

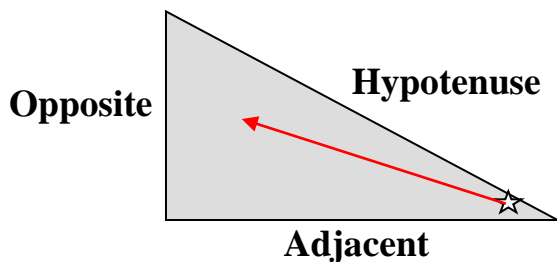
Trigonometry

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.

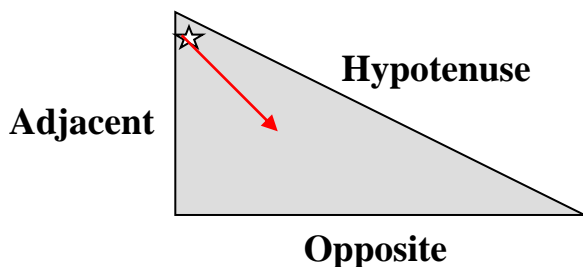
Once there are angles involved you need to use either of three rules: The **SIN, COS**, and the **TAN RULES**

These are three mathematical ratios that were worked out years ago enabling you to transfer from numbers to angles (in the triangle) and also from angles to numbers.

There are three sides to any triangle and you need manipulate these in order to use the sin, cos or tan rules as shown below:



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



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

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

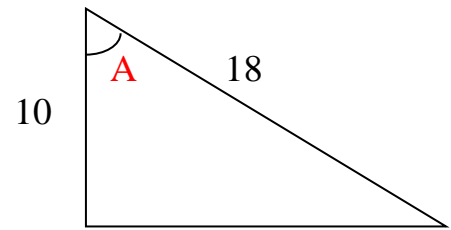
$$\tan A = \frac{\text{Opposite}}{\text{Adjacent}}$$

Remember:

- 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

Trigonometry (Continued)

Example 1: In the following triangle, calculate the angle at A?



Firstly: Which two sides do we have in relation to the angle?

Answer: Adjacent and Hypotenuse

Secondly: Which formula contains these two sides?

Answer: Cosine

Formula: $\text{Cos } A = \frac{\text{Adjacent}}{\text{Hypotenuse}}$

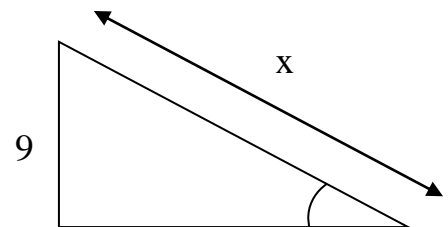
$$\text{Cos } A = \frac{10}{18}$$

$$\text{Cos } A = 0.5556$$

$$\text{Cos}^{-1} A = 56.247 \text{ degrees (inverse of Cos)}$$

$$A = 56.25 \text{ degrees}$$

Example 2: In the following triangle, calculate the length of the unknown side if the given angle is 34 degrees ?



Firstly: Which two sides do we have in relation to the angle?

Answer: Opposite and Hypotenuse

Secondly: Which formula contains these two sides?

Answer: Sine

Formula: $\text{Sin } A = \frac{\text{Opposite}}{\text{Hypotenuse}}$

$$\text{Sin } 34^\circ = \frac{9}{x} \quad (\text{sin } 34^\circ = 0.5592)$$

$$0.5592 = \frac{9}{x}$$

$$x = \frac{9}{0.5592}$$

$$x = 16.0944$$

Trigonometry (Continued)

It will be seen that 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.

(Sometimes you will have to arrive at what the angle is – the three angles in a triangle add up to 180°)

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.

