# Solving Other Equations

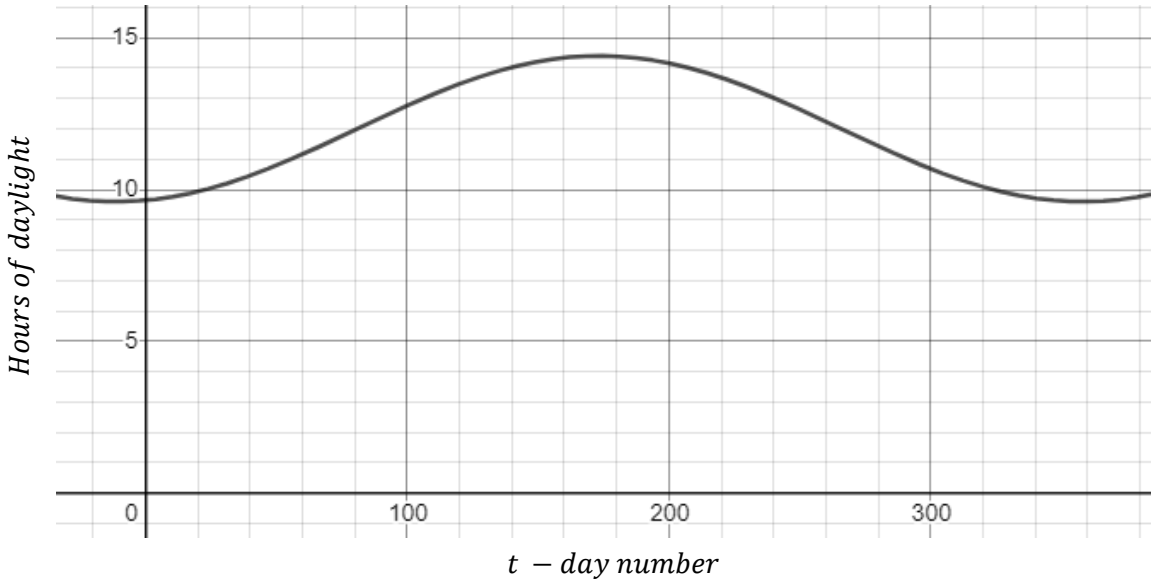
## Did you know?

Sunrise and sunset times are modelled using trigonometrical equations

For San Diego, California, a simple equation to model daylight hours would be:

Number of daylight hours $= 2.4\sin(0.017t - 1.377) + 12$

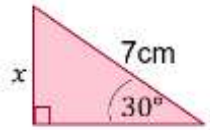
where $t$ is the day of year from 0 to 365



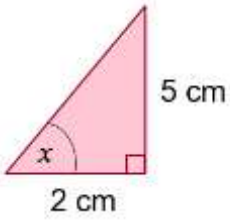

- From the graph can you tell which dates of the year are the shortest and longest day?

# Solving Equations with Trigonometry

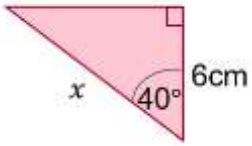
1. Calculate the length of the side marked $x$ in this triangle.



