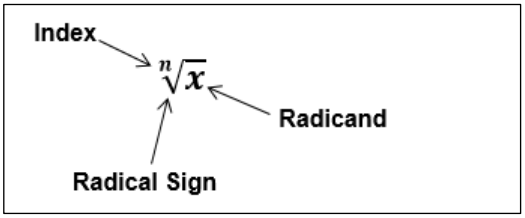
Lesson 2.3: Perfect Squares/Cubes and Their Roots

Specific Outcome: 1.1 – Determine the prime factors of a whole number. 1.4 – Determine, concretely, whether a given whole number is a perfect square, a perfect cube or neither. 1.5 – Determine, using a variety of strategies, the square root of a perfect square, and explain the process. 1.6 – Determine, using a variety of strategies, the cube root of a perfect cube, and explain the process. 1.7 – Solve problems that involve prime factors, square roots or cube roots. 2.7 – Explain, using examples, the meaning of the index of a radical. 3.1 – Sketch a diagram to represent a problem that involves surface area or volume. 3.2 – Determine the surface area of a right prism using an object or its labelled diagram. 3.4 – Determine an unknown dimension of a right prism, given the object's volume and the remaining dimensions. 3.5 – Solve a problem that involves radicals.

RADICALS

- Any expression of the form $\sqrt[n]{x}$ where $n \in N$.
- If the index is not written, it is assumed to be 2



Practice: Identify the index and the radicand in each of the following radicals.

a) $\sqrt{56}$ b) $\sqrt[4]{123x}$ c) $4\sqrt[3]{-\frac{1}{3}}$

USEFUL PROPERTIES OF RADICALS

- Multiplication Property: $\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$ where $n \in N$
- Division Property: $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ where $b > 0$

Note: The sum/difference of the roots of two numbers is NOT equal to the root of the sum/difference of the two numbers.

Practice

1. Write the following as a single radical.

a) $\sqrt{8} \times \sqrt{5}$ b) $\frac{\sqrt{20}}{\sqrt{5}}$ c) $\sqrt[3]{11} \times \sqrt[3]{-2}$ d) $\frac{\sqrt[3]{56}}{\sqrt[3]{7}}$

Fill in the tables with perfect squares and perfect cubes.

Perfect Squares	Perfect Cubes
$1^2 =$	$1^3 =$
$2^2 =$	

Definition of Perfect Squares:

- The product of a whole number multiplied by itself.
- A perfect square can be written as a power with exponent 2.
- Square roots:
  a) Square root is symbolized as $\sqrt{\ }$
  b) Every perfect square has 2 square roots: one positive and one negative.
  c) The positive square root is called the **Principal Square Root**.

Definition of Perfect Cubes:

- The product of a whole number multiplied three times
- A perfect cube can be written as a power with exponent 3.
- Cubic root is symbolized as $\sqrt[3]{\ }$

USING PERFECTSQUARES/CUBES

1. Express as a product of 2 radicals, one of which is a perfect square or cube.

a) $\sqrt{54}$ b) $\sqrt{128}$ c) $\sqrt[3]{250}$ d) $\sqrt[3]{162}$

2. Determine if the following numbers are a perfect square using the following 2 methods.

a) 196: Prime Factorization Perfect squares

b) 484: Perfect squares

2. Determine if the following numbers are a perfect cube using the following 2 methods.

a) 108: Prime Factorization Perfect cubes

b) 729: Perfect cubes

Problems:

1. The surface area of a sphere is given by the formula $SA = 4\pi r^2$. If the surface area of a beach ball is 3600π cm^2, what is the radius of the ball?

2. A cubic aquarium for three nurse sharks is 1728 cm^3. Determine the dimensions of the aquarium.

Homework: P. 146 - #4-6(ace), 7, 8, 10, 13, 17