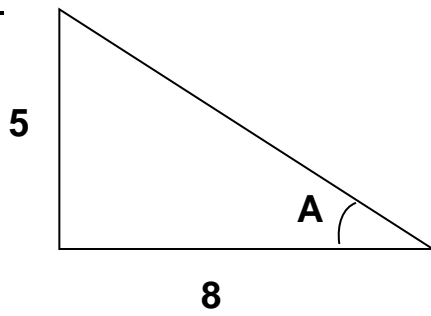
For cross multiplying purposes:

If x is below the line, swap it over

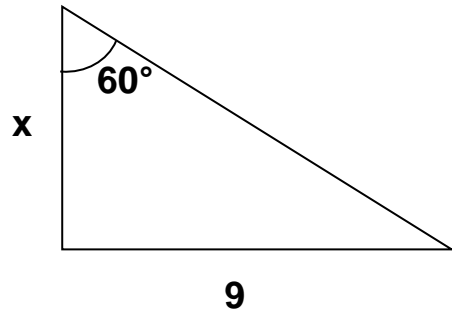
If x is above the line, just multiply it out

Find the Unknown Angle or Side Length (Sheet 1)

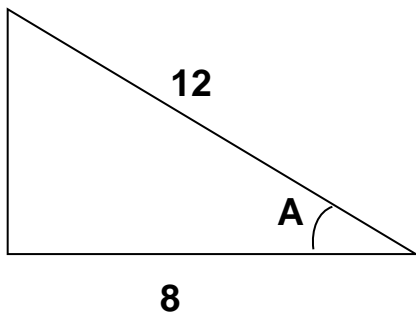
Q. 1



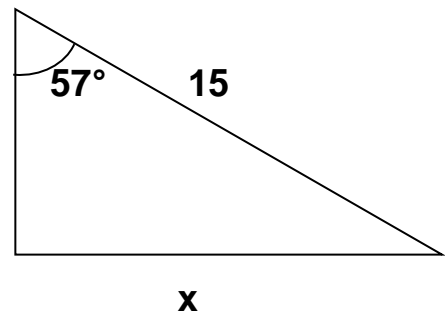
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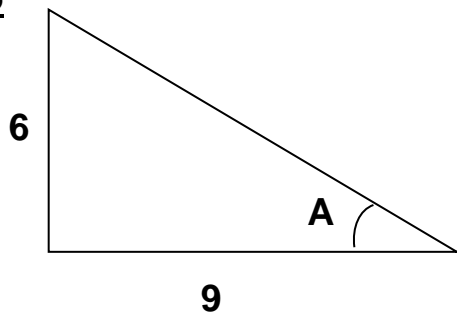
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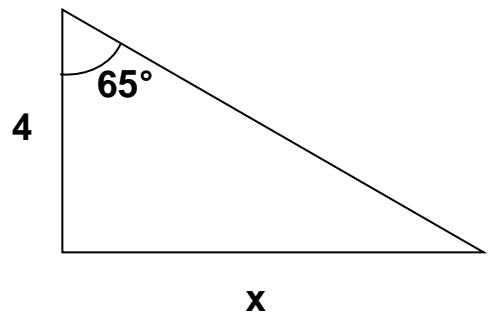
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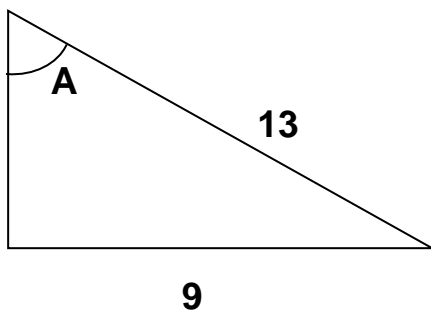
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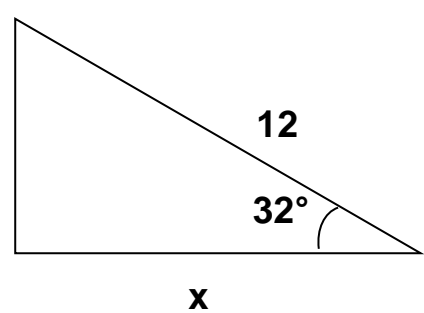
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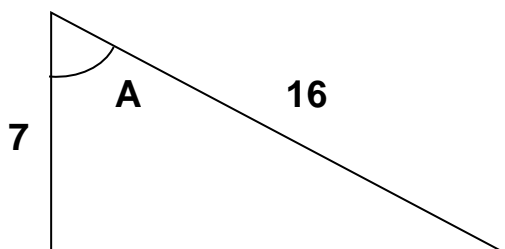
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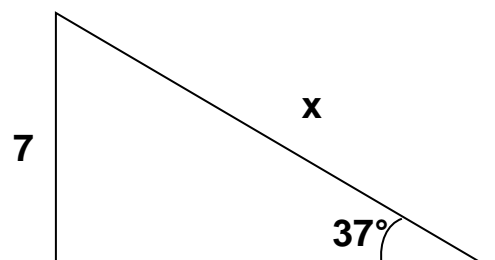
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Q. 9

