0÷0÷0÷0÷1.6×10^-3 = 1.6÷0÷0÷0÷0

Grade 9 Exponent Laws: Applying the exponent laws numerically115781

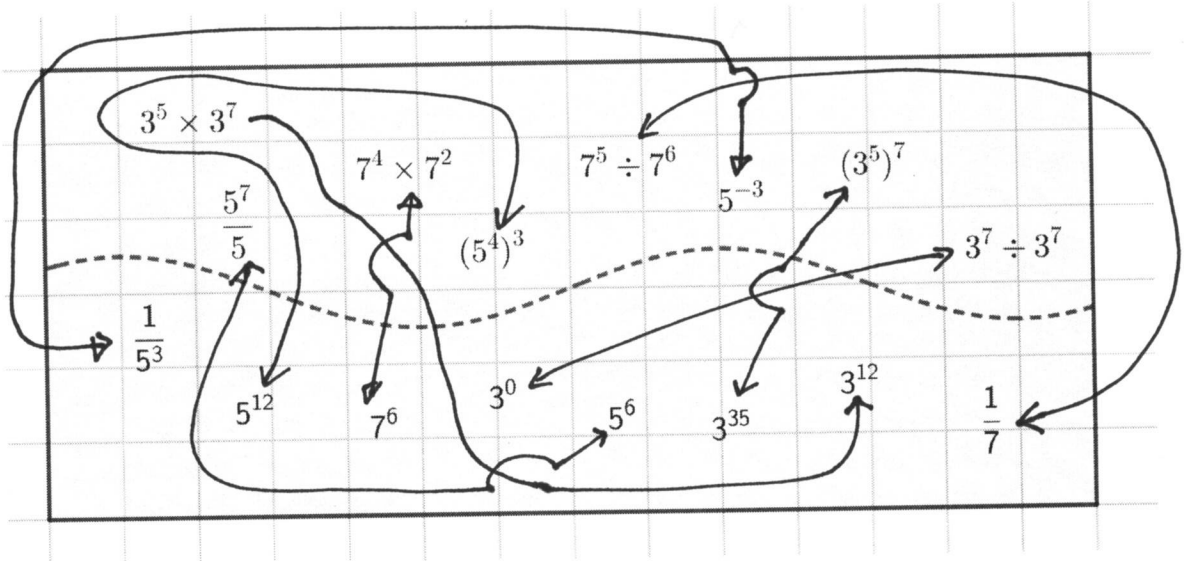
A. Exponents can be found by repeated multiplication or repeated division. Let's start with 5^5 in this table and calculate the other values by repeated division. Type 3125 into your calculator, then '='. Now press ÷ 5 = = = = etc to find the other values in the table.

5^{-4}	5^{-3}	5^{-2}	5^{-1}	5^0	5^1	5^2	5^3	5^4	5^5
0.0016	0.008	0.04	0.2	1	5	25	125	625	3125

Here are examples of three exponent laws:

Name of law	Calculation	Means....	Single Power	What to do with the exponents?
Product	$7^3 \times 7^5 =$	$(7\times7\times7)\times(7\times7\times7\times7\times7)$	$= 7^8$	add
Quotient	$5^6 \div 5^2 =$	$\frac{5^6}{5^2} = \frac{5\times5\times5\times5\times5\times5}{5\times5}$	$= 5^3$	subtract
Power	$(11^2)^4 =$	$(11\times11)\times(11\times11)\times(11\times11)\times(11\times11)$	$= 11^8$	multiply

B. Match the calculation with the single power:



C. Simplify, leave your answer as a single power of 3:

$$\frac{(3^4\times3^7)^5}{(3^2)^3\times3^9} = \frac{(3^{11})^5}{3^6\times3^9} = \frac{3^{55}}{3^{54}} = 3^1 = 3$$

D. Fill in the missing parts of the table:

Name of law	Calculation	Means...	Single Power
Product	$4^3 \times 4^4$	$(4\times4\times4)\times(4\times4\times4\times4)$	4^7
Product, Power	$(3^2)^5$	$(3\times3)\times(3\times3)\times(3\times3)\times(3\times3)\times(3\times3)$	3^{10}
Quotient	$\frac{9^4}{9^2}$	$\frac{9\times9\times9\times9}{9\times9}$	9^2
Quotient	$\frac{9^2}{9^4}$	$\frac{9\times9}{9\times9\times9\times9}$	$9^{-2} = \frac{1}{9^2}$
Product, Power	$(5^4)^3$	$(5\times5\times5\times5)\times(5\times5\times5\times5)\times(5\times5\times5\times5)$	5^{12}
Product	$7^2\times7^3\times7^4\times7^5$	$(7\times7)\times(7\times7\times7)\times(7\cdot7\cdot7\cdot7)\times(7\cdot7\cdot7\cdot7\cdot7)$	$7^{2+3+4+5} = 7^{14}$

E. Use your calculator to type this calculation in, **using one line only**

$7^6 - 5^4\times3 + (4^2 - 3^2) =$ 115781

F. Use your calculator to verify these:

Example	Written out	Is equal to
$(3\times5)^4 =$	$(3\times5)\times(3\times5)\times(3\times5)\times(3\times5)$	$= 3^4\times5^4$ or $= 15^4$
$\left(\frac{3}{5}\right)^4 =$	$\left(\frac{3}{5}\right)\times\left(\frac{3}{5}\right)\times\left(\frac{3}{5}\right)\times\left(\frac{3}{5}\right)$	$= \frac{3^4}{5^4}$ or 0.6^4

