1. NCTM

If the binary operation Δ is defined as

$a \Delta b = a^2 + 2ab + b^2$, evaluate $37 \Delta 63$.

$$a \Delta b = a^2 + 2ab + b^2$$

$$= (a+b)^2$$

$$37 \Delta 63 = (37+63)^2$$

$$= 100^2$$

$$= \boxed{10,000}$$

2. NCTM Jan/Feb 2018 #10

Define the operation @ as follows:

$a@b = (2a - b)^2$ for any real numbers
a and b.

Find the value or values of b such that

$$2@(4@b) = 25.$$

let $x = 4@b$

$$2@x = (4 - x)^2 = 25$$

$$4 - x = \pm 5$$

$$4 - x = 5 \text{ and } 4 - x = -5$$

$$x = -1 \qquad x = 9$$

try $x = -1$ then
$-1 = (8-b)^2$
can't work b/c neg

$$9 = 4@b$$

$$9 = (8 - b)^2$$

$$\pm 3 = 8 - b$$

$$3 = 8 - b \text{ and } -3 = 8 - b$$

$$5 = b \qquad\qquad 11 = b$$

$$\boxed{b = 5 \text{ and } b = 11}$$

3. NCTM Nov 2015 #25

The product

$$\sqrt[5]{8} \cdot \sqrt[3]{16}$$

can be expressed as 2^n. What is the value of n?

$$\sqrt[5]{2^3} \cdot \sqrt[3]{2^4}$$

$$2^{3/5} \quad 2^{4/3}$$

$$\frac{9}{15} + \frac{20}{15}$$

$$2^{3/5 + 4/3}$$

$$2^{29/15}$$

$$\boxed{n = \frac{29}{15}}$$

4. NCTM Nov 2015 #30

Write the following numerical expressions in order, from smallest to largest, without using a calculator:

$$-64^{-\frac{1}{2}}, \quad 64^{-\frac{2}{3}}, \quad -64^{\frac{2}{3}}, \quad -64^{-\frac{2}{3}}, \quad 64^{-\frac{1}{2}}, \quad 64^{\frac{1}{2}} \rightarrow \sqrt{64} = 8$$

$$-\frac{1}{\sqrt{64}} \qquad \frac{1}{\sqrt[3]{64}^2} \qquad -\sqrt[3]{64}^2 \qquad -\frac{1}{\sqrt[3]{64}^2} \qquad \frac{1}{\sqrt{64}}$$

$$= -\frac{1}{8} \qquad = \frac{1}{16} \qquad = -16 \qquad = -\frac{1}{16} \qquad = \frac{1}{8}$$

$$-16, \quad -\frac{1}{8}, \quad -\frac{1}{16}, \quad \frac{1}{16}, \quad \frac{1}{8}, \quad 8$$

original:

$$-64^{2/3}, \quad -64^{-1/2}, \quad -64^{-2/3}, \quad 64^{-2/3}, \quad 64^{-1/2}, \quad 64^{1/2}$$

5. NCTM Dec/Jan 2014/15 #4

Simplify:

$$81^{7/4} - \sqrt{3^{13} + 3 \cdot 9^6 + 3 \cdot 27^4}$$

$$\sqrt[4]{81}^{\,7} - \left[3^{13} + 3 \cdot (3^2)^6 + 3 \cdot (3^3)^4\right]^{1/2}$$

$$\sqrt[4]{3^4}^{\,7} - \left[3^{13} + 3 \cdot 3^{12} + 3 \cdot 3^{12}\right]^{1/2}$$

$$3^7 - \left[3^{13} + 3^{13} + 3^{13}\right]^{1/2}$$

$$3^7 - \left(3 \cdot 3^{13}\right)^{1/2}$$

$$3^7 - \left(3^{14}\right)^{1/2}$$

$$3^7 - 3^7$$

$$0$$