Exponential Functions

Algebraic	Exponential
x^2	2^x
the base changes	the power changes

$5^{-3} = \left(\frac{1}{5}\right)^3$

$\left(\frac{x}{y^{-5}}\right)^{-2}$

$5^0 = 1$

$b^{-n} = \frac{1^3}{5^3} = \frac{1}{125}$

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

Exponential Function

$f(x)$
$y = a \cdot b^{x}$ ← Exponent contains the variable

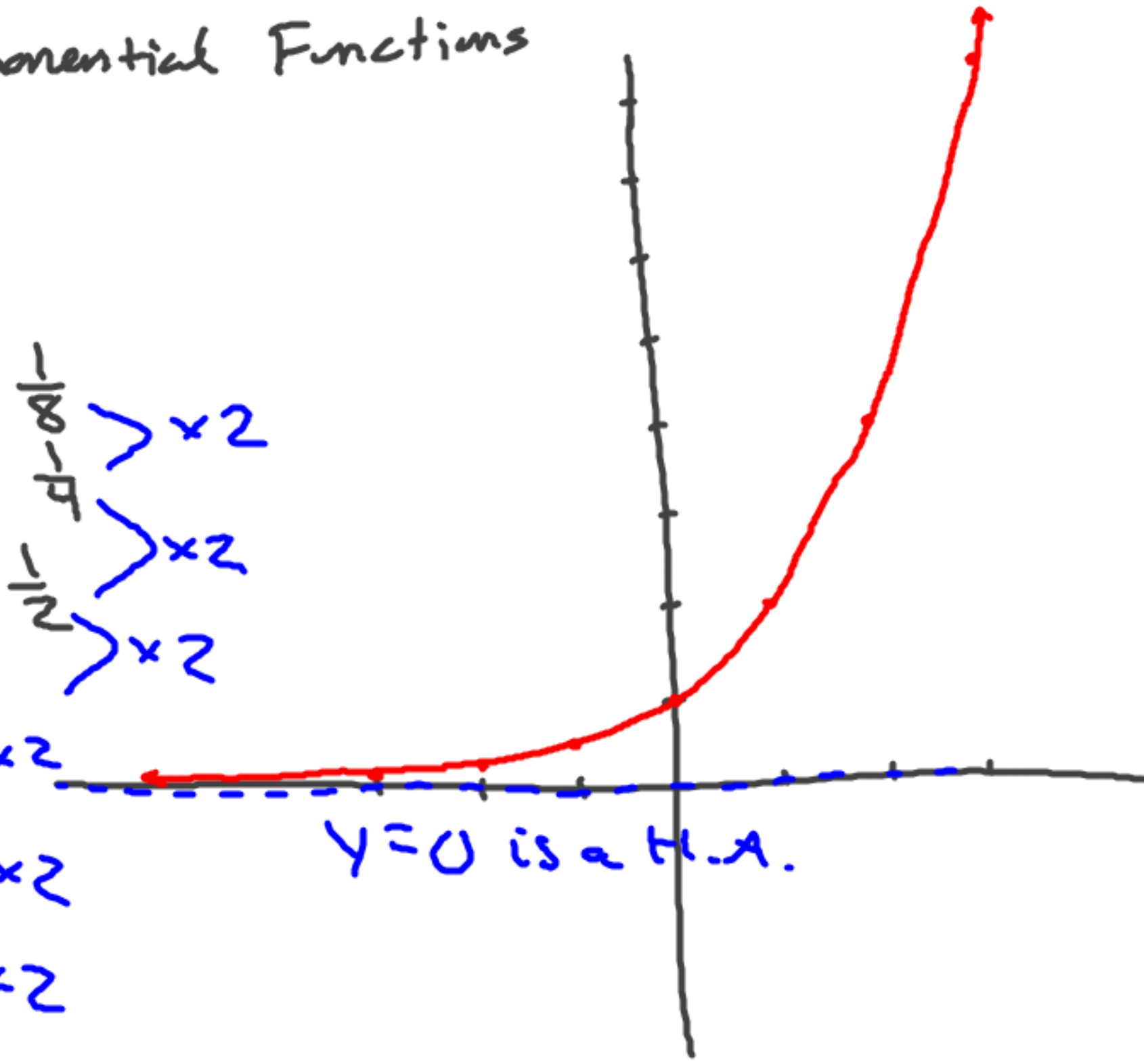
- a: number, "initial value", y-int., any real number
- b: base, always positive, any number > 0

