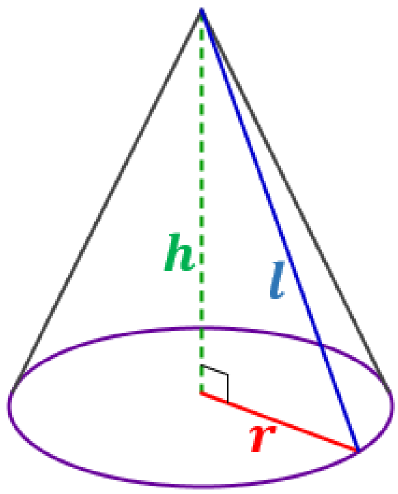
Surface Area of a Cone

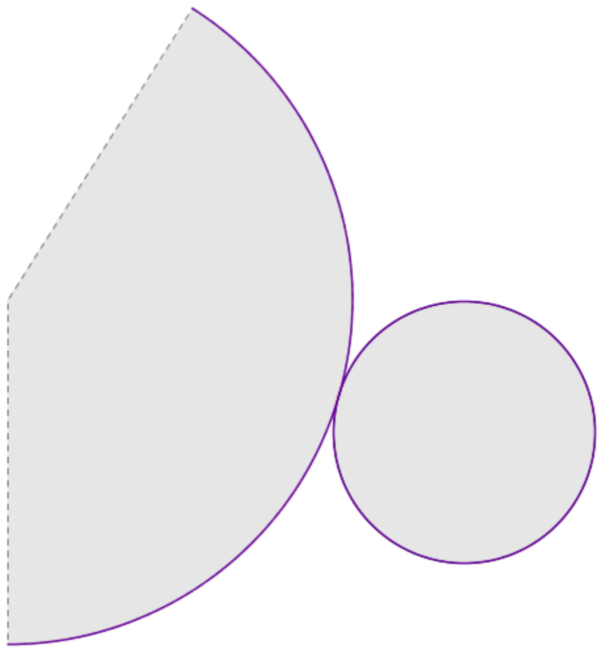
The surface area of a cone is given by:

$$SA = \pi r^2 + \pi r l$$



Where r is the radius of the base, and l is the slant height. l is linked to h and r by Pythagoras.

By considering the net of a cone, prove that the area of the curved face is $\pi r l$:



- The small circle is the base of the cone.
- The large sector curls around so the arc exactly matches the circumference of the base circle.
- The dotted lines represent the slant height, since the point where they meet is the apex of the cone.

Note: If you know the *perpendicular* height h rather than the slant height l, you can use Pythagoras to find l first: $r^2 + h^2 = l^2$.

Radius of the sector:	
Circumference of a full circle with this radius:	
Area of a full circle with this radius:	

To match up with the base circumference, the arc length of the sector must be equal to:	
The *proportion* of a full circle taken up by the sector must therefore be:	
The **area of the sector** is therefore equal to:	

(this expression gives the area of the curved surface of the cone)

Surface Area of a Cone SOLUTIONS

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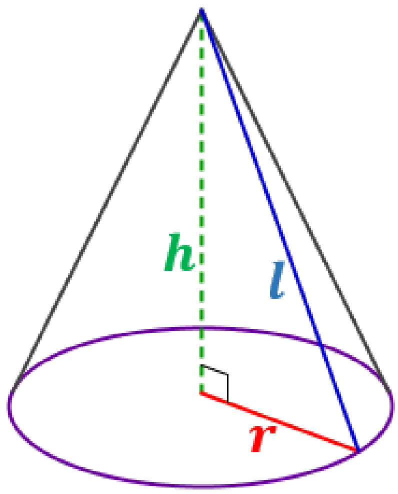

Where r is the radius of the base, and l is the slant height. l is linked to h and r by Pythagoras.

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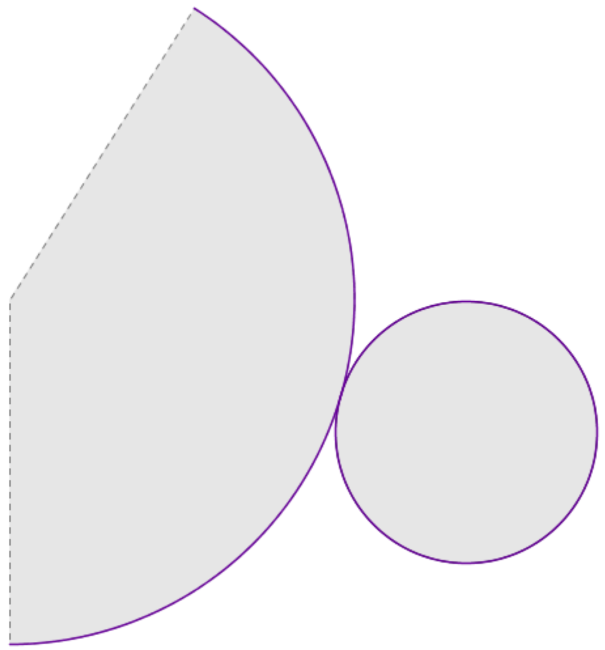

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Radius of the sector:	l
Circumference of a full circle with this radius:	$2\pi l$
Area of a full circle with this radius:	πl^2

To match up with the base circumference, the *arc length* of the sector must be equal to:	$2\pi r$
The *proportion* of a full circle taken up by the sector must therefore be:	$\frac{2\pi r}{2\pi l} = \frac{r}{l}$
The **area of the sector** is therefore equal to:	$\frac{r}{l} \times \pi l^2 = \boldsymbol{\pi r l}$

Combining this with the area of the base (πr^2) gives the overall surface area: $\boldsymbol{\pi r^2 + \pi r l}$.