7.1 Exploring Exponential Models

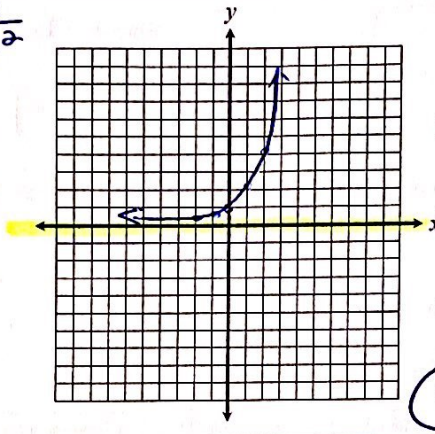
Exponential Parent Function $f(x) = b^x$	• If $b > 1$, the function is an exponential growth and is increasing • If $b < 1$, the function is an exponential decay and is decreasing
Asymptote	a line which the graph gets close to but never crosses

Directions: Classify as an exponential growth or decay, and then identify its key characteristics and graph.

1. $f(x) = 2^x$

$2^{-2} = \frac{1}{2^2}$

X	y
-2	1/4
-1	1/2
0	1
1	2
2	4



Domain: $\mathbb{R}$

Range: $(0, \infty)$

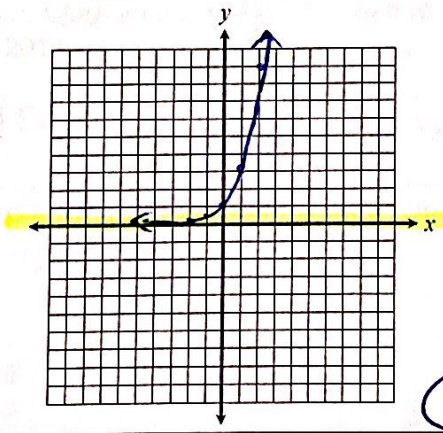
y-intercept: $(0, 1)$ plug in $x = 0$

Asymptote: $y = 0$

Growth/Decay

2. $f(x) = 3^x$

X	y
-2	1/9
-1	1/3
0	1
1	3
2	9



Domain: $\mathbb{R}$

Range: $(0, \infty)$

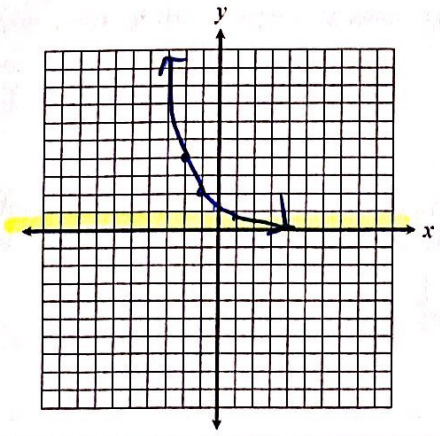
y-intercept: $(0, 1)$

Asymptote: $y = 0$

Growth/Decay

3. $f(x) = \left(\frac{1}{2}\right)^x$

X	y
-2	4
-1	2
0	1
1	1/2
2	1/4



Domain: $\mathbb{R}$

Range: $(0, \infty)$

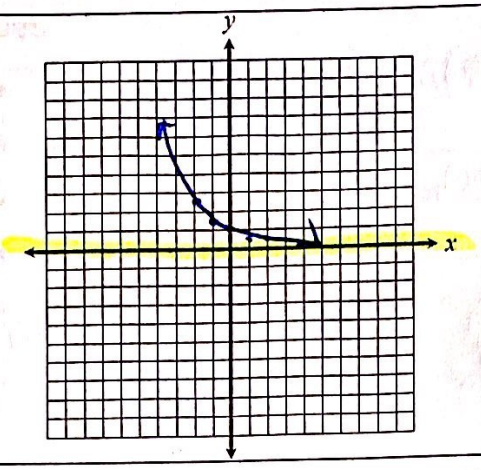
y-intercept: $(0, 1)$

Asymptote: $y = 0$

Growth/Decay

4. $f(x) = \left(\frac{2}{3}\right)^x$

X	Y	
-2	9/4	2.25
-1	3/2	1.3
0	1	
1	2/3	.6
2	4/9	.4



Domain: $\mathbb{R}$

Range: $(0, \infty)$

y-intercept: $(0, 1)$

Asymptote: $y = 0$

Growth/Decay

Exponential Growth

Occurs when a quantity **exponentially increases** over time

Formula:

$A = a(1+r)^t$

$a =$ initial amount

$r =$ rate (decimal)

$t =$ time

5. The original value of an investment is $1,800. If the value has increased by 7% each year, write an exponential function to model the situation. Then, find the value of the investment after 15 years.

$A = 1800(1+.07)^{15} = \$4966.26$

6. In 2002, there were 972 students enrolled at Oakview High School. Since then, the number of students has increased by 1.5% each year. Write an exponential function to model the situation, then find the number of students enrolled in 2014. $t = 12$

$A = 972(1+.015)^{12} =$ 1162 students

Exponential Decay

Occurs when a quantity **exponentially decreases** over time

Formula:

$A = a(1-r)^t$

$a =$ initial

$r =$ rate (decimal)

$t =$ time

7. An investment of $12,000 is losing value at a rate of 4% each year. Write an exponential function to model the situation, then find the value of the investment after 9 years.

$A = 12000(1-.04)^9 = \$8310.40$

8. Mark bought a brand new car for $35,000 in 2008. If the car depreciates in value approximately 8% each year, write an exponential function to model the situation. Then, find the value of the car in 2015.

$A = 35000(1-.08)^7 = \$19524.63$