Pre-Algebra

Worksheet 8 Powers, Exponents and Square Roots, Solutions

- *Simplify the following expressions leaving no negative exponents:*

$$\frac{2a^5b^3a}{b^5} = 2a^{5+1}b^{3-5} = 2a^6b^{-2} = \frac{2a^6}{b^2} \tag{1}$$

$$\frac{3x^{-2}}{6xy^3} = \frac{3}{6}x^{-2-1}y^{-3} = \frac{1}{2}x^{-3}y^{-3} = \frac{1}{2x^3y^3} \tag{2}$$

$$(-8x^3)^2 = (-8)^2(x^3)^2 = 64x^6 \tag{3}$$

$$\frac{(2y^3)^2}{4(y^2x)^3} = \frac{2^2(y^3)^2}{4(y^2)^3x^3} = \frac{4y^6}{4y^6x^3} = \frac{y^{6-6}}{x^3} = \frac{y^0}{x^3} = \frac{1}{x^3} \tag{4}$$

$$\left(\frac{3n^{-4}}{m^7}\right)^3 = \frac{3^3(n^{-4})^3}{(m^7)^3} = \frac{27n^{-12}}{m^{21}} = \frac{27}{n^{12}m^{21}} \tag{5}$$

$$(5xy)^3(z^{-2})^{-3} = 5^3x^3y^3z^6 = 125x^3y^3z^6 \quad \text{or} \quad (5xyz^2)^3 \tag{6}$$

$$\frac{12^3}{2^69} = \frac{(4\times 3)^3}{2^63^2} = \frac{(2^23)^3}{2^63^2} = \frac{(2^2)^33^3}{2^63^2} = \frac{2^63^3}{2^63^2} = 2^{6-6}3^{3-2} = 2^03^1 = 1\times 3 = 3 \tag{7}$$

$$\frac{15^33^{-3}}{25} = \frac{(5\times 3)^33^{-3}}{5^2} = \frac{5^33^33^{-3}}{5^2} = 5^{3-2}3^{3-3} = 5^13^0 = 5\times 1 = 5 \tag{8}$$

- *Write in scientific notation*:

$$0.0031 = 3.1\times 10^{-3} \tag{9}$$

$$314\times 100,000,000 = 3.14\times 10^2\times 10^8 = 3.14\times 10^{10} \tag{10}$$

$$(5\times 10^{11})(2.9\times 10^{-3}) = 5\times 2.9\times 10^{11-3} = 14.5\times 10^8 \tag{11}$$

- *Word problems:*

1.

$$1\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2} = \left(\frac{1}{2}\right)^7 = \frac{1}{128} \tag{12}$$

2. n: number of years
   $4^n = 64 = 4 \times 4 \times 4 = 4^3$
   $n = 3$, so the answer is 3 years

3. For a square piece of land the width is equal to the length: $w = l$
   Area $= w \times l = w \times w = w^2 = 64$
   $w = \sqrt{64} = 8$
   Surrounding: $4 \times w = 4 \times 8 = 32$ meters

4. A human body has 0.6×100 kg of water. In grams this is:
   $0.6 \times 100 \times 10^3 = 6 \times 10^{-1} \times 10^2 \times 10^3 = 6 \times 10^{-1+2+3} = 6 \times 10^4$
   One molecule is 3×10^{-23} grams
   So the number of water molecules is: $\frac{6 \times 10^4}{3 \times 10^{-23}} = \frac{6}{3} \times 10^{4-(-23)} = 2 \times 10^{27}$