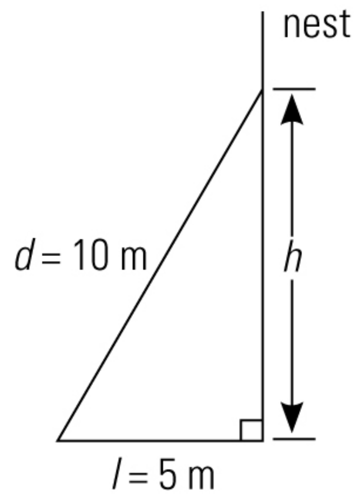
Chapter 8 Trigonometry of Right Triangles, Practise Your New Skills, p520–523
Student Resource p370–373

Practise Your New Skills

1. For each of these, square the numbers. Add the two smaller values together. If they add up to the largest, the three numbers will be a Pythagorean triple and thus can be lengths of sides of a right triangle. Discuss these with your students as some of them seem like Pythagorean triples even though they are not.

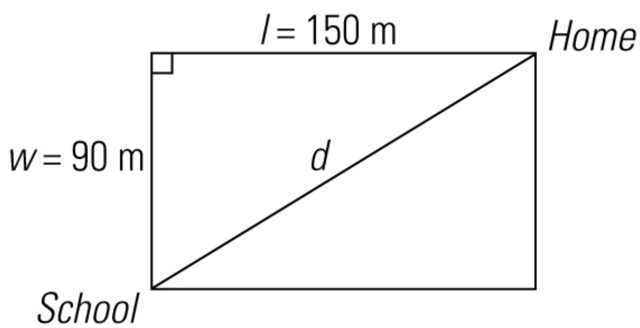
a) $36 + 144 \neq 324$ No
b) $16 + 25 \neq 81$ No
c) $256 + 900 = 1156$ Yes
d) $625 + 3600 = 4225$ Yes
e) $0.25 + 0.0144 \neq 0.169$ No

2.



Use the Pythagorean theorem.
$l^2 + h^2 = d^2$
$5^2 + h^2 = 10^2$
$25 + h^2 = 100$
$h^2 = 100 - 25$
$h^2 = 75$
$h = \sqrt{75}$
$h \approx 8.7$ m
The nest is 8.7 m up the cliff.

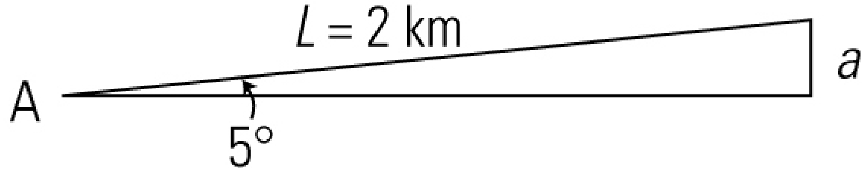
3.



a) If Usaid walks on the road, the total distance he will walk is the length plus the width of the field.
$150 + 90 = 240$ m
To find how far it is across the field by the shortcut, use the Pythagorean theorem.
$l^2 + w^2 = d^2$
$150^2 + 90^2 = d^2$
$d^2 = 22\ 500 + 8100$
$d^2 = 30\ 600$
$d = \sqrt{30\ 600}$
$d \approx 175$ m
Subtract the shortcut distance from the total distance.

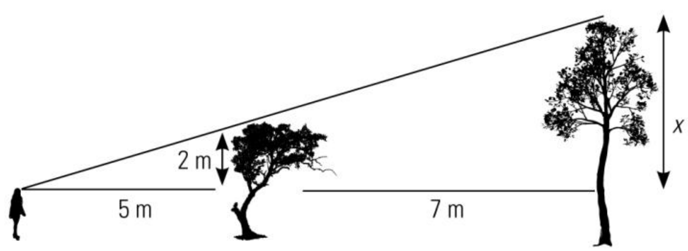
$240 - 175 = 65$
He would save 65 m.
b) Answers will vary but may include things such as there is a body of water in the field, animals are kept fenced in the field, etc.

4.



a) $\sin A = \frac{a}{l}$
$\sin A = \frac{a}{2}$
$a = 2 \sin 5°$
$a \approx 0.174$ km or 174 m
You gain approximately 174 m in altitude.
b) The change in altitude would be less because the rise would have to decrease as the angle decreased for the same distance along the road.

5.



