

Final Review #2: Exponential Expressions and Functions

Expressions:

Important Details to Know:

- zero exponent: $X^0 = 1$

- one exponent: $X^1 = X$

- negative exponents:

$$X^{-1} = \left(\frac{1}{X}\right)^1 = \frac{1}{X}$$

$$2^{-3} = \left(\frac{1}{2}\right)^3 = \frac{1}{8}$$

$$\left(\frac{a}{b^2}\right)^{-5} = \left(\frac{b^2}{a}\right)^5 = \frac{b^{10}}{a^5}$$

Properties of Exponents:

$$X^a \cdot X^b = X^{a+b}$$

ex $X^2 \cdot X^7 = X^9$

$$(X^a)^b = X^{ab}$$

ex $(X^2)^7 = X^{14}$

$$\frac{X^a}{X^b} = X^{a-b}$$

ex $\frac{X^7}{X^2} = X^5$; $\frac{X^2}{X^7} = X^{-5} = \left(\frac{1}{X}\right)^5$

Examples:

$$\begin{aligned} & -(2x)^2(x^{-1}) \\ &= -(2x)^2\left(\frac{1}{x}\right) \\ &= -(4x^2)\left(\frac{1}{x}\right) \\ &= \frac{-4x^2}{x^1} \\ &= \boxed{-4x} \end{aligned}$$

$$\begin{aligned} & (-x)^4(2x^2)^{-3} \\ &= x^4 \cdot \left(\frac{1}{2x^2}\right)^3 \\ &= x^4 \left(\frac{1}{8x^6}\right) \\ &= \frac{x^4}{8x^6} = \boxed{\frac{1}{8x^2}} \end{aligned}$$

$$\begin{aligned} & -X^4(5X)^0 \\ &= -X^4 \cdot 1 \\ &= \boxed{-X^4} \end{aligned}$$

$$\begin{aligned} & \frac{-3(X^2)^5}{9X^3 \cdot X^{10}} \\ &= \frac{-3X^{10}}{9X^{13}} \\ &= \boxed{\frac{-1}{3X^3}} \end{aligned}$$

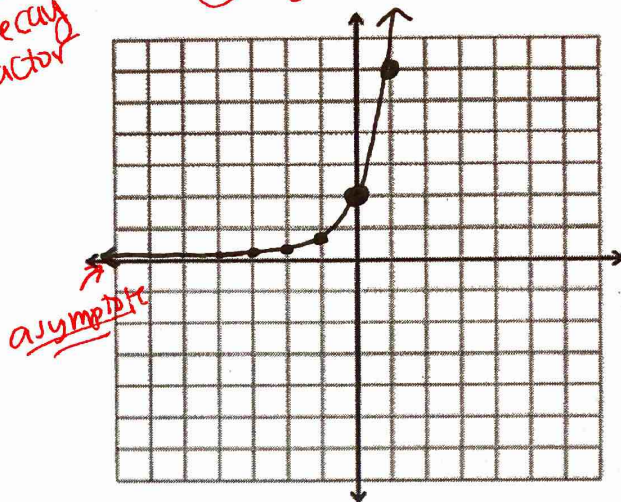
Functions:

The general form for an exponential function is $y = a \cdot b^x$:

x	$y = a \cdot b^x$
-3	$\frac{a}{b \cdot b \cdot b} = a \cdot b^{-3}$
-2	$\frac{a}{b \cdot b} = a \cdot b^{-2}$
-1	$\frac{a}{b} = a \cdot b^{-1}$
0	a
1	$a \cdot b$
2	$a \cdot b \cdot b = a \cdot b^2$
3	$a \cdot b \cdot b \cdot b = a \cdot b^3$

↑ growth/decay factor
 ↑ y-int
 ↓ · b
 ↓ · b
 ↓ · b

(ex) $y = 2(3)^x$



Examples, with four general shapes:

<p>1. $y = 3(2)^x$</p> <p>$a = 3$ <u>positive</u> above x-axis</p> <p>$b = 2$ doubling <u>increasing</u></p>	<p>2. $y = -3(2)^x$</p> <p>$a = -3$ <u>negative</u> below x-axis</p> <p>$b = 2$ doubling <u>decreasing</u></p>
<p>3. $y = 3(\frac{1}{2})^x$</p> <p>$a = 3$ <u>positive</u> above x-axis</p> <p>$b = \frac{1}{2}$ divide by 2 <u>decreasing</u></p>	<p>4. $y = -3(\frac{1}{2})^x$</p> <p>$a = -3$ <u>negative</u> below x-axis</p> <p>$b = \frac{1}{2}$ divide by 2 <u>increasing</u></p>