

## Exponential Properties:

$(a \neq 0 \text{ and } b \neq 0)$

Properties	Examples
1. $b^0 = 1$	$5^0 = 1$
2. $b^1 = b$	$10^1 = 10$
3. $b^m b^n = b^{m+n}$	$2^2 2^3 = 2^{2+3} = 2^5 = 32$
4. $\frac{b^m}{b^n} = b^{m-n} = \frac{1}{b^{n-m}}$	e.g.) $\frac{2^7}{2^4} = 2^{7-4} = 2^3 = 8$ e.g.) $\frac{2^2}{2^7} = \frac{1}{2^{7-2}} = \frac{1}{2^5} = \frac{1}{32}$
5. $(b^m)^n = b^{m \cdot n}$	$(2^2)^3 = 2^{2 \cdot 3} = 2^6 = 64$
6. $b^{-n} = \frac{1}{b^n}$	$2^{-3} = \frac{1}{2^3} = \frac{1}{8}$
7. $(ab)^n = a^n b^n$	$(2 \cdot 3)^2 = 6^2 = 2^2 3^2 = 4 \cdot 9 = 36$
8. $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$	$\left(\frac{3}{4}\right)^2 = \frac{3^2}{4^2} = \frac{9}{16}$
9. $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$	$\left(\frac{3}{4}\right)^{-2} = \left(\frac{4}{3}\right)^2 = \frac{4^2}{3^2} = \frac{16}{9}$
10. $b^{\frac{1}{n}} = \sqrt[n]{b}$	$64^{\frac{1}{3}} = \sqrt[3]{64} = 4$
11. $b^{\frac{m}{n}} = (\sqrt[n]{b})^m = \sqrt[n]{b^m}$	e.g.) $8^{\frac{2}{3}} = (\sqrt[3]{8})^2 = (\sqrt[3]{2^3})^2 = 2^2 = 4$ $8^{\frac{2}{3}} = \sqrt[3]{8^2} = \sqrt[3]{64} = 4$
12. $\sqrt[m]{a} \cdot \sqrt[n]{b} = \sqrt[m \cdot n]{a^n b^m}$	$\sqrt[4]{2} \cdot \sqrt[5]{3} = \sqrt[4 \cdot 5]{2^5 \cdot 3^4} = \sqrt[20]{32 \cdot 81} = \sqrt[20]{2592}$
13. $\sqrt[m]{\sqrt[n]{b}} = \sqrt[n]{\sqrt[m]{b}} = \sqrt[m \cdot n]{b}$	$\sqrt[4]{\sqrt[3]{2}} = \sqrt[(4 \cdot 3)]{2} = \sqrt[12]{2}$
14. $\sqrt[n]{b^n} = \begin{cases}  b  & \text{if } n \text{ is even} \\ b & \text{if } n \text{ is odd} \end{cases}$	e.g.) $\sqrt[4]{(-4)^4} =  -4  = 4$ $n$ is even e.g.) $\sqrt[3]{(-4)^3} = (-4) = -4$ $n$ is odd