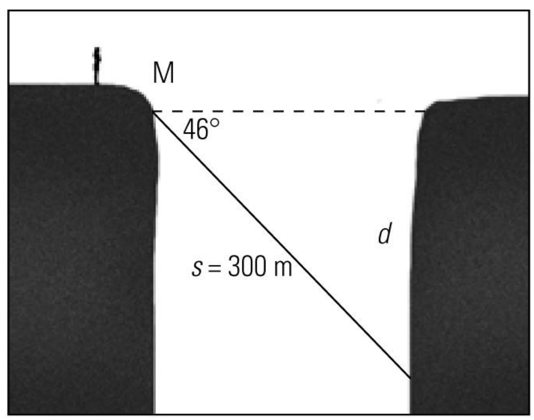
Use similar triangles.
$$\frac{2}{x} = \frac{5}{12}$$
$$x \times \frac{2}{x} = \frac{5}{12} \times x$$
$2 \times 12 = 5x$
$5x = 24$
$x = \frac{24}{5}$
$x = 4.8$ m
Add 4.8 to 1.5 (Marcy's height).
$4.8 + 1.5 = 6.3$
The second tree is 6.3 tall.

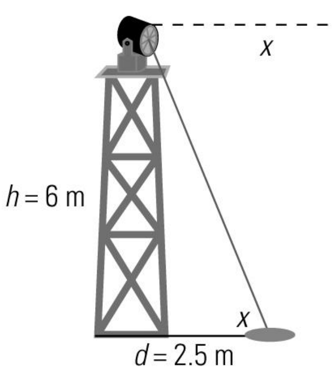
6. Use similar triangles.
$$\frac{\text{AB}}{208} = \frac{30}{24}$$
$$\text{AB} = \frac{30 \times 208}{24}$$

$AB = 260$ m
The lake is 260 m long.

7. a) $\tan E = \frac{h}{w}$
$\tan 32° = \frac{h}{4}$
$h = 4 \tan 32°$
$h \approx 2.5$ m
The vertical height is 2.5 m.
b) $\sin E = \frac{x}{w}$
$\sin 32° = \frac{x}{4}$
$x = 4 \sin 32°$
$x \approx 2.1$ m
The support pieces are approximately 2.1 m.
c) $r^2 = h^2 + w^2$
$r^2 = 2.5^2 + 4^2$
$r^2 = 6.25 + 16$
$r^2 = 22.25$
$r = \sqrt{22.25}$
$r \approx 4.7$ m
The rafter is approximately 4.7 m.

8. a)
$\sin M = \frac{d}{s}$
$\sin 46° = \frac{d}{300}$
$x = 300 \sin 46°$
$x \approx 215.8$ m
The pit is approximately 215.8 m deep.
b) He would also need to know the shape of the pit, how long the pit was, or if it was circular or oval. Then he could find the volume of the pit to determine the amount of gravel removed.

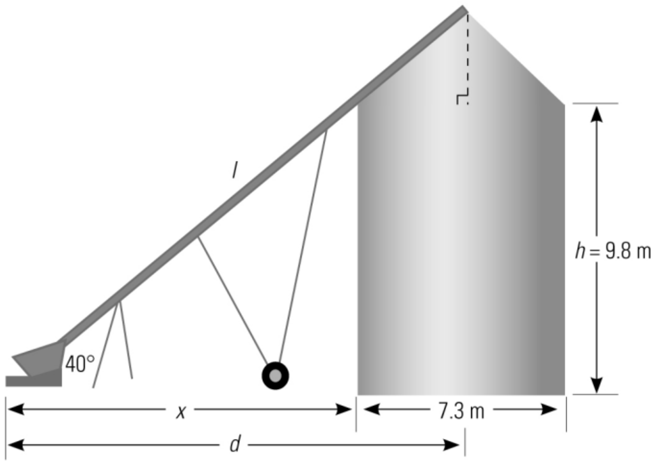




9. $x = \tan^{-1}\left(\frac{h}{d}\right)$
$x = \tan^{-1}\left(\frac{6}{2.5}\right)$
$x \approx 67°$
The angle of depression is 67°.

Extend Your Thinking

10. a)



b) Simplify the diagram. If the auger touches the top of the bin when it is inclined at 40°, find the distance from the edge of the bin.

tan A = $\frac{h}{x}$

tan 40° = $\frac{9.8}{x}$

x tan 40° = 9.8

$$x = \frac{9.8}{\tan 40°}$$

$h \approx$ 11.7 m

It is 3.65 m from the edge to the centre (7.3 ÷ 2).

Find the horizontal distance from the end of the auger to the centre of the bin by adding.