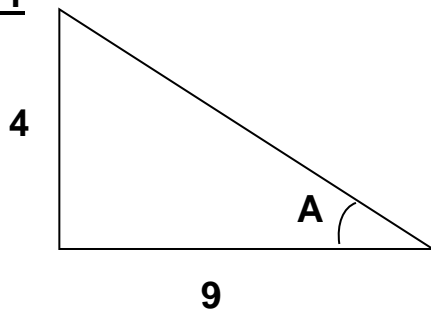


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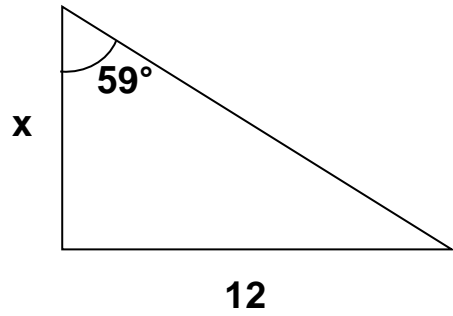


Find the Unknown Angle or Side Length (Sheet 1)

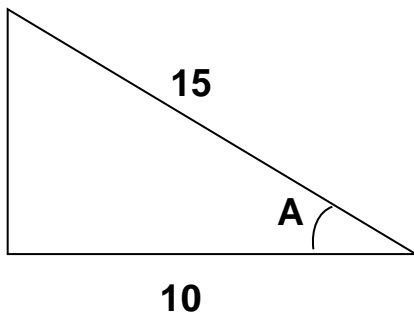
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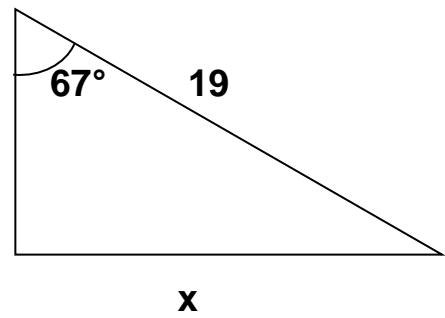
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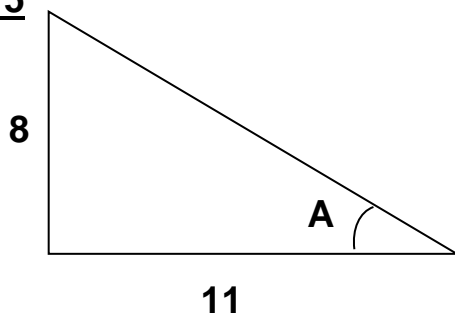
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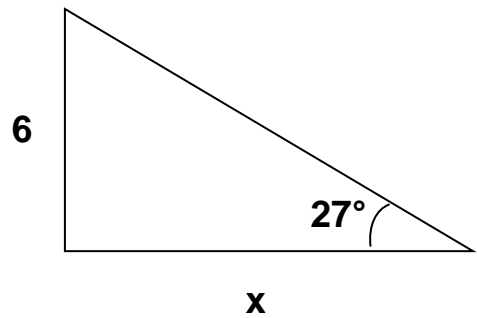
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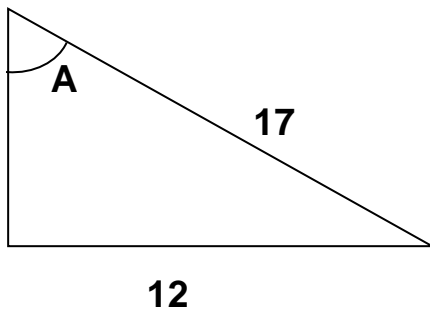
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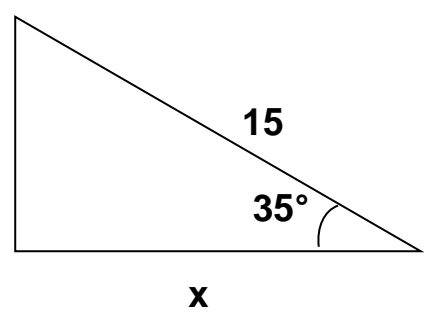
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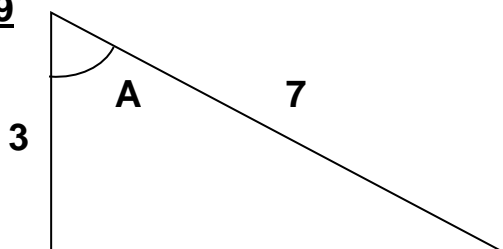
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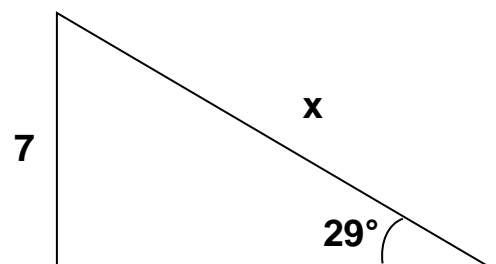
Q. 18



