Quantitative Methods Trigonometry

Module No. Cons 1012

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Trigonometry

- Earlier we learned what the Hypotenuse line in a triangle was. It is the longest length and it is always opposite the right angle in a right angled triangle.
- It is possible to calculate the angles in any right angle triangle once you have two sides, or if you have one side and one angle you can calculate the other side.
- The **SIN, COS,** and the **TAN RULES** are required once angles are involved.
- These are three mathematical ratios that enable you to transfer from numbers to angles (in the triangle) and also from angles to numbers.

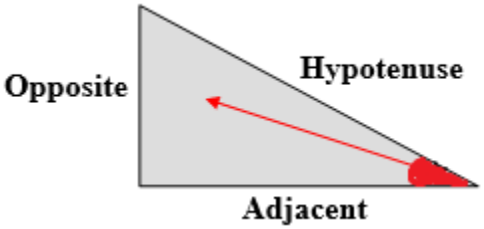
Trigonometry

- You will have to decide which of the rules **SIN, COS,** and the **TAN RULES** are applied. This will depend on what information is shown.

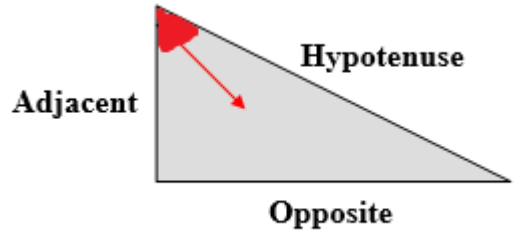
$$\sin A = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

$$\cos A = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

$$\tan A = \frac{\text{Opposite}}{\text{Adjacent}}$$



In the same triangle, when the angle changes, the opposite and adjacent sides also change



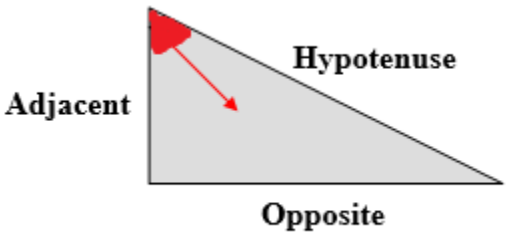
Trigonometry

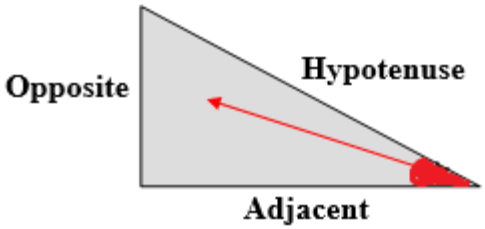
- The **HYPOTENUSE** is the longest side in the triangle and is always opposite from the right-angle *(It's position never changes).*
- The **OPPOSITE** is the side that is opposite to the angle in question.
- The **ADJACENT** is the side that is adjacent to or beside the angle in question.

$$\sin A = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

$$\cos A = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

$$\tan A = \frac{\text{Opposite}}{\text{Adjacent}}$$





Trigonometry

- For every question only one of the formulas can be used.
- To work out which formula to use you need to assess what you have and what you want.
- In all cases you will have two out of the three pieces of information required.
- You may be required to carry out some additional work to find the remaining angle. The three angles in a triangle add up to 180°.
- 30° + 60° + 90° = 180°
- 18° + 72° + 90° = 180°

Trigonometry

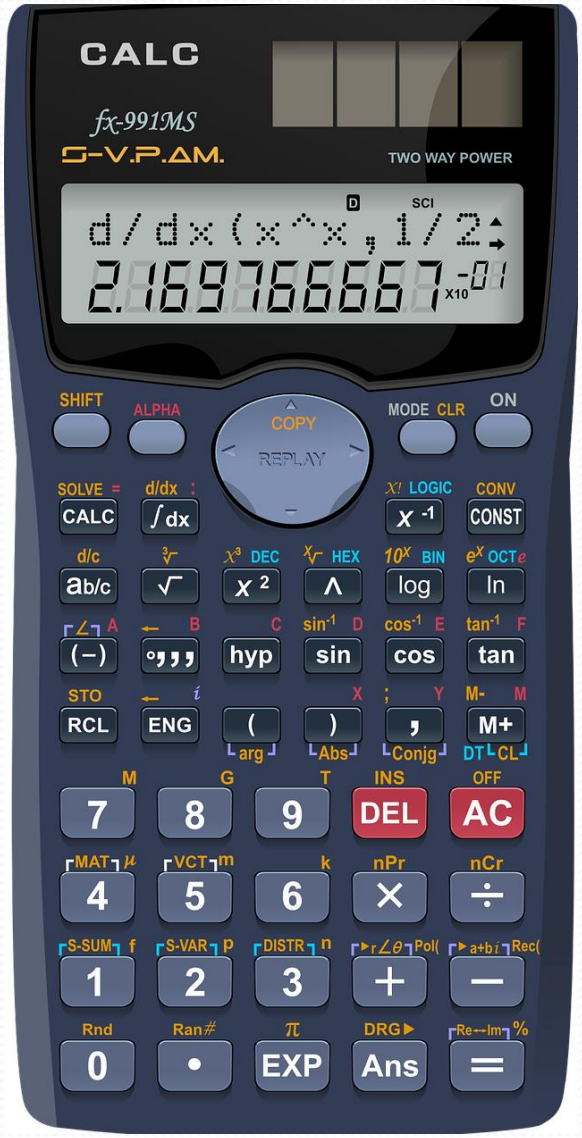
- For every question only one of the formulas can be used.

