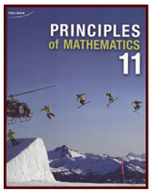

For further information about surface area and scale factor see pp. 496 to 498 of *Principles of Mathematics 11*.

Practice Run

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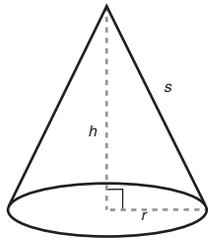
Tipis protected nomadic people from the elements for years. For large families, these cone shaped dwellings often had a floor diameter of $9\frac{1}{3}$ metres and a height of $8\frac{2}{3}$ metres. For smaller families, these cone shaped dwellings were often reduced to having a floor diameter of 7 metres and a height of $5\frac{1}{4}$ metres.



1. Determine the scale factor.

2. Determine the surface area of the original, larger tipi including the floor.

3. What is the surface area of a tipi that has all dimensions that are half the size of the original, larger tipi?

Check your answers.

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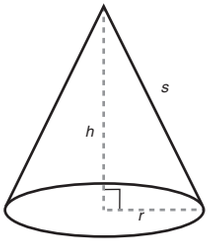
Tipis protected nomadic people from the elements for years. For large families, these cone shaped dwellings often had a floor diameter of $9\frac{1}{3}$ metres and a height of $8\frac{2}{3}$ metres. For smaller families, these cone shaped dwellings were often reduced to having a floor diameter of 7 metres and a height of $5\frac{1}{4}$ metres.



1. Determine the scale factor.

$$k = \frac{7}{9\frac{1}{3}}$$

$$k = 7 \div 9\frac{1}{3}$$

$$k = 7 \div \frac{28}{3}$$

$$k = 7 \times \frac{3}{28}$$

$$k = \frac{21}{28}$$

$$k = \frac{3}{4}$$

The scale factor is $\frac{3}{4}$.

2. Determine the surface area of the original, larger tipi including the floor.

$SA_{cone} = \pi r^2 + \pi rs$

Determine the slant height, s, of the larger tipi using Pythagorean's Theorem.

$$r = 9\frac{1}{3} \div 2$$
$$r = \frac{28}{3} \times \frac{1}{2}$$
$$r = \frac{28}{6}$$
$$r = \frac{14}{3}$$

$$s^2 = h^2 + r^2$$
$$s^2 = \left(8\frac{2}{3}\right)^2 + \left(\frac{14}{3}\right)^2$$
$$s^2 = \left(\frac{26}{3}\right)^2 + \left(\frac{14}{3}\right)^2$$
$$s^2 = \frac{676}{9} + \frac{196}{9}$$
$$s^2 = \frac{872}{9}$$
$$\sqrt{s^2} = \sqrt{\frac{872}{9}}$$
$$s = \frac{\sqrt{872}}{3} = \frac{\sqrt{2^2 \cdot 218}}{3}$$
$$s = \frac{2\sqrt{218}}{3} \text{ m}$$

Determine the surface area of the original, larger tipi.

$$SA = \pi r^2 + \pi rs$$
$$SA = \pi\left(\frac{14}{3}\right)^2 + \pi\left(\frac{14}{3}\right)\left(\frac{2\sqrt{218}}{3}\right)$$
$$SA = \left(\frac{196}{9}\right)\pi + \left(\frac{28\sqrt{218}}{9}\right)\pi$$
$$SA = \frac{196 + 28\sqrt{218}}{9}\pi$$
$$SA \doteq 212.7 \text{ m}^2$$

The surface area of the original, larger tipi is 212.7 m^2.

3. What is the surface area of a tipi that has all dimensions that are half the size of the original, larger tipi?

$SA \doteq 212.7 \text{ m}^2$ and $k = \frac{1}{2}$

$$SA_{\text{half size tipi}} = SA_{\text{original tipi}} \times (\text{scale factor})^2$$
$$SA_{\text{half size tipi}} \doteq 212.7 \times \left(\frac{1}{2}\right)^2$$
$$SA_{\text{half size tipi}} \doteq 53.2 \text{ m}^2$$

The surface area of the smaller tipi is approximately 53.2 m^2.