3.65 + 11.7 = 15.35 or about 15.4 m

Use the cosine function to find the length of the auger.

cos A = $\frac{d}{l}$

cos 40° = $\frac{15.4}{l}$

l cos 40° = 15.4

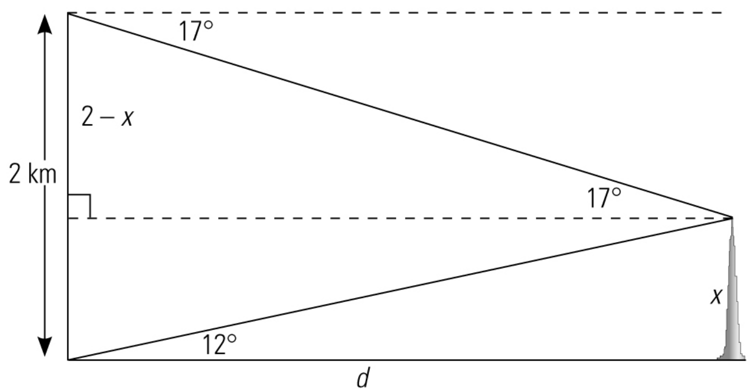
$$l = \frac{15.4}{\cos 40°}$$

$l \approx$ 20.1 m

The auger would be 20.1 m long.

11. The grade would be zero.

12.



Denote the height of the Burj as x.

$\tan 12° = \frac{x}{d}$

$d \tan 12° = x$

$d = \frac{x}{\tan 12°}$

$\tan 17° = \frac{2 - x}{d}$

$d \tan 17° = 2 - x$

$d = \frac{2 - x}{\tan 17°}$

Therefore, since d equals d, we can calculate as follows.

$\frac{x}{\tan 12°} = \frac{2 - x}{\tan 17°}$

$x \tan 17° = (2 - x) \tan 12°$

$x \tan 17° = 2 \tan 12° - x \tan 12°$

$x \tan 17° + x \tan 12° = 2 \tan 12°$

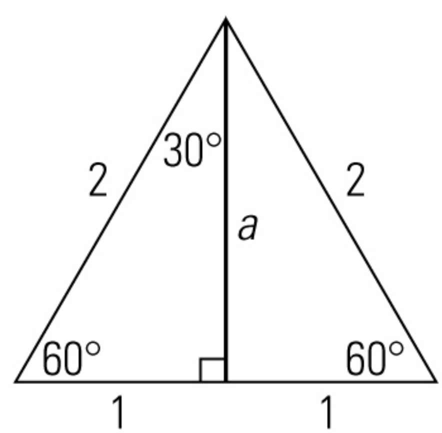
$x (\tan 17° + \tan 12°) = 2 \tan 12°$

$x = \frac{2 \tan 12°}{\tan 17° + \tan 12°}$

$x \approx 0.82$ km or 820 m

It is approximately 820 m tall.

13. These are "special triangles". If one angle of a right triangle is 60°, then the other is 30°. Start with an equilateral triangle with each side equals to 2 units. Drop the perpendicular from one vertex to the opposite side. This will bisect the side. Use the Pythagorean theorem.



$1^2 + a^2 = 2^2$

$1 + a^2 = 4$

$a^2 = 4 - 1$

$a^2 = 3$

$a = \sqrt{3}$

$a \approx 1.73$

Using this and similar triangles, she could solve any right triangle with an acute angle of 60°.

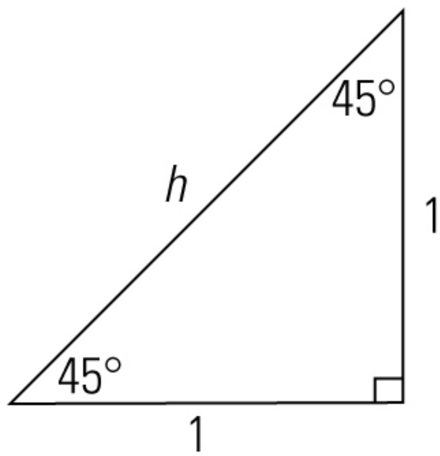
$\sin 30° = \frac{1}{2}$

$\cos 30° = \frac{\sqrt{3}}{2}$
$\tan 30° = \frac{1}{\sqrt{3}}$

$\sin 60° = \frac{\sqrt{3}}{2}$

$\cos 60° = \frac{1}{2}$
$\tan 60° = \sqrt{3}$

Similarly, for a right triangle with a 45° angle, she could use the following diagram.



The two legs of the triangle will be equal, say 1.
$1^2 + 1^2 = h^2$
$1 + 1 = h^2$
$h^2 = 2$
$h = \sqrt{2}$
$h \approx 1.41$
$\sin 45° = \frac{1}{\sqrt{2}}$
$\cos 45° = \frac{1}{\sqrt{2}}$
$\tan 45° = 1$