

## Chapter 7 – Backwards Problems

### Warm-UP!

1. Find the radius of a circle whose area is  $81\pi$

$$\begin{aligned}
 A &= \pi r^2 \\
 81\pi &= \pi r^2 \\
 \sqrt{81} &= \sqrt{r^2} \\
 r &= 9
 \end{aligned}$$

### What is a backwards problem?

When we are looking for a variable that we are typically given and already have the "answers".

### Steps:

1. Underline/highlight important information
2. Make a list of variables and their values
3. Write down all formulas for the shape
4. Plug in the numbers that you know, whatever formula has only 1 variable left, solve for it
5. Continue plugging in and solving until you answer the question

### Examples:

1. Find the width of a rectangular prism whose length is 6 and height of the prism is 9, when the surface area of the prism is 198.

Rectangular Prism

$$\begin{aligned}
 w &= ? \\
 l &= 6 \\
 h &= 9 \\
 SA &= 198
 \end{aligned}$$

$$\begin{aligned}
 SA &= 2lw + 2lh + 2wh & V &= lwh \\
 198 &= 2(6)w + 2(6)(9) + 2w(9) & V &= (6)w(9) \\
 198 &= 12w + 108 + 18w \\
 198 &= 30w + 108 \\
 \underline{-108} & & \underline{-108} & \\
 90 &= 30w \\
 \frac{90}{30} &= \frac{30w}{30}
 \end{aligned}$$

$$w = 3$$

2. Find the area of the base for a regular pentagonal prism whose sides are 6cm, height of the prism is 8cm, and surface area of the prism is 363. PRISM

$$\begin{aligned}
 B &= ? \\
 \text{\# of sides} &= 5 \\
 b &= 6 \\
 h &= 8 \\
 SA &= 363 \\
 p &= 30 \\
 L &= 240 \\
 \boxed{B = 61.5}
 \end{aligned}$$

$$\begin{aligned}
 p &= \text{\# of sides} \cdot b & B &= \frac{1}{2}ap & L &= ph & SA &= L + 2B & V &= Bh \\
 p &= (5)(6) & B &= \frac{1}{2}ap & L &= p(8) & 363 &= L + 2B & V &= B(8) \\
 p &= 30 & B &= \frac{1}{2}a(30) & L &= (30)(8) & 363 &= 240 + 2B \\
 & & & & L &= 240 & \begin{array}{r} -240 \\ -240 \\ \hline 123 = 2B \\ \frac{123}{2} = \frac{2B}{2} \\ \boxed{B = 61.5} \end{array}
 \end{aligned}$$

3. What regular shape with side lengths of 6 forms a pyramid with volume of 344.14, surface area of 313.2, height of 11.03 and slant height of 12.2? Pyramid

$$\begin{aligned}
 \text{\# of sides} &= ? \\
 b &= 6 \\
 V &= 344.14 \\
 SA &= 313.2 \\
 h &= 11.03 \\
 l &= 12.2 \\
 B &= 93.52 \\
 L &= 219.68 \\
 \text{\# of sides} &= 6 \\
 \boxed{\text{hexagon}}
 \end{aligned}$$

$$\begin{aligned}
 p &= \text{\# of sides} \cdot b & B &= \frac{1}{2}ap & L &= \frac{1}{2}(\text{\# of sides})b \cdot l & SA &= L + B & V &= \frac{1}{3}Bh \\
 p &= \text{\# of sides} \cdot (6) & B &= \frac{1}{2}ap & L &= \frac{1}{2}(\text{\# of sides})(6)(l) & 313.2 &= L + B & 344.14 &= \frac{1}{3}B(11.03) \\
 & & 93.52 &= \frac{1}{2}ap & & & \begin{array}{r} 313.2 = L + 93.52 \\ -93.52 \quad -93.52 \\ \hline L = 219.68 \end{array} & \begin{array}{r} 344.14 = \frac{3.68B}{3.68} \\ \frac{344.14}{3.68} = \frac{3.68B}{3.68} \\ B = 93.52 \end{array} \\
 & & & & & & & & & \\
 & & & & & & & & & \downarrow \\
 219.68 &= \frac{1}{2}(\text{\# of sides})(6)(12.2) \\
 \frac{219.68}{36.6} &= \frac{36.6(\text{\# of sides})}{36.6} \\
 \text{\# of sides} &= 6 \\
 \boxed{\text{hexagon}}
 \end{aligned}$$