

# Product of Powers

Same Base

$$3^4 \cdot 3^2$$

$$(3 \cdot 3 \cdot 3 \cdot 3) \cdot (3 \cdot 3)$$

$$3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$$

$$3^6$$

$$a^m \cdot a^n = a^{m+n}$$

$$3^{4+2} = 3^6$$

$$7^5 \cdot 7^4$$

$$(7 \cdot 7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7 \cdot 7 \cdot 7)$$

$$7^9$$

$$a^m \cdot a^n = a^{m+n}$$

$$7^{5+4} = 7^9$$

# Power of Product

①  $(7 \times 3)^5$

$$(a \times b)^m = a^m \cdot b^m$$

$7^5 \cdot 3^5$

$$(7 \times 3)(7 \times 3)(7 \times 3)(7 \times 3)(7 \times 3)$$

$$7 \cdot 3 \cdot 7 \cdot 3 \cdot 7 \cdot 3 \cdot 7 \cdot 3 \cdot 7 \cdot 3$$

$$7^5 \cdot 3^5$$

②  $(19 \times 23)^{100}$

$$19^{100} \times 23^{100}$$

# Quotient of Powers

1.)  $\frac{7^9}{7^4}$  ← means ÷

$$\frac{\cancel{7 \cdot 7 \cdot 7 \cdot 7} \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7}{\cancel{7 \cdot 7 \cdot 7 \cdot 7}} = 7^5$$

OR

$$\frac{a^m}{a^n} = a^{m-n}$$

$$\frac{7^9}{7^4} = 7^{9-4} = 7^5$$

2.)  $\frac{333^{23}}{333^{10}} = 333^{23-10} = 333^{13}$

← (subtract)

# Power of Quotient

1.)  $\left(\frac{2}{3}\right)^4$

$$\frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3}$$

$$\frac{2 \times 2 \times 2 \times 2}{3 \times 3 \times 3 \times 3}$$

$$= \frac{2^4}{3^4}$$

OR

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

$$= \frac{2^4}{3^4}$$

2.)  $\left(\frac{7}{8}\right)^9 = \frac{7^9}{8^9}$

3.)  $\left(\frac{1}{8}\right)^4 = \frac{1^4}{8^4}$

# Power of Power

x multiply

$$① (2^3)^4$$

$$2^3 \cdot 2^3 \cdot 2^3 \cdot 2^3$$

$$(2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2)$$

$$2^{12}$$

OR

$$(2^3)^4 = 2^{3 \cdot 4} = 2^{12}$$

$$② (8^2)^4 = 8^{2 \cdot 4} = 8^8$$

$$③ (r^7)^{10} = r^{7 \cdot 10} = r^{70}$$

# Practice

$$1.) \left( \frac{7^{12}}{7^9} \right)$$

$$2.) \left( \frac{a^{20}}{a^{11}} \right)$$

$$3.) \left( \frac{1}{3} \right)^8$$

$$4.) \left( \frac{a}{b} \right)^3$$

$$5.) (4^7)^3$$

$$6.) (x^{11})^2$$