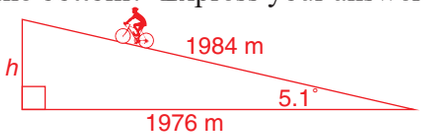
c. How much higher is Chad when he is at the top of the hill compared to when he is at the bottom? Express your answer to the nearest metre.



$$\sin 5.147...^\circ = \frac{\text{length opposite } 5.147...^\circ}{\text{hypotenuse}}$$

$$\sin 5.147...^\circ = \frac{h}{1984}$$

$$1984 \cdot \sin 5.147...^\circ = \frac{h}{1984} \cdot 1984$$

$$178 \text{ m} \doteq h$$

Chad is approximately 178 m higher when he is at the top of the hill.

The Pythagorean theorem could have also been used to solve this problem.

Please complete *Lesson 3.2 Explore Your Understanding Assignment* located in *Workbook 3.2* before proceeding to *Lesson 3.3*.

Lesson 3.3: Solving Problems with Triangles

Practice – IV

1. At the time of this writing, the Burj Khalifa (formerly the Burj Dubai) is the world's tallest building at 829.8 m. If you were to stand 200 m from the centre of the building, what would the angle of elevation be to the top? Express your answer to the nearest degree.

$$\tan\theta = \frac{\text{length opposite } \theta}{\text{length adjacent to } \theta}$$

$$\tan\theta = \frac{829.8 \text{ m}}{200 \text{ m}}$$

$$\tan\theta = \frac{829.8}{200}$$

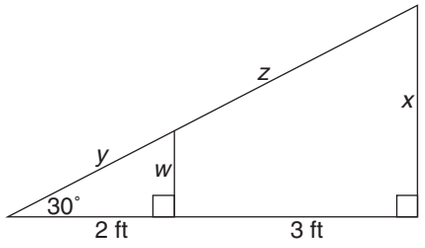
$$\theta = \tan^{-1}\left(\frac{829.8}{200}\right)$$

$$\theta \doteq 76^\circ$$

© *Thinkstock*

The angle of elevation to the top is approximately 76°.

2. Determine the unknown lengths in the diagram. Express your answers to the nearest tenth of a foot.



$$\tan 30^\circ = \frac{\text{length opposite } 30^\circ}{\text{length adjacent to } 30^\circ}$$

$$\tan 30^\circ = \frac{w}{2 \text{ ft}}$$

$$2 \text{ ft} \cdot \tan 30^\circ = \frac{w}{2 \text{ ft}} \cdot 2 \text{ ft}$$

$$1.154\ldots \text{ft} = w$$

$$1.2 \text{ ft} \doteq w$$

$$\cos 30^\circ = \frac{\text{length adjacent to } 30^\circ}{\text{hypotenuse}}$$

$$\cos 30^\circ = \frac{2 \text{ ft}}{y}$$

$$y \cdot \cos 30^\circ = \frac{2 \text{ ft}}{y} \cdot y$$

$$\frac{y \cdot \cos 30^\circ}{\cos 30^\circ} = \frac{2 \text{ ft}}{\cos 30^\circ}$$

$$y = 2.309\ldots \text{ft}$$

$$y \doteq 2.3 \text{ ft}$$

$$\tan 30^\circ = \frac{\text{length opposite } 30^\circ}{\text{length adjacent to } 30^\circ}$$

$$\tan 30^\circ = \frac{x}{5 \text{ ft}}$$

$$5 \text{ ft} \cdot \tan 30^\circ = \frac{x}{5 \text{ ft}} \cdot 5 \text{ ft}$$

$$2.886\ldots \text{ft} = x$$

$$2.9 \text{ ft} \doteq x$$

Let v represent the hypotenuse of the larger triangle.

