

Properties of Exponents Review

$$1) a^0 = 1, a \neq 1 \quad \begin{pmatrix} 0^x = 0 \\ x^0 = 1 \end{pmatrix}$$

$$2) x^{-n} = \frac{1}{x^n}$$

$$\text{EX. } 10^{-2} = \frac{1}{10^2} = \boxed{\frac{1}{100}}$$

$$\text{EX. } \frac{-5x^{-1}y^5z^{-5}}{2a^{10}b^{-4}c^2}$$

$$= \frac{-5y^5b^4}{2x^1z^5a^{10}c^2}$$

$$3) a^m \cdot a^n = a^{m+n}$$

$$\text{EX. } 2^2 \cdot 2^3 = 2^5 = 32$$

$$4) (a^m)^n = a^{m \cdot n}$$

$$\text{EX. } (2^2)^{-3} = 2^{-6} = \frac{1}{2^6} = \boxed{\frac{1}{64}}$$

$$5) (ab)^m = a^m b^m \quad [\text{but } (a+b)^m \neq a^m + b^m]$$

$$\text{EX. } (2x^2)^{-3} = 2^{-3} x^{-6}$$

$$= \frac{1}{2^3 x^6} = \boxed{\frac{1}{8x^6}}$$

①

$$6) \frac{a^m}{a^n} = a^{m-n}$$

$$\text{EX. } \frac{5^3}{5^5} = 5^{-2} = \frac{1}{5^2} = \boxed{\frac{1}{25}}$$

$$7) \left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

$$\left[\left(\frac{x}{y}\right)^2 = \frac{x}{y} \cdot \frac{x}{y} = \frac{x^2}{y^2} \right]$$

$$\text{EX. } \left(\frac{5a^3}{10b^{-2}}\right)^{-3} = \left(\frac{1 \cdot a^3 b^2}{2}\right)^{-3} = \left(\frac{2}{1a^3 b^2}\right)^3$$

$$\frac{1^3 a^{-9} b^{-6}}{2^{-3}} = \frac{2^3}{a^9 b^6}$$

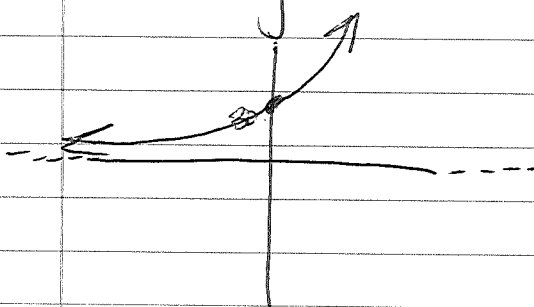
$$= \boxed{\frac{8}{a^9 b^6}}$$

Exponential Functions

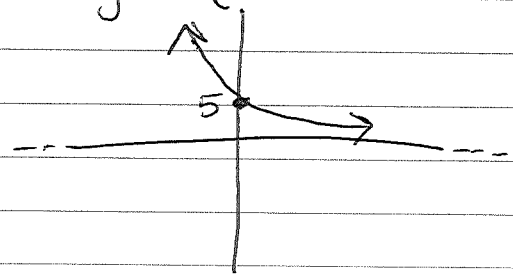
$$y = a \cdot b^x$$

a = vertical stretch/shrink
(also y -intercept)

EX. $y = 30 \cdot 4^x$



$$y = 5(0.3)^x$$



Patterns in Exponential Data

EX. $f(x) = 34 \cdot 3^x$

x	$f(x)$
0	34
+1 < 1	102 > +3
+1 < 2	306 > +3
+1 < 3	918 > +3
+1 < 4	2,754
+2 < +1 < 5	8,262 > +3 ²
+1 < 6	24,786
+3 < 9	743,598 > +3 ³

Add-multiply
property of
exponential
functions

Ex, f is an exponential function
 $f(0) = 1000$ & $f(1) = 900$
 find $f(2)$, $f(3)$, & $f(6)$

x	$f(x)$
$+1 < 0$	1000 $\rightarrow \times .9$
$+1 < 1$	900 $\rightarrow \times .9$
$+1 < 2$	810
$+3 < 3$	729 $\rightarrow \times .9^3$
$+3 < 6$	531.441

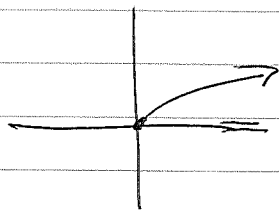
find ~~$f(4)$~~ $f(-4)$
 $1000 \times .9^{-4}$
 $= 1,524.158$

find ~~$f(11)$~~ $f(11)$
 $531.441 \times .9^5$
 $= 313.811$

Rational Exponents & Radicals

Graph $y = x^{1/2}$ & look @ table

x	0	1	2	3	4
y	0	1	1.414	1.732	2



$$x^{1/2} = \sqrt{x}$$

$$x^{1/2} \cdot x^{1/2} = x^1$$

$$\sqrt{x} \cdot \sqrt{x} = x^1$$

$$x^{1/3} = \sqrt[3]{x}$$

↙ index
↑ radicand

$$x^{1/5} = \sqrt[5]{x}$$

(5th root of x)

Ex. $\sqrt[3]{8} = 2$

$\sqrt[3]{125} = 5$

$\sqrt[5]{32} = 2$

What about $x^{2/3}$?

rational form $\rightarrow x^{2/3} = (x^{1/3})^2$ or $x^{1/3} \cdot x^{1/3}$

$(\sqrt[3]{x})^2$

$\sqrt[3]{x} \cdot \sqrt[3]{x}$

$\sqrt[3]{x^2}$

↑

$x^{5/4} = (\sqrt[4]{x})^5$ or $\sqrt[4]{x^5}$ "POWER OVER ROOT"

radical form ↗

Ex. $9^{3/2} = \sqrt{9^3} = 3^3 = 27$

$32^{2/5} = \sqrt[5]{32^2} = 2^2 = 4$

$$16^{-3/2} = \frac{1}{16^{3/2}} = \frac{1}{\sqrt[2]{16^3}} = \frac{1}{4^3} = \boxed{\frac{1}{64}}$$

$$\frac{15a^{3/5}}{5a^{1/5}} = 3a^{2/5}$$

$$(3^{1/2})^6 = 3^3 = \boxed{27}$$

$$\sqrt{x} \cdot \sqrt[3]{x^2}$$

$$x^{1/2} \cdot x^{2/3} = x^{(3)(1/2) + (2)(2/3)} = x^{3/2 + 4/3} = x^{17/6} = x^{2\frac{5}{6}}$$

$$= \sqrt[6]{x^7}$$

$$\sqrt[4]{18a^3b^4} = 3ab^2\sqrt[4]{2a}$$

18 (aaa)

 /

2 · 9 (3·3)

 /

3 · 3

$$\sqrt[4]{32a^5b^7} = 2ab^2\sqrt[4]{2ab^3}$$

32 (aaaaa) (bbbbbbb)

 /

2 · 2 · 2 · 2 · 2