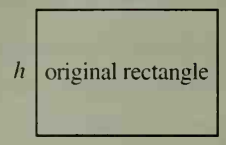
We can generalize the situation described in Example 1. Suppose the base of a rectangle is multiplied by a factor of c.



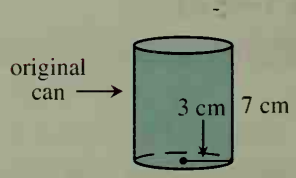
$P = 2b + 2h$
$A = bh$

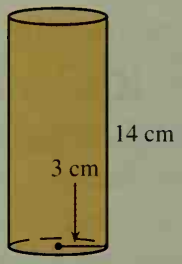
$P = 2(cb) + 2h = 2cb + 2h \neq c(2b + 2h)$
$A = cb(h) = c \cdot bh$

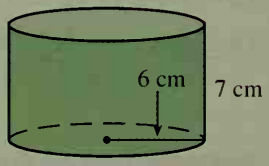
Notice that the area is multiplied by a factor of c, but the perimeter is not.

Example 2 A manufacturer of cans wants to double the volume of a can with radius 3 cm and height 7 cm. If the height is doubled, will the volume double? If the radius is doubled, will the volume double?

Solution







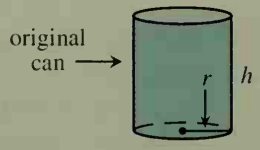
$V = \pi r^2 h$
$= \pi \cdot 3^2 \cdot 7$
$= 63\pi$

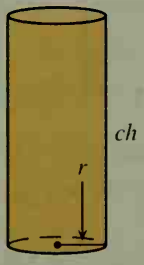
$V = \pi r^2 h$
$= \pi \cdot 3^2 \cdot 14$
$= 126\pi$

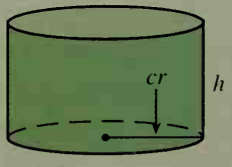
$V = \pi r^2 h$
$= \pi \cdot 6^2 \cdot 7$
$= 252\pi$

Doubling the height doubles the volume. Doubling the radius increases the volume by a factor of 4.

Again, we can generalize the situation described in Example 2. Suppose that a cylinder has radius r and height h. First the height is multiplied by a factor of c. Then the radius is multiplied by a factor of c.







$V = \pi r^2 h$

$V = \pi r^2 (ch)$
$= c \cdot \pi r^2 h$

$V = \pi (cr)^2 h$
$= c^2 \cdot \pi r^2 h$

If the height is multiplied by c, then the volume is also multiplied by c.
If the radius is multiplied by c, then the volume is multiplied by c^2.