RATU NAVULA COLLEGE

Y11 LIFE MATHEMATICS HOME LEARNING KIT 9

LESSON 60

LO: **Applications Of Pythagoras theorem in Construction**

In order to construct the corners of buildings accurately, we need right angles.

Pythagorean triad : any 3 numbers which satisfy Pythagoras theorem.

This only works for right angled triangles.

Example: Show that {3, 4, 5} is a Pythagorean triad.

$3^2 + 4^2 = 5^2$
$9 + 16 = 25$
$25 = 25$

Show that {5, 12, 13} is a Pythagorean triad.

$5^2 + 12^2 = 13^2$
$25 + 144 = 169$

$169 = 169$

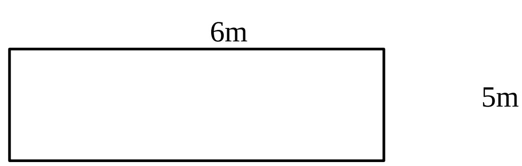
Example: {4, 5, 6} is not a Pythagorean triad.

$4^2 + 5^2 \neq 6^2$

$41 \neq 36$

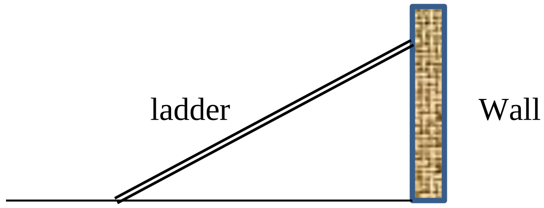
Exercises

1. A builder laying the foundations of a garage wants to be sure he has the walls of the garage are at right angles. The length of the garage is 6m and the width is 5m.



Explain how measuring the length will check that the walls of the garage meet at right angles.

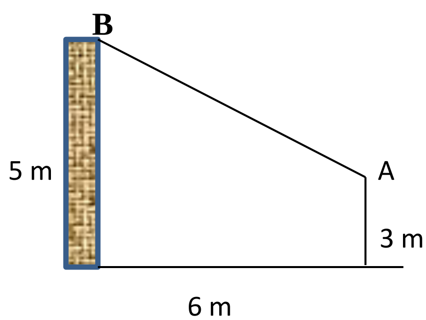
2. A 5m ladder is leaning against a wall. The foot of the ladder is 3 m from the base of the wall.



How far up the wall does the ladder reach?

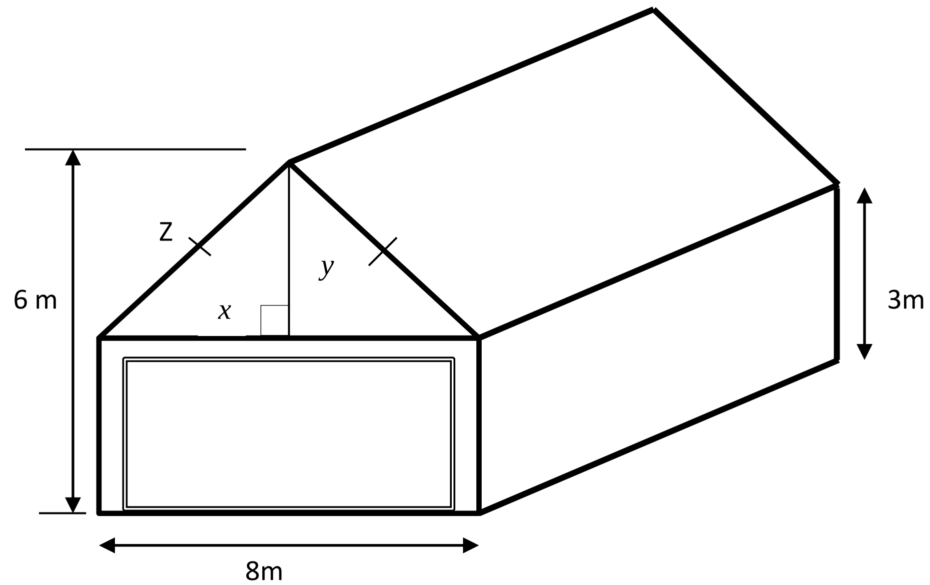
3. In the diagram AB is the sloping roof of a shed. Point A is 3m high, B is 5 m high. The width of the shed is 6 m

Find AB, the length of roofing iron needed for the roof.



4. A rectangular football field measures 56m by 100m. Calculate the distance across the field from one corner to the corner diagonally opposite.

5. The following is a building sketch of a garage

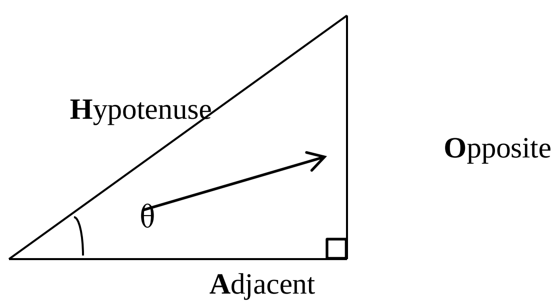


a) Find the value of x.
b) Find the value of y.
c) Find the value of z using Pythagoras Theorem.

