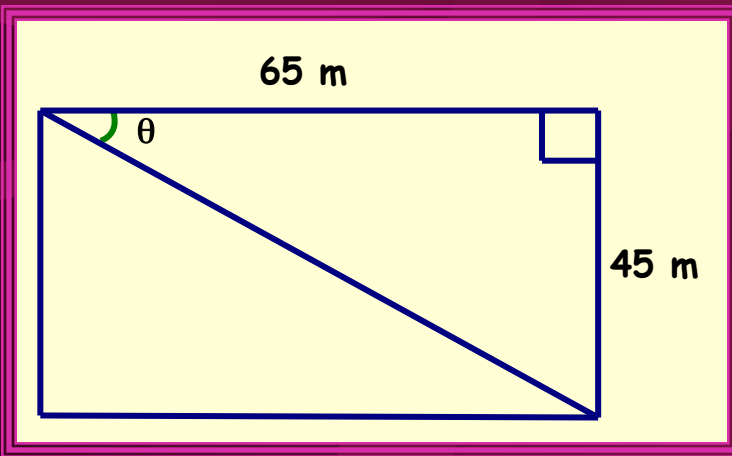$$\tan 26° = \frac{3}{x}$$

$$x = \frac{3}{\tan 26°}$$

$$x \approx 6.15$$

$$2 \times 6.15 = 12.3$$

Therefore, the house is approximately 12 m wide.

Example 6:

Pietra walked diagonally across a rectangular schoolyard 45 m by 65 m. To the nearest degree, at what angle with respect to the longer side did she walk?

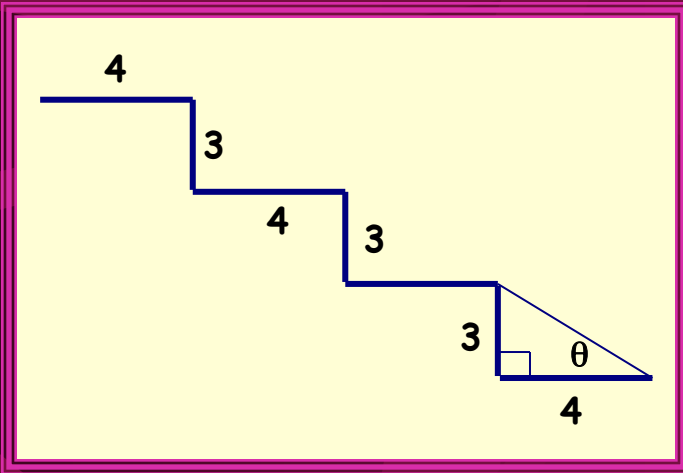$$tan\,\theta = \frac{45}{65}$$

$$tan\,\theta = 0.6923$$

$$\theta = tan^{-1}(0.6923)$$

$$\theta \approx 35°$$

Therefore, she walked at a 35° angle.

Example 7:

Comfortable stairs have a slope of ¾. What angle do the stairs make with the horizontal, to the nearest degree?

$$tan\,\theta = \frac{3}{4}$$

$$tan\,\theta = 0.75$$

$$\theta = tan^{-1}(0.75)$$

$$\theta \approx 37°$$

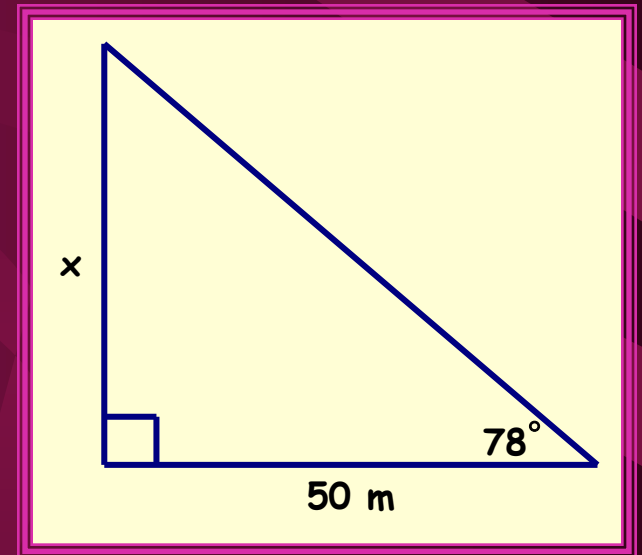Therefore, the stairs make an angle of 37° with the horizontal.

