

1. NCTM Dec/Jan 2015/16 #11

Simplify the following expression:

$$\begin{aligned} & \left( \sqrt{4 + \sqrt{4 + \sqrt{4}}} \right)^4 \\ & \left[ \left( 4 + \sqrt{4 + \sqrt{4}} \right)^{1/2} \right]^4 = \left( 4 + \sqrt{4 + \sqrt{4}} \right)^2 \\ & = (4 + \sqrt{4 + \sqrt{4}})(4 + \sqrt{4 + \sqrt{4}}) \end{aligned}$$

2. Find  $a$  if  $\sqrt{a}(\sqrt{14}) = 2\sqrt{7}$

$$\begin{aligned} & = \sqrt{4 \cdot 7} \\ & = \sqrt{28} \\ & = \sqrt{2 \cdot 14} \\ & = \sqrt{2} \sqrt{14} \end{aligned}$$

$$\boxed{a = 2}$$

$$\begin{aligned} & = 16 + 8\sqrt{4 + \sqrt{4}} + (4 + \sqrt{4}) \\ & = 16 + 4 + 2 + 8\sqrt{4 + 2} \\ & = \boxed{22 + 8\sqrt{6}} \end{aligned}$$

3. Given  $a$ ,  $b$ , and  $c$  are all positive integers and are not equal to 1. Find  $a + b + c$ .

$$\begin{aligned} \sqrt[3]{128x^a y^b w^c} &= 4xy^2 \sqrt[3]{2x^2 w^c} \\ &= \sqrt[3]{64 \cdot 2 x^3 y^6 x^2 w^c} \\ &= \sqrt[3]{128 x^5 y^6 w^c} \end{aligned}$$

$$a = 5$$

$$b = 6$$

$$c = 2$$

$$a + b + c = \boxed{13}$$

General Novel Problems

4. NCTM Sept 2014 # 2

Given the following system of equations—

$$\begin{cases} (9x - 6y = 21) \\ (6x - 4y = k) \end{cases} \begin{matrix} 4 \\ 6 \end{matrix}$$

—find the value of  $k$  such that the system has an infinite number of solutions.

$$\begin{array}{r} 36x - 24y = 84 \\ - (36x - 24y = 6k) \\ \hline 0 \qquad = 84 - 6k \end{array}$$

$$\begin{aligned} 84 - 6k &= 0 \\ 84 &= 6k \end{aligned}$$

$$\boxed{14 = k}$$