Q. 19



Q. 20



Formulas :	<u>opposite</u>	<u>adjacent</u>	<u>opposite</u>
	Sin A = hypotenuse	Cos A = hypotenuse	Tan A = adjacent

Q. 1 $\frac{5}{8}$
 Tan A = $\frac{5}{8}$
 Tan A = 0.625
 Tan⁻¹ A = 32.005
Answer = 32°

Q. 2 $\frac{9}{9}$
 Tan 60° = $\frac{9}{x}$
 $\frac{9}{1.7321} = x$
 $x = \frac{9}{1.7321}$
Answer = 5.196

Q. 3 $\frac{8}{12}$
 Cos A = $\frac{8}{12}$
 Cos A = 0.6666
 Cos⁻¹ A = 48.1896
Answer = 48.19°

Q. 4 $\frac{x}{15}$
 Sin 57° = $\frac{x}{15}$
 $\frac{x}{0.8387} = 15$
 0.8387 x 15 = x
Answer = 12.58

Q. 5 $\frac{6}{9}$
 Tan A = $\frac{6}{9}$
 Tan A = 0.6666
 Tan⁻¹ A = 33.690
Answer = 33.69°

Q. 6 $\frac{x}{4}$
 Tan 65° = $\frac{x}{4}$
 $\frac{x}{2.145} = 4$
 2.145 x 4 = x
Answer = 8.578

Q. 7 $\frac{9}{13}$
 Sin A = $\frac{9}{13}$
 Sin A = 0.6923
 Sin⁻¹ A = 43.813
Answer = 43.81°

Q. 8 $\frac{x}{12}$
 Cos 32° = $\frac{x}{12}$
 $\frac{x}{0.848} = 12$
 0.848 x 12 = x
Answer = 10.18

Q. 9 $\frac{7}{16}$
 Cos A = $\frac{7}{16}$
 Cos A = 0.4375
 Cos⁻¹ A = 64.0555
Answer = 64.06°

Q.10 $\frac{7}{x}$
 Sin 37° = $\frac{7}{x}$
 $\frac{7}{0.6018} = x$
 $x = 0.6018$
Answer = 11.63