Formulas: $\sin A = \frac{\text{opposite}}{\text{hypotenuse}}$ $\cos A = \frac{\text{adjacent}}{\text{hypotenuse}}$ $\tan A = \frac{\text{opposite}}{\text{adjacent}}$

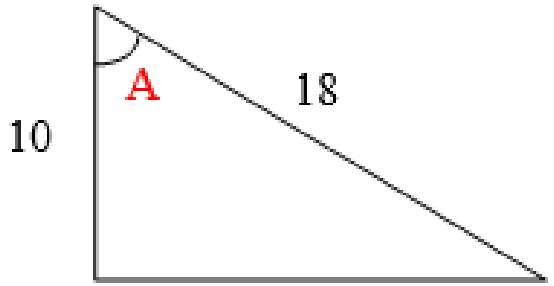
- If you have an angle starting out you will have to subject it to Sin, Cos, or Tan to calculate your answer.
- If you are looking for an angle, your last line will consist of you using Inverse Sin, Inverse Cos, or Inverse Tan against a decimal figure to get your answer.
- For cross multiplying purposes:
- **If x is below the line, swap it over**
- **If x is above the line, just multiply it out**

Calculators

- Different models of calculators have 2nd function buttons in different places. On this model it is the SHIFT button
- Make sure that you become familiar with them by carrying out simple or known calculations.
- Be careful pressing the equals button too many times.
- Inverse Cos or Cos^{-1} press SHIFT Cos to convert decimal number to degrees.



Trigonometry

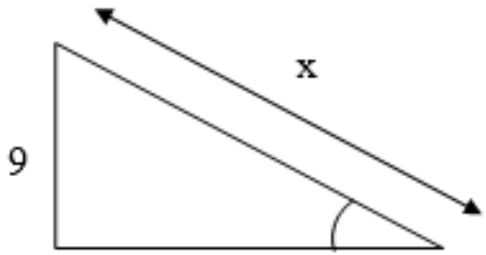


- Example 1: Calculate the angle at A
- **Which two sides do we have in relation to the angle?**
- Adjacent and Hypotenuse
- **Which formula contains these two sides?**

Formula $\cos A = \frac{\text{Adjacent}}{\text{Hypotenuse}}$

- Cosine
- $\cos A = \frac{10}{18}$ $(10 \div 18 = 0.5556)$
- $\cos A = 0.5556$
- $\cos^{-1} A = 56.247$ degrees (inverse of Cos)
- $A = 56.25°$

Trigonometry

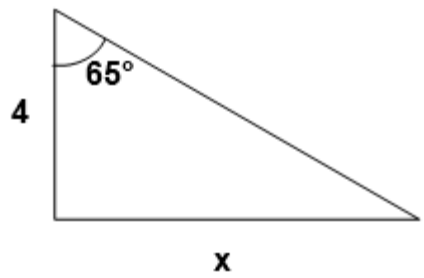


- Example 2: Calculate the length of the unknown side if the given angle is 34°
- **Which two sides do we have in relation to the angle?**
- Opposite and Hypotenuse
- **Which formula contains these two sides?** *Formula* Sine A = $\frac{\text{Opposite}}{\text{Hypotenuse}}$
- Sine
- Sine 34° = $\frac{9}{X}$ (sin 34° = 0.5592)
- 0.5592 = $\frac{9}{X}$
- X = $\frac{9}{0.5592}$
- X = 16.0944

