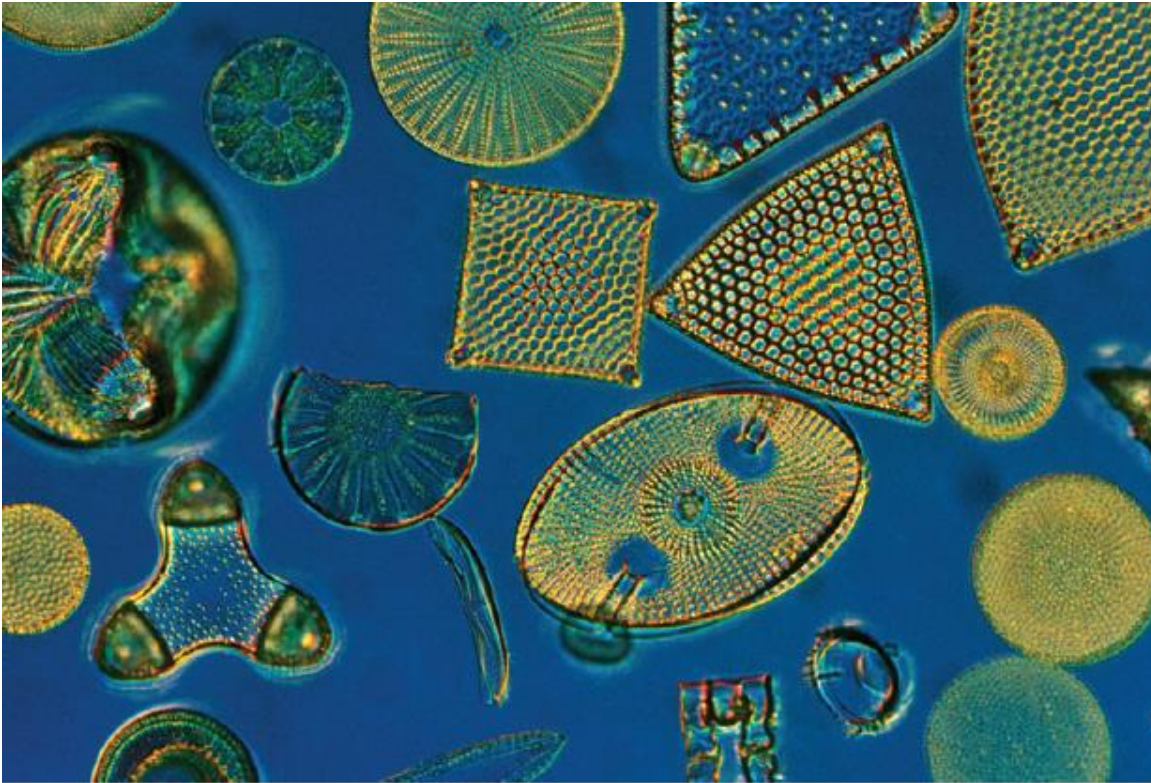


## 4.4 - Simplifying Algebraic Expressions with Exponents

- GOAL – Simplify algebraic expressions involving powers and radicals.



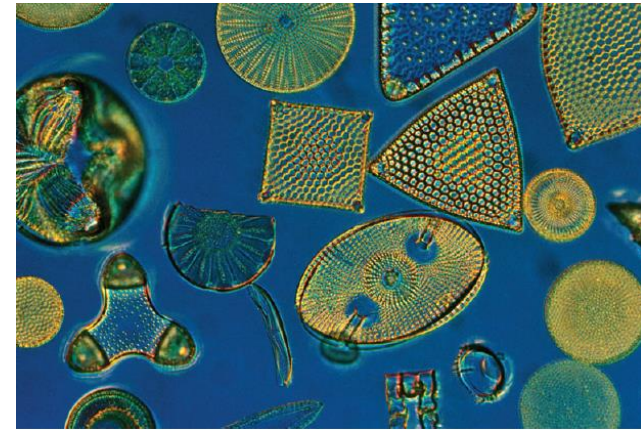
Microorganisms' surface area and volume affect their ability to survive.

For a sphere,

$$SA(r) = 4\pi r^2 \text{ and}$$

$$V(r) = \frac{4}{3}\pi r^3$$

# Example #1



- Simplify  $\frac{SA(r)}{V(r)}$ , given that  $SA(r) = 4\pi r^2$  and  $V(r) = \frac{4}{3}\pi r^3$ .
- $\frac{SA(r)}{V(r)} = \frac{4\pi r^2}{\frac{4}{3}\pi r^3}$
- $= 3r^{-1}$
- $= \frac{3}{r}$

## Example #2

Simplify  $\frac{(2x^{-3}y^2)^3}{(x^3y^{-4})^2}$ .

$$\frac{(2x^{-3}y^2)^3}{(x^3y^{-4})^2} = \frac{(2)^3(x^{-3})^3(y^2)^3}{(x^3)^2(y^{-4})^2}$$

$$= \frac{8x^{-9}y^6}{x^6y^{-8}}$$

$$= 8x^{-9-6}y^{6-(-8)}$$

$$= 8x^{-15}y^{14}$$

$$= \frac{8y^{14}}{x^{15}}$$

# Example #3

Evaluate the expression  $\frac{(x^{2n+1})(x^{3n-1})}{x^{2n-5}}$  for  $x = -3$  and  $n = 2$ .

$$\begin{aligned}\frac{(x^{2n+1})(x^{3n-1})}{x^{2n-5}} &= \frac{(-3)^{2(2)+1}(-3)^{3(2)-1}}{(-3)^{2(2)-5}} \\ &= \frac{(-3)^5(-3)^5}{(-3)^{-1}} \\ &= \frac{(-243)(-243)}{\frac{1}{-3}} \\ &= -177\,147\end{aligned}$$

## Example #4

$$\begin{aligned} \text{Simplify } \frac{(27a^{-3}b^{12})^{\frac{1}{3}}}{(16a^{-8}b^{12})^{\frac{1}{2}}} &= \frac{27^{\frac{1}{3}} a^{-3 \cdot \frac{1}{3}} b^{12 \cdot \frac{1}{3}}}{16^{\frac{1}{2}} a^{-8 \cdot \frac{1}{2}} b^{12 \cdot \frac{1}{2}}} \\ &= \frac{3a^{-1}b^4}{4a^{-4}b^6} \\ &= \frac{3}{4} a^{-1+4} b^4 \\ &= \frac{3}{4} a^3 b^{-2} \\ &= \frac{3a^3}{4b^2} \end{aligned}$$