Number of Divisors

Complete the following steps for each set of numbers.

1. **Generate a prime factorization of each number.**
2. **List all the factors of the number.**
3. **Determine the number of factors.**
4. **Look for patterns and find a connection between the prime factored form of the number and its total number of factors.**

SET A			
#	Prime Factored Form	List of All Factors	Number Of Factors
4	2^2	1, 2, 4	3
8	2^3	1, 2, 4, 8	4
9	3^2	1, 3, 9	3
16	2^4	1, 2, 4, 8, 16	5
25	5^2	1, 5, 25	3
27	3^3	1, 3, 9, 27	4
32	2^5	1, 2, 4, 8, 16, 32	6
49	7^2	1, 7, 49	3
64	2^6	1, 2, 4, 8, 16, 32, 64	7
81	3^4	1, 3, 9, 27, 81	5
125	5^3	1, 5, 25, 125	4
128	2^7	1, 2, 4, 8, 16, 32, 64, 128	8

What connection is there between the prime-factored form of a number and its total number of factors?

The total number of factors is always one larger than the exponent when the number is in prime-factored form.

SET B			
#	Prime Factorization	List of All Factors	Number Of Factors
6	$2^1 \times 3^1$	1, 2, 3, 6	4
15	$3^1 \times 5^1$	1, 3, 5, 15	4
77	$7^1 \times 11^1$	1, 7, 11, 77	4
Sample answers might be:			
10	$2^1 \times 5^1$	1, 2, 5, 10	4
14	$2^1 \times 7^1$	1, 2, 7, 14	4
21	$3^1 \times 7^1$	1, 3, 7, 21	4
35	$5^1 \times 7^1$	1, 5, 7, 35	4

What connection is there between the prime-factored form of one of these numbers and its total # of factors?
Take each exponent and increase it by one. Find the product of the two numbers (2 x 2 = 4).
Or…Double the sum of the two exponents.

SET C			
#	Prime Factorization	List of All Factors	Number Of Factors
12	$2^2 \times 3^1$	1, 2, 3, 4, 6, 12	6
45	$3^2 \times 5^1$	1, 3, 5, 9, 15, 45	6
50	$2^1 \times 5^2$	1, 2, 5, 10, 25, 50	6
Sample answers might be:			
18	$2^1 \times 3^2$	1, 2, 3, 6, 9, 18	6
20	$2^2 \times 5^1$	1, 2, 4, 5, 10, 20	6
28	$2^2 \times 7^1$	1, 2, 4, 7, 14, 28	6

What connection is there between the prime-factored form of one of these numbers and its total # of factors?
Take each exponent and increase it by one. Find the product of the two numbers (3 x 2 = 6).
Or…Double the sum of the two exponents.

SET D			
#	Prime Factorization	List of All Factors	# of Factors
24	$2^3 \times 3^1$	1, 2, 3, 4, 6, 8, 12, 24	8
40	$2^3 \times 5^1$	1, 2, 4, 5, 8, 10, 20, 40	8
54	$2^1 \times 3^3$	1, 2, 3, 6, 9, 18, 27, 54	8
Sample answers might be:			
56	$2^3 \times 7^1$	1, 2, 4, 7, 8, 14, 28, 56	8
88	$2^3 \times 11^1$	1, 2, 4, 8, 11, 22, 44, 88	8
135	$3^3 \times 5^1$	1, 3, 5, 9, 15, 27, 45, 135	8

Take each exponent and increase it by one. Find the product of the two numbers (4 x 2 = 8).
Or…Double the sum of the two exponents.

SET E			
#	Prime Factorization	List of All Factors	# of Factors
72	$2^3 \times 3^2$	1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72	12
108	$2^2 \times 3^3$	1, 2, 3, 4, 6, 9, 12, 18, 27, 36, 54, 108	12
200	$2^3 \times 5^2$	1, 2, 4, 5, 8, 10, 20, 25, 40, 50, 100, 200	12
Sample answers might be:			
392	$2^3 \times 7^2$	1, 2, 4, 7, 8, 14, 28, 49, 56, 98, 196, 392	12
500	$2^2 \times 5^3$	1, 2, 4, 5, 10, 20, 25, 50, 100, 125, 250, 500	12

Take each exponent and increase it by one. Find the product of the two numbers (4 x 3 = 12).

SET F			
#	Prime Factorization	List of All Factors	# Of Factors
36	$2^2 \times 3^2$	1, 2, 3, 4, 6, 9, 12, 18, 36	9
100	$2^2 \times 5^2$	1, 2, 4, 5, 10, 20, 25, 50, 100	9
225	$3^2 \times 5^2$	1, 3, 5, 9, 15, 25, 45, 75, 225	9
Sample answers might be:			
196	$2^2 \times 7^2$	1, 2, 4, 7, 14, 28, 49, 98, 196	9
441	$3^2 \times 7^2$	1, 3, 7, 9, 21, 49, 63, 147, 441	9

Take each exponent and increase it by one. Find the product of the two numbers (3 x 3 = 9).

SET G			
#	Prime Factorization	List of All Factors	# of Factors
144	$2^4 \times 3^2$	1, 2, 3, 4, 6, 8, 9, 12, 16, 18, 24, 36, 48, 72, 144	15
324	$2^2 \times 3^4$	1, 2, 3, 4, 6, 9, 12, 18, 27, 36, 54, 81, 108, 162, 324	15
Sample answers might be:			
400	$2^4 \times 5^2$	1, 2, 4, 5, 8, 10, 16, 20, 25, 40, 50, 80, 100, 200, 400	15
784	$2^4 \times 7^2$	1, 2, 4, 7, 8, 14, 16, 28, 49, 56, 98, 112, 196, 392, 784	15

Take each exponent and increase it by one. Find the product of the two numbers (5 x 3 = 15).

SET H			
#	Prime Factorization	List of All Factors	# of Factors
30	$2^1 \times 3^1 \times 5^1$	1, 2, 3, 5, 6, 10, 15, 30	8
120	$2^3 \times 3^1 \times 5^1$	1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40, 60, 120	16
140	$2^2 \times 5^1 \times 7^1$	1, 2, 4, 5, 7, 10, 14, 20, 28, 35, 70, 140	12
162	$2^1 \times 3^4$	1, 2, 3, 6, 9, 18, 27, 54, 81, 162	10
396	$2^2 \times 3^2 \times 11^1$	1, 2, 3, 4, 6, 9, 11, 12, 18, 22, 33, 36, 44, 66, 99, 132, 198, 396	18

Take each exponent and increase it by one. Find the product of the two numbers.

The number of factors of 30 is equal to 2 x 2 x 2 or 8.
The number of factors of 120 is equal to 4 x 2 x 2 or 16.
The number of factors of 140 is equal to 3 x 2 x 2 or 12.
The number of factors of 162 is equal to 2 x 5 or 10.
The number of factors of 396 is equal to 3 x 3 x 2 or 18.