SEPTEMBER 2015

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
13	14 Power to a Power W.S	15	16	17	18	19

Integer Exponents WS

All Exp Rule Revi

Lesson 3: Numbers in Exponential Form Raised to a Power

Classwork

For any number x and any positive integers m and n,

$$(x^m)^n = x^{mn}$$

because

$$(x^m)^n = \underbrace{x \cdot x \cdots x}_{m \text{ times}}{}^{n}$$

$$= \underbrace{x \cdot x \cdots x}_{m \text{ times}} \times \cdots \times \underbrace{x \cdot x \cdots x}_{m \text{ times}} \quad (n \text{ times})$$

$$= x^{mn}.$$

a power raised to another power means we multiply the powers

$(x^2)^4 = x^2 \cdot x^2 \cdot x^2 \cdot x^2 = x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x = x^8$

Exercise 1

$(15^3)^9 = 15^{27}$

Exercise 2

$((-2)^5)^8 = (-2)^{40}$

Exercise 3

$(3.4^{17})^4 = 3.4^{68}$

Exercise 4

Let s be a number.

$(s^{17})^4 = s^{68}$

Exercise 5

Sarah wrote $(3^5)^7 = 3^{12}$. Correct her mistake. Write an exponential expression using a base of 3 and exponents of 5, 7, and 12 that would make her answer correct.

$(3^5)^7 = 3^{35}$ $\qquad 3^5 \cdot 3^7 = 3^{12}$

Exercise 6

A number y satisfies $y^{24} - 256 = 0$. What equation does the number $x = y^4$ satisfy?

$+256 \quad +256$

$y^{24} = 256$ $\qquad y = \sqrt[24]{256}$

For any numbers x and y, and positive integer n,

$$(xy)^n = x^n y^n$$

because

$$xy^{\,n} = \underbrace{xy \cdots xy}_{n \text{ times}}$$
$$= \underbrace{x \cdot x \cdots x}_{n \text{ times}} \cdot \underbrace{y \cdot y \cdots y}_{n \text{ times}}$$
$$= x^n y^n.$$

$(x^2y)^3 = x^2y \cdot x^2y \cdot x^2y = x \cdot x \cdot y \cdot x \cdot x \cdot y \cdot x \cdot x \cdot y = x^6y^3$

Exercise 7

$(11 \times 4)^9 = 11^9 \cdot 4^9$

Exercise 8

$(3^2 \times 7^4)^5 = 3^{10} \cdot 7^{20}$

Exercise 9

Let a, b, and c be numbers.

$(3^2a^4)^5 = 3^{10} \cdot a^{20}$

Exercise 10

Let x be a number.

$(5x)^7 = (5 \cdot x) = 5^7x^7$

Exercise 11

Let x and y be numbers.

$(5xy^2)^7 = 5^7x^7y^{14}$

Exercise 12

Let a, b, and c be numbers.

$(a^2bc^3)^4 = a^8b^4c^{12}$

Exercise 13

Let x and y be numbers, $y \neq 0$, and let n be a positive integer. How is $\left(\frac{x}{y}\right)^n$ related to x^n and y^n?

$\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}$

$$(2x^3)^3 = 2^3 \cdot x^9$$

$$= 8x^9$$

$$(3y^{10})^2 = 3^2 y^{20}$$

$$= 9y^{20}$$

$$(xy^{2}z)^{5} = x^{5}y^{10}z^{5}$$

$$x^2(2x^3)^4 =$$

$$x^2 \cdot 2^4 \cdot x^{12}$$

$$2^4 \cdot x^2 \cdot x^{12} = 16x^{14}$$

$(2ab^2)^3 \cdot (3a^4b)^2$

$2^3 a^3 b^6 \cdot 3^2 a^8 b^2$

$8 \cdot 9 \cdot a^{11} b^8$

$72a^{11}b^8$

$$\left(\frac{5x^2y^5}{10x^3y^2}\right)^2 = \frac{5^2x^4y^{10}}{10^2x^6y^4}$$

$$= \frac{25y^6}{100x^2} = \frac{y^6}{4x^2}$$

Problem Set

1. Show (prove) in detail why $2 \cdot 3 \cdot 7^{\,4} = 2^4 3^4 7^4$.

2. Show (prove) in detail why $xyz^{\,4} = x^4 y^4 z^4$ for any numbers x, y, z.

3. Show (prove) in detail why $xyz^{\,n} = x^n y^n z^n$ for any numbers x, y, and z and for any positive integer n.