Q. 11 $\frac{4}{23.9625}$
 Tan A = $\frac{4}{23.9625}$
 Tan A = 0.4444
 Tan⁻¹ A = 23.9625
Answer = 23.96°

Q.12 $\frac{12}{x}$
 Tan 59° = $\frac{12}{x}$
 $\frac{12}{1.6643} = x$
 $x = 1.66$
Answer = 7.229

Q.13 $\frac{10}{15}$
 Cos A = $\frac{10}{15}$
 Cos A = 0.6666
 Cos⁻¹ A = 48.1896
Answer = 48.19°

Q.14 $\frac{x}{19}$
 Sin 67° = $\frac{x}{19}$
 $\frac{x}{0.9205} = 19$
 0.9205 x 19 = x
Answer = 17.49

Q.15 $\frac{8}{11}$
 Tan A = $\frac{8}{11}$
 Tan A = 0.7273
 Tan⁻¹ A = 36.0273
Answer = 36.03°

Q. 16 $\frac{6}{x}$
 Tan 27° = $\frac{6}{x}$
 $\frac{6}{0.5095} = x$
 $x = 0.5095$
Answer = 11.776

Q.17 $\frac{12}{17}$
 Sin A = $\frac{12}{17}$
 Sin A = 0.7059
 Sin⁻¹ A = 44.901
Answer = 44.9°

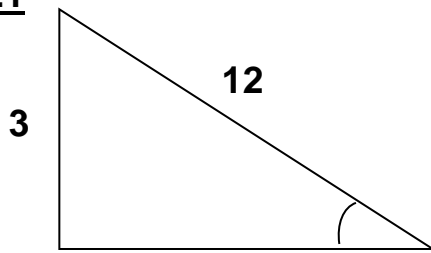
Q.18 $\frac{x}{15}$
 Cos 35° = $\frac{x}{15}$
 $\frac{x}{0.8192} = 15$
 0.8192 x 15 = x
Answer = 12.29

Q. 19 $\frac{3}{7}$
 Cos A = $\frac{3}{7}$
 Cos A = 0.4286
 Cos⁻¹ A = 64.623
Answer = 64.62°

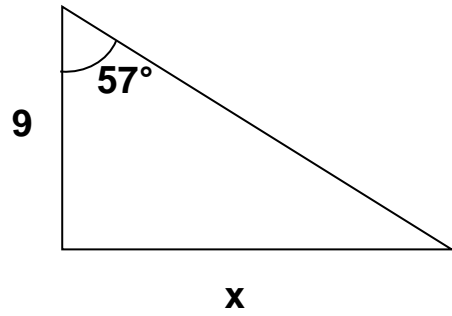
Q.20 $\frac{7}{x}$
 Sin 29° = $\frac{7}{x}$
 $\frac{7}{0.4848} = x$
 $x = 0.4848$
Answer = 14.44

Find the Unknown Angle or Side Length (Sheet 2)