LESSON 61

LO: Naming the sides of a right angle triangle

Review of Trigonometric Ratios



1. **Hypotenuse** is the longest side, opposite the right-angle.
2. **Opposite** side is directly opposite the angle θ
3. **Adjacent** side is the side next to the angle θ

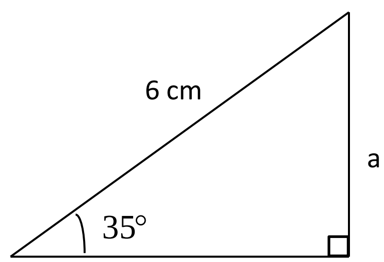
SOHCAHTOA

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

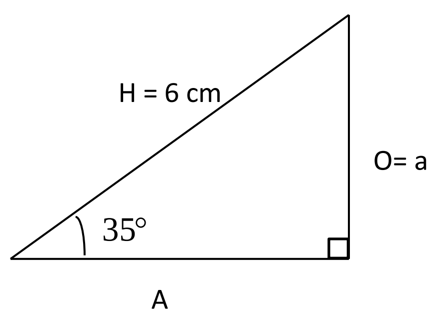
$$\sin\theta \ = \frac{O}{H} \qquad \cos\theta \ = \frac{A}{H} \qquad \tan\theta \ = \frac{O}{A}$$

Note: The angle of elevation is measured up from the horizontal while the angle of depression is measured down from the horizontal.

Example : Find the value of a



1. Label the sides of the triangle



2. Identify the appropriate ratio to use.
   We are finding the length of the opposite side and are given the length of the hypotenuse so choose the sine ratio.

$$\sin\theta = \frac{O}{H}$$

$$\sin 35° = \frac{a}{6}$$

$$a = 6\sin 35°$$

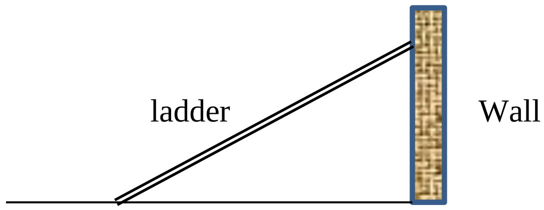
$$a = 3.44cm$$

Applications

Buildings, surveying and architecture

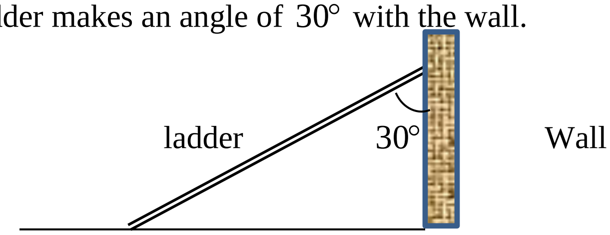
Exercises

1. A 5m ladder is leaning against a wall. The foot of the ladder is 3 m from the base of the wall.



What angle does the ladder make with the ground?

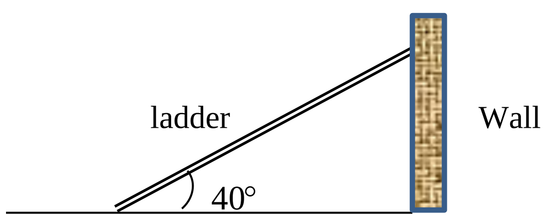
2. A 3 m ladder makes an angle of 30° with the wall.



a) How far up the wall does the ladder reach?

b) How far is the foot of the ladder from the wall?

3. A ladder makes an angle of 40° with the ground and it reaches 2.5 m up the wall.



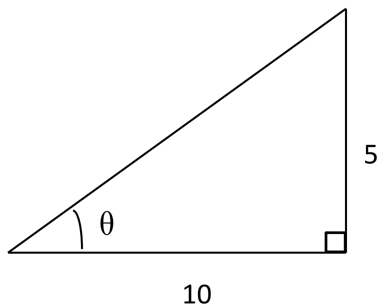
a) Find the length of the ladder?

b) How far is the foot of the ladder from the wall?

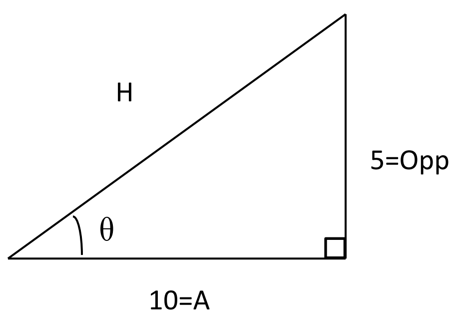
LESSON 62

LO: Solve practical situations using Trigonometric ratios.