$$f(x) = 4 \cdot (2)^{x}$$

Graphing Exponential Functions

$y = 2^x$

x	y	
-3	$2^{-3} = \left(\frac{1}{2}\right)^3 = \frac{1}{8}$	×2
-2	$2^{-2} = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$	×2
-1	$2^{-1} = \left(\frac{1}{2}\right)^1 = \frac{1}{2}$	×2
0	$2^0 = 1$	×2
1	$2^1 = 2$	×2
2	$2^2 = 4$	×2
3	$2^3 = 8$	×2

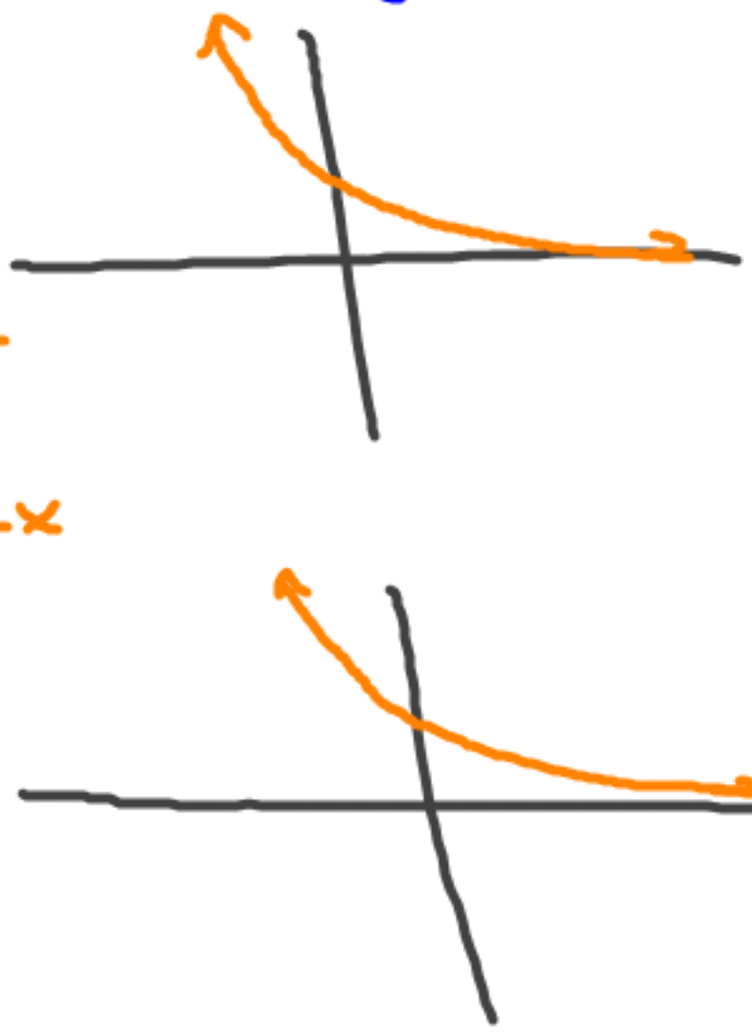


if b is a fraction less than 1
the graph flips left to right

$\left(\frac{1}{b}\right)^x$

same

b^{-x}



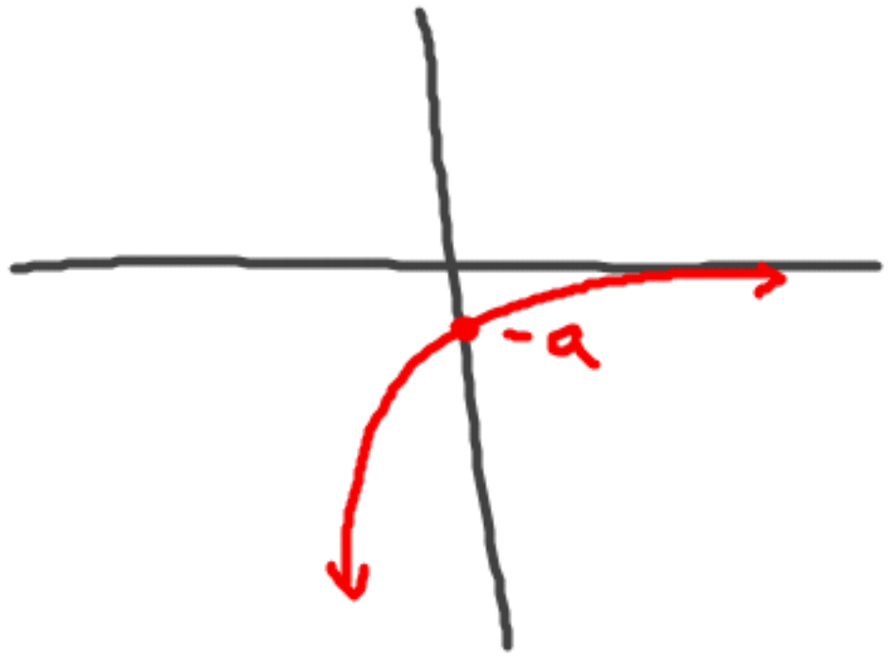
$b>1$

$y = a \cdot b^x$

$y = -a \cdot b^x$

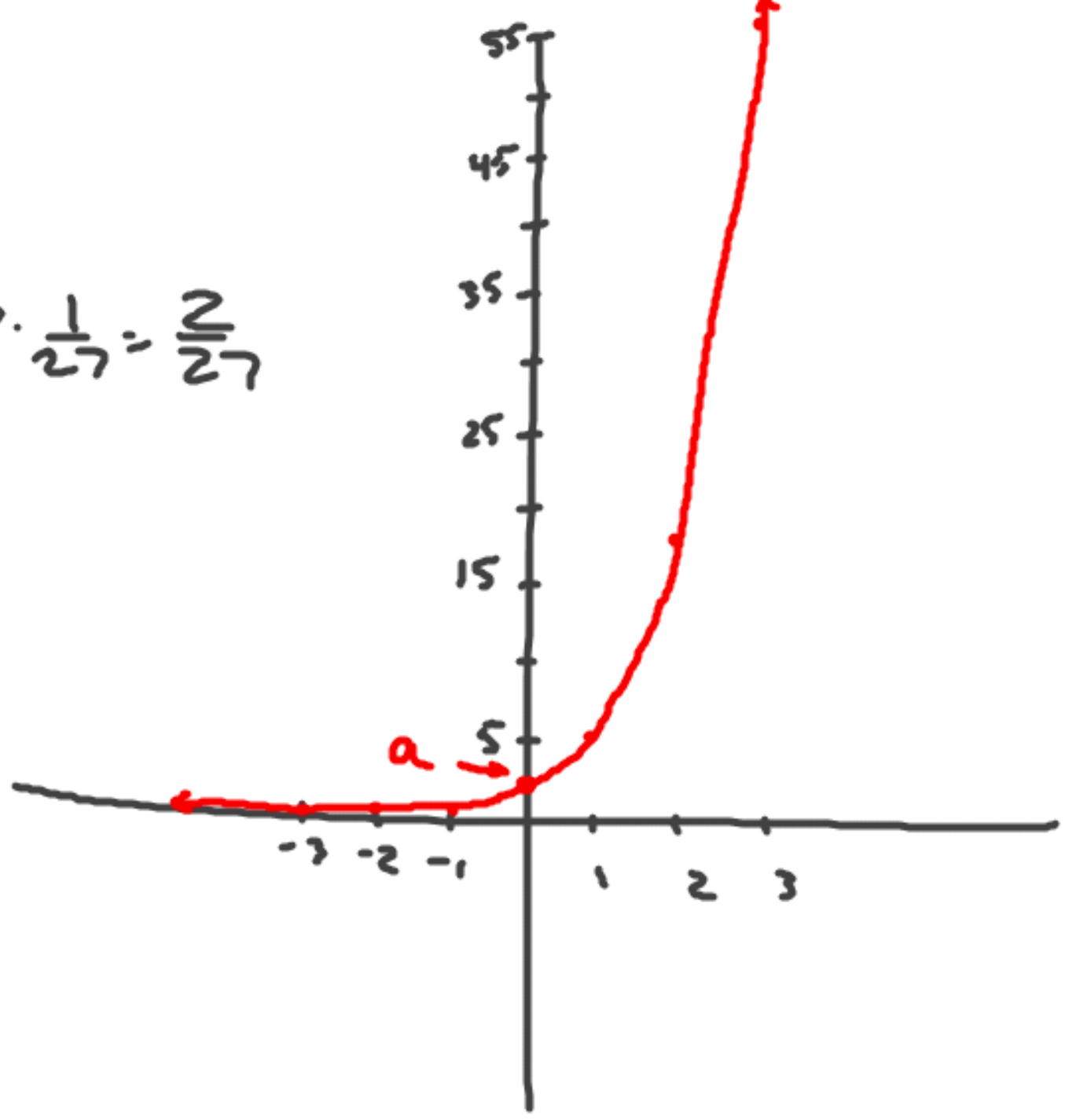
$y = a \cdot b^{-x}$ $\left(y = a \cdot \left(\frac{1}{b}\right)^x\right)$