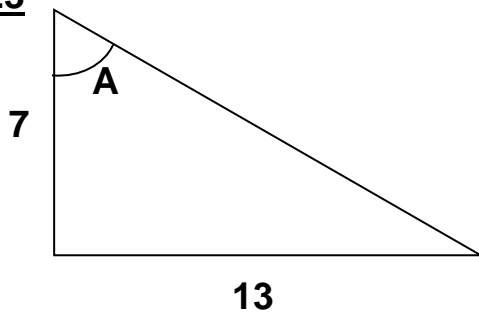
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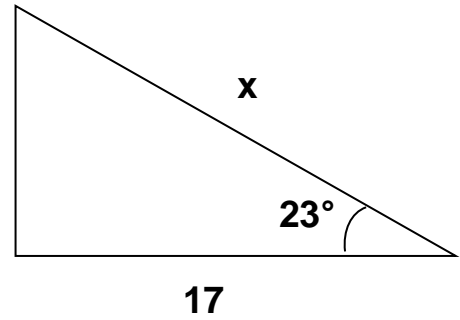
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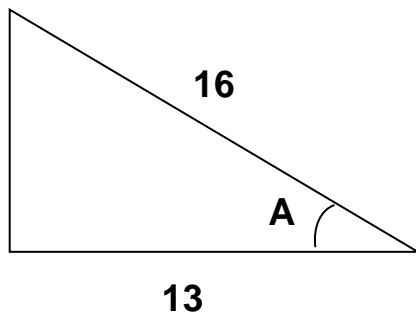
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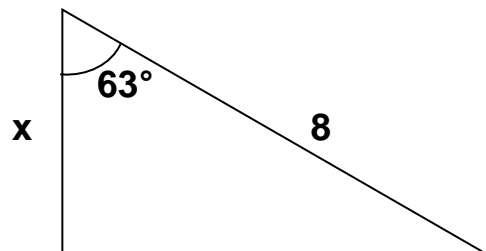
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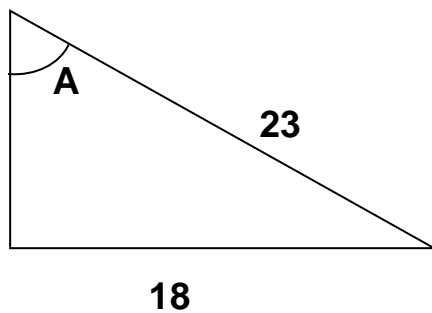
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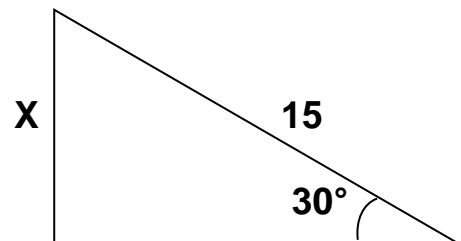
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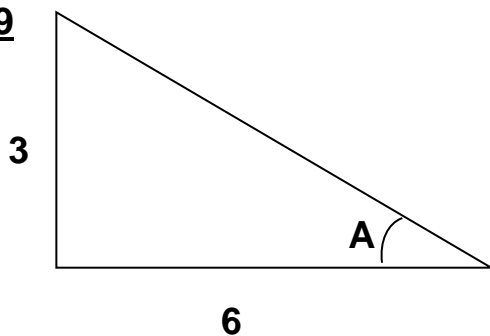
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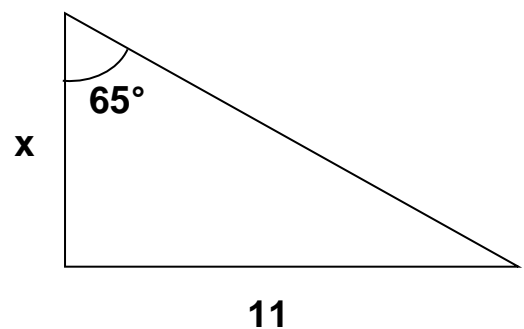
Q. 28



Q. 29

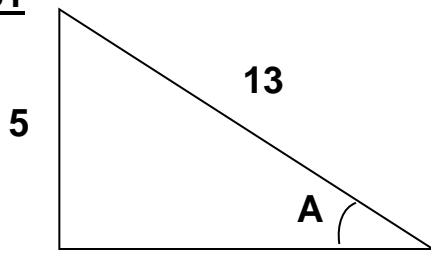


Q. 30

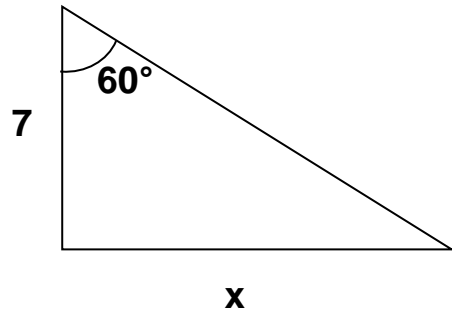


Find the Unknown Angle or Side Length (Sheet 2)