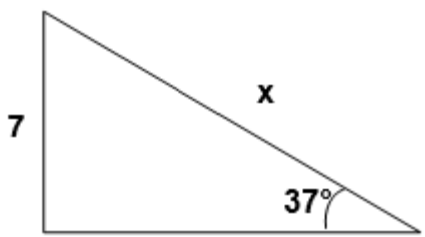
Trigonometry

- Find the Unknown Angle or Side Length

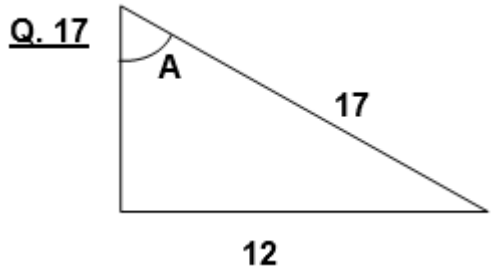
Q. 6



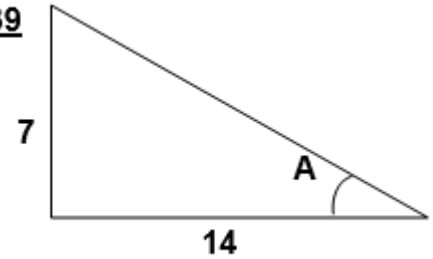
Q. 10



Q. 17

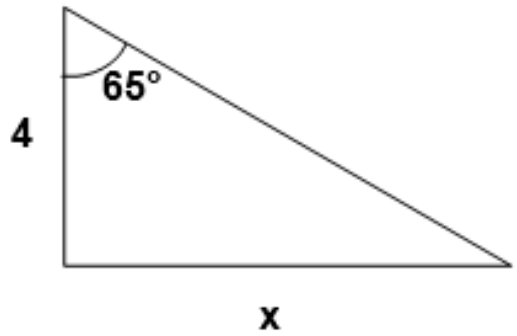


Q. 39



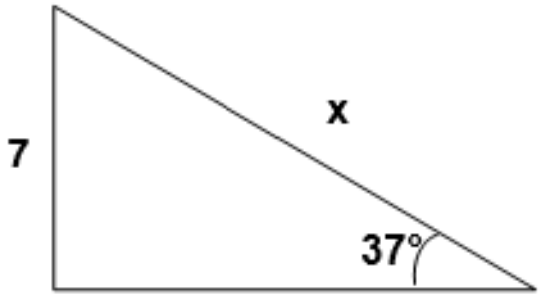
Solutions

Q. 6



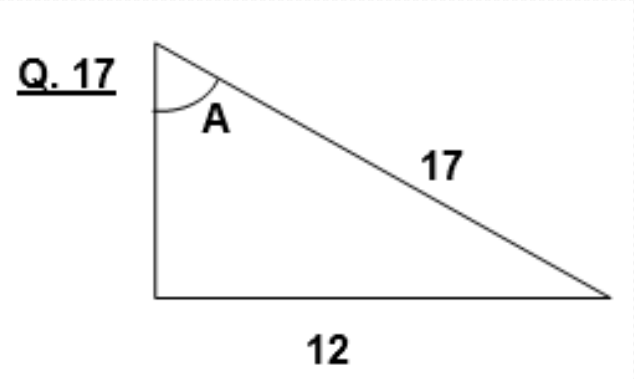
- Tan 65° = X/4
- 2.145 = X/4
- 2.245 x 4 = X
- Answer = 8.578

Q. 10

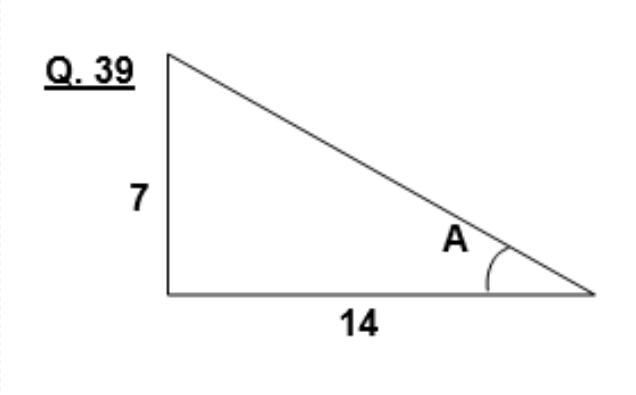


- Sin 37° = 7/X
- 0.6018 = 7/X
- X = 7/0.6018
- Answer 11.63

Solutions



- Sin A = 12/17
- Sin A = 0.7059
- Sin^{-1} A = 44.901
- Answer = 44.9°



- Tan A = 7/14
- Tan A = 0.5
- Tan^{-1} A = 26.565
- Answer 26.57°