Example 8:

From a point 50 m from the base of the Skylon Tower in Niagara Falls, the angle of elevation of the top of the tower is 78°. Find the height of the tower, to the nearest metre.

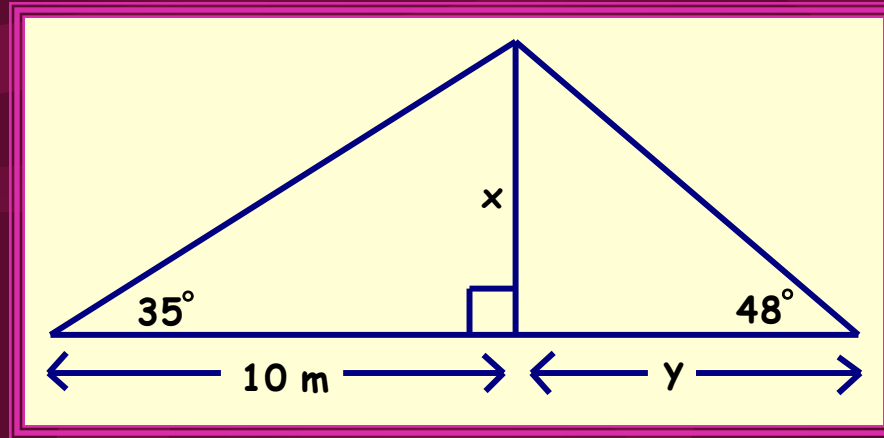$$\tan 78° = \frac{x}{50}$$

$$x = 50(\tan 78°)$$

$$x \approx 235$$

Therefore, the tower is approximately 235 m high.

Example 9:

Find the length of x, then the length of y, to the nearest tenth of a metre.

$$\tan 35° = \dfrac{x}{10} \qquad \tan 48° = \dfrac{7}{y}$$

$$x = 10(\tan 35°)$$

$$x \approx 7.0 \qquad y = \dfrac{7}{\tan 48°}$$

$$y \approx 6.3$$

Example 10:

Find the length of x, to the nearest tenth of a centimetre, then the measure of angle y, to the nearest degree.

$tan\ 48° = \dfrac{x}{8}$

$x = 8(tan\ 48°)$

$x \approx 8.88$

$tan\ y = \dfrac{8.88}{9}$

$tan\ y = 0.9866$
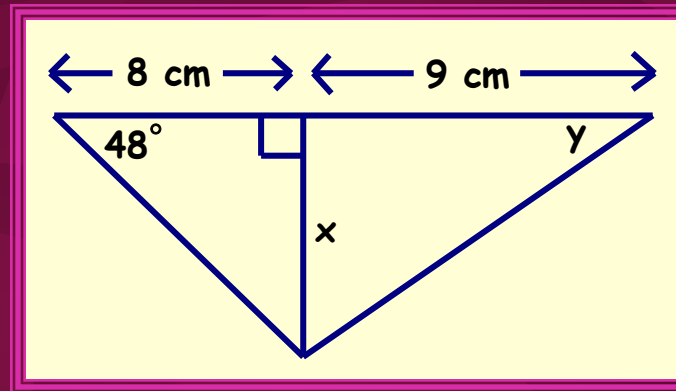
$y = tan^{-1}(0.9866)$

$y \approx 45°$

Homework

Pages 254 – 255 #9, 10, 11, 12, 13a-f