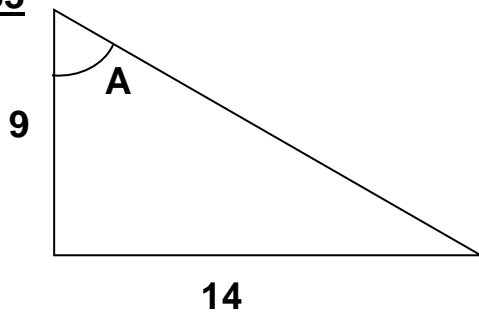
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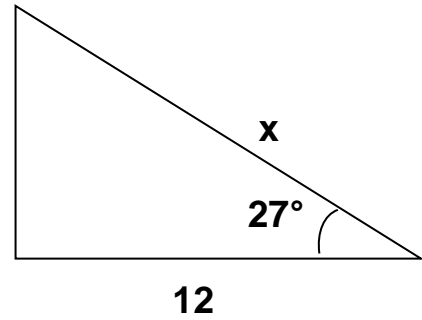
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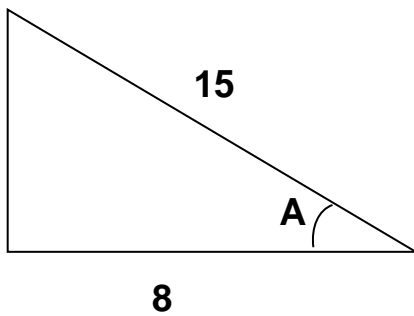
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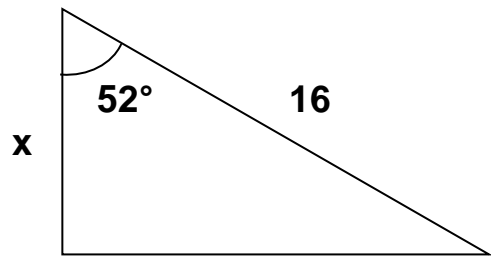
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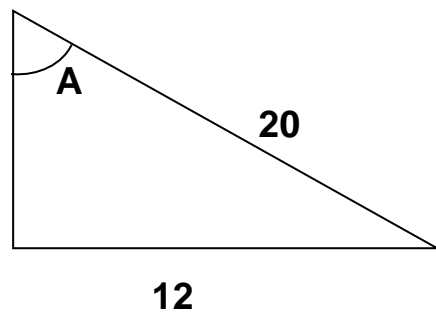
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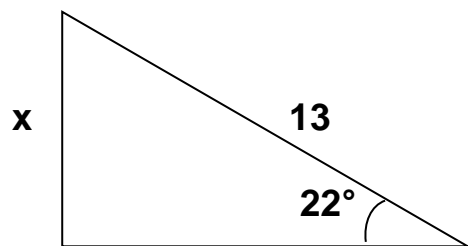
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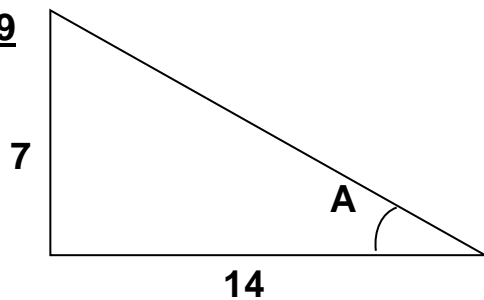
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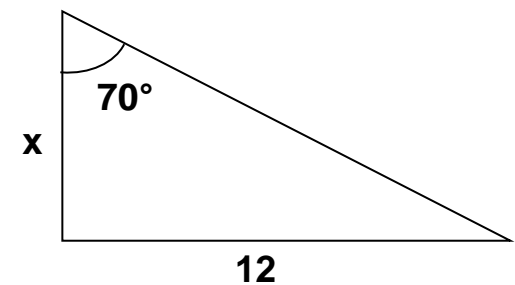
Q. 38