Example: Find the value of θ



1. Label the sides of the triangle



2. Identify the appropriate ratio to use.
   We are are given O and A so choose the tangent ratio.

$$\tan\theta = \frac{O}{A}$$

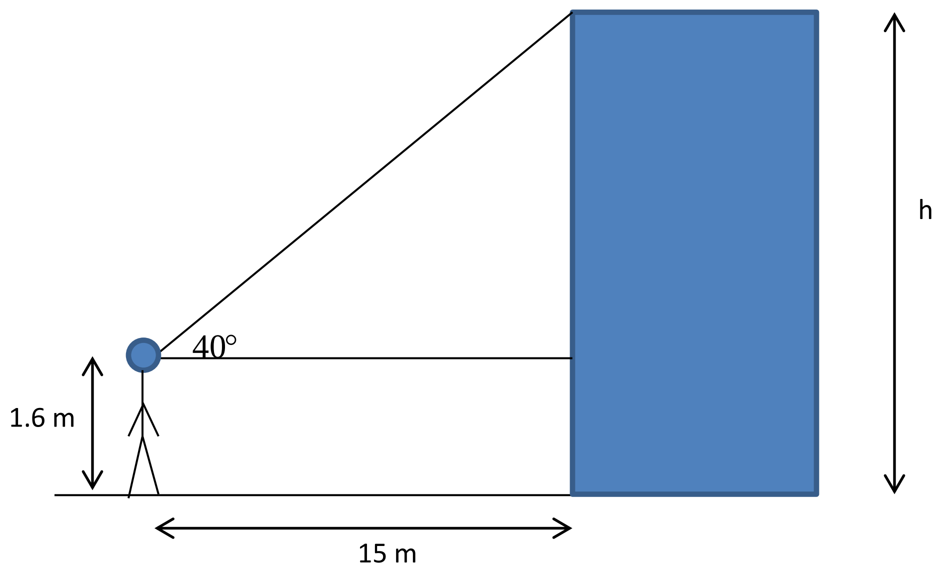
$$\tan\theta = \frac{5}{10}$$

$$\theta = \tan^{-1}\frac{5}{10}$$

$$\theta = 26.57^\circ$$

ACTIVITY

1. A surveyor needs to determine the height of a building. He measures the angle of elevation of the top of building as $40°$. The surveyor's eye level is 1.6m above the ground.



Find the height h of the building.

2. At a certain time of the day a post , 5m tall , casts a shadow of 2m. What is the angle of elevation of the sun at that time?

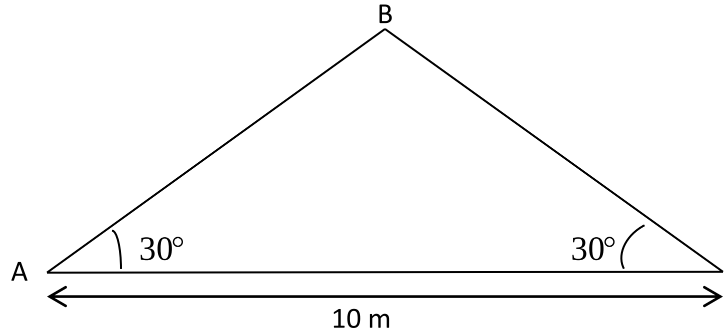
LESSON 63

LO: applications of Pythagoras Theorem to practical situations.

Many practical problems have solutions which involve finding side lengths of right-angled triangles. A clear diagram, including all information given, is the starting point for solving such problems. Include extra lines where necessary to complete a right-angled triangle in your diagram.

ACTIVITY

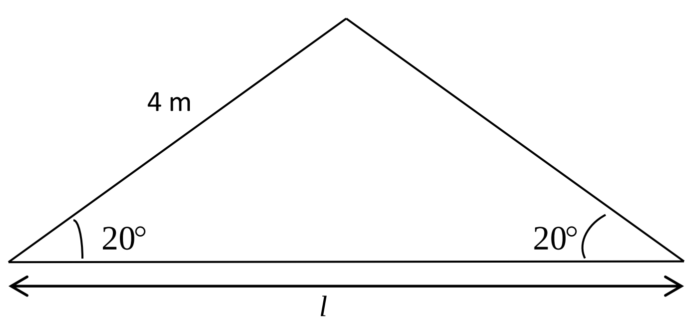
1. A carpenter wants to make a roof pitched at $30°$ as shown.



Find the length of the beam AB.

2. A person standing 10 m away from a tree observes the top of the tree at an angle of elevation of $45°$. If the person is 1.5 m tall, what is the height of the tree?

3. Determine the length of the roofing beam, *l*, required to support a roof of pitch $20°$ as shown in the diagram.



LESSON 64

LO: applications of Pythagoras Theorem to practical situations.

To solve practical problems, draw a clear diagram from the given information. If this diagram does not contain a right-angled triangle, you may need to add an extra line perpendicular to an existing line of your diagram.

ACTIVITY

1. The top of a tree, when viewed 20 m from the base of the tree, has an angle of elevation of $45°$. Find the height of the tree.

2. A tree 6m high casts a shadow 4m long. What angle do the sun's rays make with the ground?

3. Calculate the angle of pitch (θ) of a roof truss 5m wide and 1.3 m high