# Engineering

## Developing an understanding of the Pythagoras Theorem

## Content and alignment

The Pythagoras theorem is a challenge for many learners and yet it is a pivotal skill in the engineering trades as it allows engineers to find the length of a side of an object without directly measuring it. The Pythagoras Theorem states that in a right-angled triangle the square on the hypotenuse (the longest side or the side opposite the right angle) is the same size as the squares on the other two sides - sometimes written as $\mathbf{c^2 = b^2 + a^2}$. This formula is difficult to apply without a conceptual understanding of the theory.

## Intent

The intent of this resource is to provide learners with a practical and visual example of the theorem. Before taking your learners through the sequence described below, it would be useful to work through the following resource with your learners:

Engineering: Pythagoras Theorem cut-out

## Sequence

There are three parts to this sequence. Learners will:

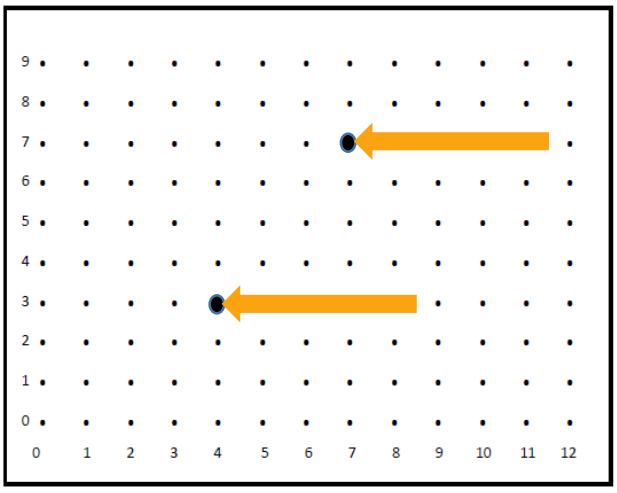
1. construct right-angled triangles based on coordinates
2. identify the square area of the legs of a triangle
3. add the square areas and find the square root.

### *1. Construct right-angled triangles based on coordinates*

A useful activity that supports learners' knowledge of right-angled triangles is to draw triangles using 'points'. A printable resource for this can be found in Engineering: Pythagoras Theorem coordinates sheets.

**Step one:** Hand out the 'coordinates sheet 1' to learners. Working in pairs have learners find and mark the two points identified by the coordinates.

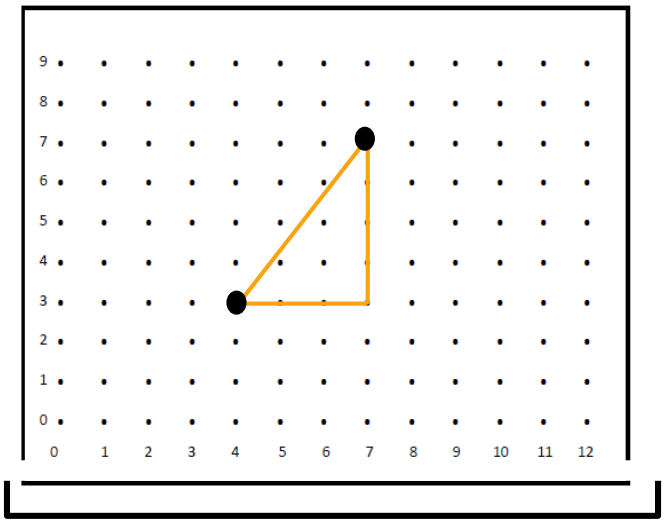
Coordinates (4, 3), (7, 7)



**Note:** If learners are unfamiliar with the process of finding coordinates, the coordinates sheet can be presented onto a whiteboard, and the tutor can demonstrate the process.

**Step two:** Once the points have been identified, have the learners connect the points with a straight line and draw a right-angled triangle.

For example: the coordinates (4, 3) and (7, 7) have been connected and drawn as a right-angled triangle.



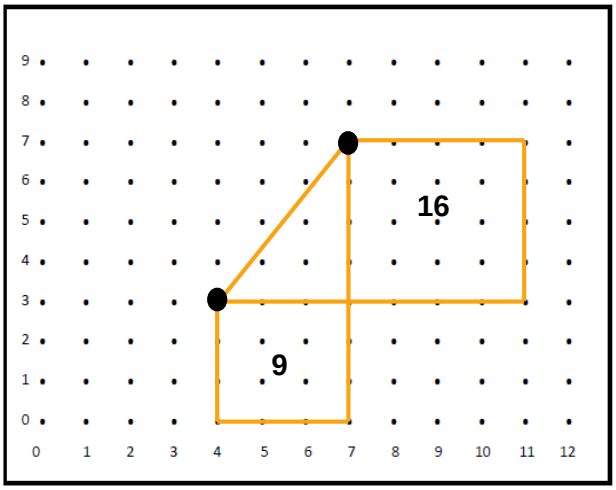

## *2. Identify the square area of the legs of a triangle*

**Step one:** Ask the learners to estimate the length of the hypotenuse using the distance between the dots as units. Then ask the learners to discuss how they might determine the length of the hypotenuse using the Pythagoras Theorem.

**Step two:** Discuss the concept of 'squaring' the legs, and have the learners do it. Following this, have learners work out the total number of unit squares in each of the two squares.

Next, have learners use this information to identify how many unit squares there are in the square of the hypotenuse. Then have them add the unit squares of the two smaller squares together:

9 + 16 = 25



### *3. Add the square areas and find the square root*

The square root is often described as the opposite to the square. Have learners estimate the square root and then use a calculator to check the answer. Continue this process several times with different sized triangles, using 'coordinates sheet 1' in Engineering: Pythagoras Theorem coordinates sheets. Be sure to have the learners estimate the answers first and judge if their estimates improve as they do more examples.

**Note:** Learners can begin to draw their own triangles as challenges to other learners (see 'coordinates sheet 2' in Engineering: Pythagoras Theorem coordinates sheets).

## Summary

This activity is a great way to get learners to apply the Pythagoras Theorem while seeing how it works. However, it is best used as a brief supplementary activity used to consolidate the concept before moving on to authentic tasks. The sequence takes learners through a process of discussing the Pythagoras Theorem and then estimating the length of the hypotenuse before calculating the answer.