$y = -a \cdot b^{-x}$



$$y = 2 \cdot 3^x$$

x	y
-3	$2 \cdot 3^{-3} = 2 \cdot \left(\frac{1}{3}\right)^3 = 2 \cdot \frac{1}{27} = \frac{2}{27}$
-2	$2 \cdot 3^{-2} = 2\left(\frac{1}{9}\right) = \frac{2}{9}$
-1	$2 \cdot 3^{-1} = 2 \cdot \frac{1}{3} = \frac{2}{3}$
0	$2 \cdot 3^0 = 2$
1	$2 \cdot 3^1 = 6$
2	$2 \cdot 3^2 = 18$
3	$2 \cdot 3^3 = 54$



GROWTH & DECAY

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

GROWTH: $b > 1$

DECAY: $b < 1$

$y = 3 \cdot (4)^x$ GROWTH

$y = 2 \cdot \left(\frac{1}{2}\right)^x$ DECAY

$y = 3 \cdot (2)^{-x}$

$3\left(\frac{1}{2}\right)^x$ DECAY

$y = 2\left(\frac{1}{4}\right)^{-x}$

$2(4)^x$ GROWTH

Write an exponential equation for the function that passes the 2 given points

$(0, 4)$ $(3, 32)$

$y = a \cdot b^x$

$y = 4 \cdot b^x$ $\quad y = 4 \cdot 2^x$

$32 = 4 \cdot b^3$

$\frac{4}{\sqrt[3]{8}} = \frac{4}{\sqrt[3]{b^3}}$

$2 = b$

$(0, \frac{3}{a})$ $(-1, 6)$

$y = 3 \cdot b^x$ $y = 3\left(\frac{1}{2}\right)^x$

$\frac{6}{3} = \frac{3 \cdot b^{-1}}{3}$

$2 = b^{-1}$

$b \cdot 2 = b^{-1} \cdot b$

$\frac{2b}{2} = \frac{1}{2}$

$b = \frac{1}{2}$

528: 22-26E, 27-38 ALL