$$a^2 + b^2 = c^2$$

$$(2 \text{ ft} + 3 \text{ ft})^2 + x^2 = v^2$$

$$(5 \text{ ft})^2 + (2.886\ldots \text{ ft})^2 = v^2$$

$$25 \text{ ft}^2 + 8.333\ldots \text{ ft}^2 = v^2$$

$$33.333\ldots \text{ ft}^2 = v^2$$

$$\sqrt{33.333\ldots \text{ ft}^2} = \sqrt{v^2}$$

$$5.773\ldots \text{ ft} = v$$

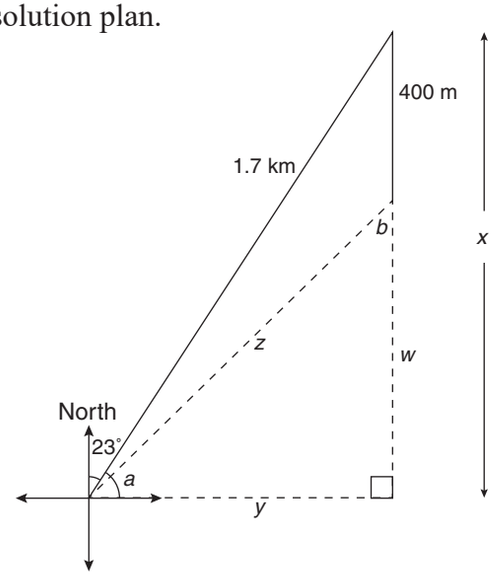
$$z = v - y$$

$$z = 5.773\ldots \text{ ft} - 2.309\ldots \text{ ft}$$

$$z \doteq 3.5 \text{ ft}$$

3. While on an orienteering trip, Krastio walks 23º East of North for 1.7 km. He then walks due south for 400 m. To determine his direction and distance back to his original position, Krastio draws the following diagram and solution plan.

   - Use the angle 23º to determine the measure of angle a.
   - Use a sine ratio to determine the value of x.
   - Use the value of x to determine the value of w.
   - Use a tangent ratio to determine the value of y.
   - Use a tangent ratio to determine the measure of angle b.
   - Use the Pythagorean theorem to determine the value of z.



Krastio must return to his original position. Determine the direction and distance that Krastio must walk. Give your answers to the nearest degree and the nearest tenth of a kilometre.

$$23° + a = 90°$$
$$\cancel{23°} + a - \cancel{23°} = 90° - 23°$$
$$a = 67°$$

$$\sin 67° = \frac{\text{length opposite } 67°}{\text{hypotenuse}}$$
$$\sin 67° = \frac{x}{1.7 \text{ km}}$$
$$1.7 \text{ km} \cdot \sin 67° = \frac{x}{\cancel{1.7 \text{ km}}} \cdot \cancel{1.7 \text{ km}}$$
$$1.564... \text{ km} = x$$

$$400 \cancel{\text{m}} \cdot \frac{1 \text{ km}}{1000 \cancel{\text{m}}} = 0.4 \text{ km}$$

$$w = 1.564... \text{ km} - 0.4 \text{ km}$$
$$w = 1.164... \text{ km}$$

$$w^2 + y^2 = z^2$$
$$(1.164... \text{ km})^2 + (0.662... \text{ km})^2 = z^2$$
$$1.356... \text{ km}^2 + 0.438... \text{ km}^2 = z^2$$
$$1.795... \text{ km}^2 = z^2$$
$$\sqrt{1.795... \text{ km}^2} = \sqrt{z^2}$$
$$1.3 \text{ km} \doteq z$$

$$\tan 67° = \frac{\text{length opposite } 67°}{\text{length adjacent to } 67°}$$
$$\tan 67° = \frac{1.56... \text{ km}}{y}$$
$$\tan 67° = \frac{1.56... \text{ km}}{\cancel{y}} \cdot \cancel{y}$$
$$\frac{y \cdot \cancel{\tan 67°}}{\cancel{\tan 67°}} = \frac{1.56 \text{ km}}{\tan 67°}$$
$$y = 0.662... \text{ km}$$

$$\tan b = \frac{\text{length opposite } b}{\text{length adjacent to } b}$$
$$\tan b = \frac{0.662... \cancel{\text{km}}}{1.164... \cancel{\text{km}}}$$
$$\tan b = \frac{0.662...}{1.164...}$$
$$b = \tan^{-1}\left(\frac{0.662...}{1.164...}\right)$$
$$b \doteq 30°$$

Krastio will walk approximately 1.3 km 30° west of south to return to his original position.

Please complete *Lesson 3.3 Explore Your Understanding Assignment*, located in *Workbook 3*.3.