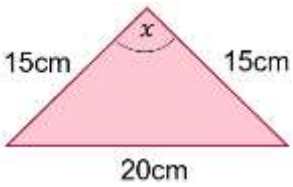

2. Calculate the value of the angle marked $x$ in this triangle.



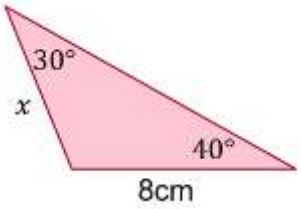

3. Calculate the value of the side marked $x$ in this triangle



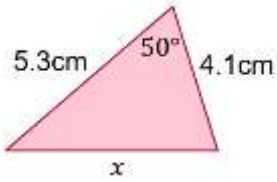

4. Calculate the value of the angle marked $x$ in this triangle.



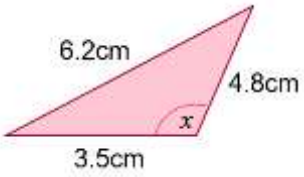

5. Calculate the value of the side marked $x$ in this triangle



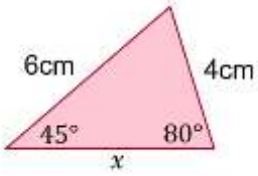

6. Calculate the value of the side marked $x$ in this triangle.




7. Calculate the value of the angle marked $x$ in this triangle.




8. Calculate the value of the side marked $x$ in this triangle.

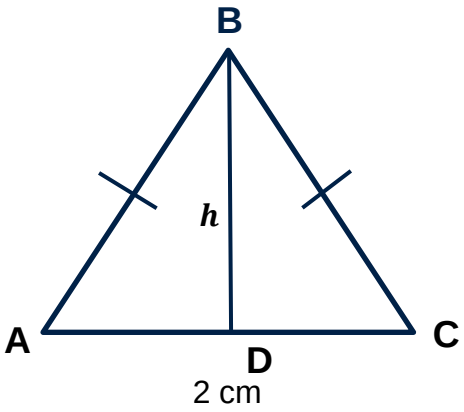


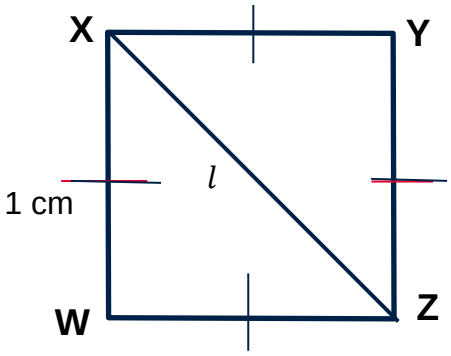

# Other Equations

**Solve the following**

1. $3^x = 243$
2. $2^{2x+3} = 128$ **Hint:** write 128 as powers of 2
3. $\sqrt{x+3} = 7$
4. $2\sqrt{x} + 1 = \sqrt{12} + 3$
5. $3\sqrt{x} + 12 = 7\sqrt{x}$
6. $\sin x = \frac{1}{2} \quad 0 \leq x \leq 360$
7. $\cos x = 0.866 \quad 0 \leq x \leq 360$
8. $\frac{8}{3x+7} = 2$

## Missing info




| | Answer |
|---|---|
| Length of AB | |
| Length of BD | |
| Length of AD | |
| Size of $\angle BAD$ | |
| Size of $\angle ABD$ | |

| | Answer |
|---|---|
| Length of WZ | |
| Length of XZ | |
| Size of $\angle WZX$ | |
| Size of $\angle WXZ$ | |

Use your knowledge of regular shapes to complete the tables above (you will need them for the next task).

## Let's get Triggy

Use your tables and diagrams from the previous activity to complete this table

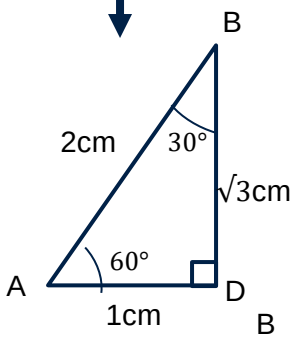
| $\boldsymbol{\theta}$ | $\mathbf{30°}$ | $\mathbf{45°}$ | $\mathbf{60°}$ |
|---|---|---|---|
| $\boldsymbol{sin\theta}$ | $\frac{\quad}{AB} = \frac{1}{2}$ | $\frac{XW}{\quad} = \frac{WZ}{XZ} = \frac{\quad}{\quad}$ | $\frac{\quad}{AB} = \frac{\quad}{\quad}$ |
| $\boldsymbol{cos\theta}$ | $\frac{\quad}{\quad} = \frac{\sqrt{3}}{\quad}$ | $\frac{\quad}{\quad} = \frac{WZ}{\quad} = \frac{\quad}{\quad}$ | $\frac{\quad}{\quad} = \frac{\quad}{\quad}$ |
| $\boldsymbol{tan\theta}$ | $\frac{\quad}{\quad} = \frac{\quad}{\sqrt{3}}$ | $\frac{\quad}{\quad} = \frac{\quad}{\quad} = 1$ | $\frac{\quad}{\quad} = \frac{\quad}{1} = \sqrt{\quad}$ |

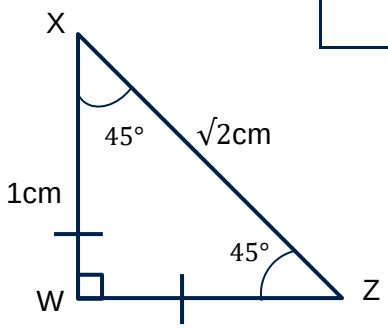
## Let's get Triggy Hint

Use your tables and diagrams from the previous activity to complete this table

Some examples are filled in to get you started

These will help




| $\theta$ | $30°$ | $45°$ | $60°$ |
|---|---|---|---|
| $\sin\theta =$ | $\frac{AD}{AB} = \frac{1}{2}$ | $\frac{XW}{\quad} = \frac{WZ}{XZ} = \frac{\quad}{\quad}$ | $\frac{\quad}{AB} = \frac{\sqrt{3}}{\quad}$ |
| $\cos\theta =$ | $\frac{\quad}{\quad} = \frac{\sqrt{3}}{\quad}$ | $\frac{\quad}{\quad} = \frac{WZ}{XW} = \frac{\quad}{\quad}$ | $\frac{AD}{AB} = \frac{\quad}{\quad}$ |
| $\tan\theta =$ | $\frac{\quad}{\quad} = \frac{\quad}{\sqrt{3}}$ | $\frac{\quad}{\quad} = \frac{\quad}{\quad} = 1$ | $\frac{\quad}{\quad} = \frac{\quad}{1} = \sqrt{\quad}$ |

