

72. a. A Norman window is shaped like a rectangle whose length is twice its width, surmounted by a semicircle. Write a polynomial that gives its area.
 b. If $x = 3$ feet, find the area of the window.
73. a. A grain silo is built in the shape of a cylinder with a hemisphere on top. Write an expression for the volume of the silo in terms of the radius and height of the cylindrical portion.
 b. If the total height of the silo is five times its radius, write a polynomial in one variable for its volume.
74. a. A cold medication capsule is made in the form of a cylinder with a hemispherical cap on each end. Write an expression for the volume of the capsule in terms of the radius and length of the cylindrical portion.
 b. If the radius of the capsule is one-fourth of its overall length, write a polynomial in one variable for its volume.

1.3

PRODUCTS

Products of Monomials

Consider the following examples of products:

1. $x^2x^3 = (xx)(xxx) = xxxxx = x^5$;
2. $(x^2)^3 = (x^2)(x^2)(x^2) = (xx)(xx)(xx) = x^6$;
3. $(xy)^3 = (xy)(xy)(xy) = (xxx)(yyy) = x^3y^3$.

These calculations suggest the three laws of exponents, which are used to simplify products of powers.

For all natural numbers m and n ,

$$a^m a^n = a^{m+n}, \quad (1)$$

$$(a^m)^n = a^{mn}, \quad (2)$$

and

$$(ab)^n = a^n b^n. \quad (3)$$