This is also true:

Example	Written out	Conclusion
$(3+5)^4 =$	$(3+5)\times(3+5)\times(3+5)\times(3+5)$	$= 8^4$

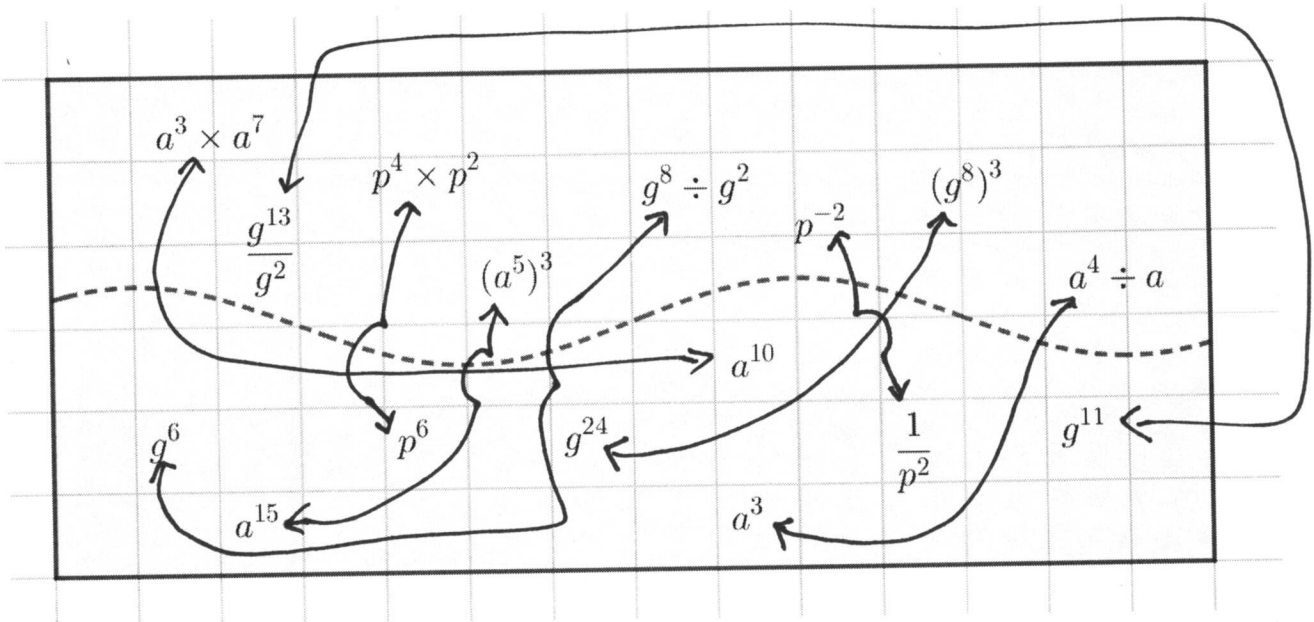
However, it is not true that ~~$(3+5)^4 = 3^4 + 5^4$~~ – When there is **addition** inside a bracket, and an **exponent** outside the bracket, we can do some fine math but alas, this page is out of space.

Applying the exponent laws to algebraic expressions

From time to time in math – well, most of the time - we use values that are changing (variables) or for some reason, we don't know (unknowns). We use a letter to stand in the place for the number we don't know. We can apply the exponent laws in just the same way, treating the letter in exactly the same way as we treat a number.

Name of law	Calculation	Means....	Single Power
Product	$x^3 \times x^5 =$	$(x \times x \times x) \times (x \times x \times x \times x \times x)$	$= x^8$
Quotient	$p^6 \div p^2 =$	$\frac{p \times p \times p \times p \times p \times p}{p \times p}$	p^4
Power	$(a^2)^4 =$	$(a \times a) \times (a \times a) \times (a \times a) \times (a \times a)$	$= a^8$

G. Match the calculation with a single power:



H. Complete the missing parts of the table:

Calculation	Means...	Single Power
$a^3 \times a^4 =$	$(a\times a\times a)\times(a\times a\times a\times a)$	$= a^7$
$b^3 \times b^3 =$	$(b\times b\times b)\times(b\times b\times b)$	$= b^6$ or $(b^3)^2$
$\frac{y^5}{y^3}$	$= \frac{y\times y\times y\times y\times y}{y\times y\times y}$	$= y^2$
$\frac{a^2\times b^5}{a^3\times b} =$	$\frac{\cancel{a}\times\cancel{a}\times b\times b\times b\times b\times\cancel{b}}{\cancel{a}\times\cancel{a}\times a\times\cancel{b}}$	$= \frac{b^4}{a}$
$(p^4)^3 =$	$(p\times p\times p\times p)\times(p\times p\times p\times p)\times(p\times p\times p\times p)$	$= p^{12}$

J. Simplify:

$$\frac{15(a^3\times a^5)^2 b^5}{5(a^7)^2 b^6} = \frac{15}{5}\cdot\frac{(a^3\times a^5)^2}{(a^7)^2}\cdot\frac{b^5}{b^6}$$

$$= 3\cdot\frac{(a^8)^2}{a^{14}}\cdot\frac{1}{b}$$

$$= 3\cdot\frac{a^{16}}{a^{14}}\cdot\frac{1}{b}$$

$$= 3\cdot\frac{a^2}{1}\cdot\frac{1}{b}$$

$$= \frac{3a^2}{b}$$