## Trig Maze

Starting at $\sqrt{3}$ on the left hand side of the rectangle, find your way to the right hand side by landing only on expressions that are equivalent to $\sqrt{3}$

| | | | | | | |
|---|---|---|---|---|---|---|
| $\frac{\tan 30°}{3}$ | $\frac{9}{3^{0.5}}$ | $\frac{\sqrt{18}}{\sqrt{6}}$ | $\frac{1.5}{0.05}$ | $\frac{\sqrt{12}}{\sqrt{2}}$ | $\frac{2\sqrt{6}}{\sqrt{4}}$ | $\frac{\sqrt{9}}{3^0}$ |
| $\frac{\sqrt{27}}{3}$ | $\frac{3\sqrt{3}}{\sqrt{3}}$ | $2\cos 60°$ | $\frac{\tan 60°}{2}$ | $\frac{\sin 30°}{\cos 30°}$ | $3\tan 30°$ | $\frac{\sqrt{6}}{\sqrt{2}}$ |
| $\frac{6}{\sqrt{2}}$ | $\frac{\cos 60°}{\sin 60°}$ | $\frac{9}{3\sqrt{3}}$ | $\frac{3}{\sqrt{3}}$ | $2\cos 30°$ | $\frac{3+\sqrt{3}}{\sqrt{3}}$ -1 | $3\tan 60°$ |
| $\sqrt{3}$ | $\frac{9}{\sqrt{3}}$ | $2\sin 60°$ | $\frac{\sqrt{9}}{3}$ | $\frac{\sqrt{9}}{\sqrt{3}}$ | $\frac{\sqrt{6}}{2}$ | $\frac{\cos 30°}{2}$ |
| $3^{\frac{1}{2}}$ | $\tan 60°$ | $\frac{\sqrt{12}}{2}$ | $2\sin 30°$ | $\frac{\sin 60°}{\cos 60°}$ | $\frac{9^{0.5}}{3^{0.5}}$ | $\frac{2\sqrt{6}}{\sqrt{8}}$ |
| $\frac{\cos 60°}{2}$ | $\frac{\sqrt{12}}{4}$ | $\frac{\sin 30°}{2}$ | $\frac{\sqrt{9}}{3}$ | $\frac{\tan 60°}{3}$ | $\frac{9 \times 10^1}{3 \times 10^{-1}}$ | $\frac{3+\sqrt{3}}{\sqrt{3}}$ |

## Triggy Problems

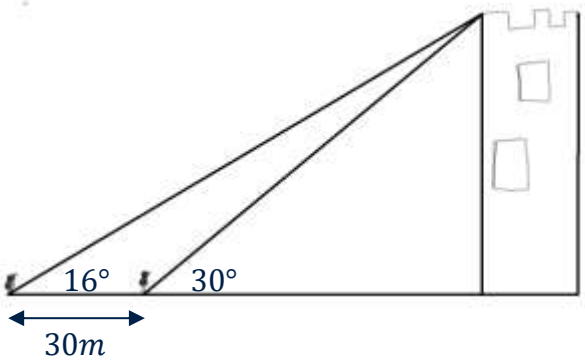
1. The area of an equilateral triangle is $10\ cm^2$.

   What are the lengths of the sides?

2. Two birds are sitting looking at the top of a tower block, as shown in the diagram

   They are 30m apart.

   How tall is the tower?




## Multiple Equations

If $\frac{ab}{a+b} = \frac{1}{4}$ and $\frac{bc}{b+c} = \frac{1}{2}$ and $\frac{ac}{a+c} = \frac{1}{8}$ find $a$, $b$ and $c$

Hint:

- Rearrange these equations so they are linear i.e. no fractions
- Find an expression for $b$ and $c$ in terms of $a$
- Substitute into the equation that uses $b$ and $c$

## Powers

Using what you know about powers, can you solve this equation

$$(x-6)^{x^2-9}=1$$

Hint

- What do you know about $a^0$
- What do you know about $1^a$
- What do you know about $(-1)^a$

## Geometry Puzzle