Q. 39



Q. 40



Formulas :	<u>opposite</u>	<u>adjacent</u>	<u>opposite</u>
	Sin A = hypotenuse	Cos A = hypotenuse	Tan A = adjacent

Q. 21 $\frac{3}{x}$
 Sin A = $\frac{3}{x}$
 Sin A = 0.25
 Sin⁻¹ A = 14.478
Answer = 14.48°

Q. 22 $\frac{x}{9}$
 Tan 57° = $\frac{x}{9}$
 $1.540 = \frac{x}{9}$
 1.540 x 9 = x
Answer = 13.86

Q. 23 $\frac{13}{7}$
 Tan A = $\frac{13}{7}$
 Tan A = 1.857
 Tan⁻¹ A = 61.7
Answer = 61.7°

Q. 24 $\frac{17}{x}$
 Cos 23° = $\frac{17}{x}$
 0.9205 = $\frac{17}{x}$
 $x = \frac{17}{0.9205}$
Answer = 18.468

Q. 25 $\frac{13}{16}$
 Cos A = $\frac{13}{16}$
 Cos A = 0.8125
 Cos⁻¹ A = 35.659
Answer = 35.66°

Q. 26 $\frac{x}{8}$
 Cos 63° = $\frac{x}{8}$
 0.454 = $\frac{x}{8}$
 0.454 x 8 = x
Answer = 3.632

Q. 27 $\frac{18}{x}$
 Sin A = $\frac{18}{x}$
 Sin A = 0.7826
 Sin⁻¹ A = 51.5
Answer = 51.5°

Q. 28 $\frac{x}{15}$
 Sin 30° = $\frac{x}{15}$
 0.5 = $\frac{x}{15}$
 0.5 x 15 = x
Answer = 7.5

Q. 29 $\frac{3}{6}$
 Tan A = $\frac{3}{6}$
 Tan A = 0.5
 Tan⁻¹ A = 26.565
Answer = 26.57°

Q.30 $\frac{11}{x}$
 Tan 65° = $\frac{11}{x}$
 2.1445 = $\frac{11}{x}$
 $x = \frac{11}{2.1445}$
Answer = 5.129

Q. 31 $\frac{5}{13}$
 Sin A = $\frac{5}{13}$
 Sin A = 0.3846
 Sin⁻¹ A = 22.62
Answer = 22.62°

Q.32 $\frac{x}{7}$
 Tan 60° = $\frac{x}{7}$
 1.732 = $\frac{x}{7}$
 $x = 1.732 \times 7$
Answer = 12.124

Q.33 $\frac{14}{9}$
 Tan A = $\frac{14}{9}$
 Tan A = 1.556
 Tan⁻¹ A = 57.265
Answer = 57.27°

Q.34 $\frac{12}{x}$
 Cos 27° = $\frac{12}{x}$
 0.891 = $\frac{12}{x}$
 $x = \frac{12}{0.891}$
Answer = 13.468

Q.35 $\frac{8}{15}$
 Cos A = $\frac{8}{15}$
 Cos A = 0.5333
 Cos⁻¹ A = 57.77
Answer = 57.77°

Q. 36 $\frac{x}{16}$
 Cos 52° = $\frac{x}{16}$
 0.6157 = $\frac{x}{16}$
 $x = 0.6157 \times 16$
Answer = 9.85

Q.37 $\frac{12}{20}$
 Sin A = $\frac{12}{20}$
 Sin A = 0.6
 Sin⁻¹ A = 36.87
Answer = 36.87°

Q.38 $\frac{x}{13}$
 Sin 22° = $\frac{x}{13}$
 0.3746 = $\frac{x}{13}$
 0.3746 x 13 = x
Answer = 4.87

Q. 39 $\frac{7}{14}$
 Tan A = $\frac{7}{14}$
 Tan A = 0.5
 Tan⁻¹ A = 26.565
Answer = 26.57°

Q.40 $\frac{12}{x}$
 Tan 70° = $\frac{12}{x}$
 2.747 = $\frac{12}{x}$
 $x = \frac{12}{2.747}$
Answer = 4.368