Surface Area of a Cone

The surface area of a cone is given by:

\[ SA = \pi r^2 + \pi rl \]

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 \( \pi rl \):

- 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: \( r^2 + h^2 = l^2 \).

<table>
<thead>
<tr>
<th>Radius of the sector:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circumference of a full circle with this radius:</td>
</tr>
<tr>
<td>Area of a full circle with this radius:</td>
</tr>
</tbody>
</table>

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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<th>Radius of the sector:</th>
<th>( l )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circumference of a full circle with this radius:</td>
<td>( 2\pi l )</td>
</tr>
<tr>
<td>Area of a full circle with this radius:</td>
<td>( \pi l^2 )</td>
</tr>
</tbody>
</table>

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:

\[ \frac{r}{l} \times \pi l^2 = \pi rl \]

Combining this with the area of the base (\( \pi r^2 \)) gives the overall surface area: \( \pi r^2 + \pi rl \).