Math 9 Section 1.4 – Defining Powers

Homework: Section 1.4 on Pg. 23; 1all, 2left, 3all, 5-10left, 11all, 13 – Answers on Pg. 362

Exponential Form: $5 \times 5 \times 5 \times 5 = 5^4$ ← power/exponent

Base

The base tells us what number is being multiplied.
The exponent or power tells us how many times we multiply that number by itself.

Write in exponential form, then evaluate

$2 \times 2 \times 2 = 2^3 = 8$

$7 \times 7 \times 7 \times 7 \times 7 = 7^5 = 16807$

Write in repeated factor form

$4^6 = 4 \times 4 \times 4 \times 4 \times 4 \times 4$
$= 4096$

$a^4 = a \times a \times a \times a$ multiply
$= a \cdot a \cdot a \cdot a$

NOTE: be careful with powers when negatives and brackets are involved. For example:

$(-2)^4 = +2 \times +2 \times +2 \times +2$
$= +16$

$-2^4 = -2 \times 2 \times 2 \times 2$
$= -16$

$-(-2)^4 = -(-2 \times -2 \times -2 \times -2)$
$= -(16)$
$= -16$

In general, if *a* is positive (a > 0), then:

$(-a)^{even}$ will be $+$

$(+a \times +a) \times (+a \times +a)$

AND

$(-a)^{odd}$ will be $-$

$(+a \times +a) \times -a$

To complete 1.4 in the workbook, you will need to know two rules that we will prove later…

$x^1 = x$	$x^0 = 1$

…except: 0^0 is undefined

For example:

$7^1 = 7$

$(-7)^1 = -7$

$7^0 = 1$

$(-7)^0 = 1$

$-7^0 = -1$

What happens when we make exponents bigger?

$2^1 = 2$ $\quad 2^2 = 4$ $\quad 2^3 = 8$ $\quad 2^4 = 16$

$\left(\frac{1}{2}\right)^1 = \frac{1}{2} = 0.5$

$1 \div 2 = 0.5$

$\left(\frac{1}{2}\right)^2 = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

$= 0.25$

$\left(\frac{1}{2}\right)^3 = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$

$= 0.125$

$\left(\frac{1}{2}\right)^4 = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$

$= \frac{1}{16} = 0.0625$

$\left(\frac{3}{2}\right)^1 = \frac{3}{2} = 1.5$

$\left(\frac{3}{2}\right)^2 = \frac{3}{2} \times \frac{3}{2} = \frac{9}{4}$

$= 2.25$

$\left(\frac{3}{2}\right)^3 = \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2}$

$= \frac{27}{8} = 3.375$

$\left(\frac{3}{2}\right)^4 = \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2}$

$= \frac{81}{16} = 5.0625$

$1^1 = 1$ $\quad 1^2 = 1 \times 1 = 1$ $\quad 1^3 = 1 \times 1 \times 1 = 1$ $\quad 1^4 = 1$

What did we notice?

When the base is bigger than 1, bigger powers give us bigger answers

When the base is smaller than 1, bigger powers give us smaller answers

When the base is equal to 1, bigger powers give us the same answers

$<$ ← eats the bigger one

Use >, < or = to complete a true statement

Even exp $\quad$ odd exp

$+$ $\quad$ $-$

$(4)^3 < (4)^5$

Bigger exp

Base > 1

$\left(\frac{3}{5}\right)^3 > \left(\frac{3}{5}\right)^4$

Base < 1

smaller exp

$(-1)^8 > (-1)^{11}$

$+ > -$ always

$-$ $\quad$ $+$

$\left(-\frac{5}{2}\right)^3 < \left(-\frac{5}{2}\right)^2$

$+$ $\quad$ $-$

$\left(-\frac{2}{7}\right)^6 > -\left(\frac{2}{7}\right)^5$

$\left(\frac{8}{9}\right)^0 = \left(-\frac{8}{9}\right)^0$

$1 = 1$

Be careful with negatives!

Remember, a negative number is always smaller than a positive number.