

Standard Form of an Exponential Function:

$$y = ab^{x-h} + k$$

Where a is your initial value, b is your base, and k is your horizontal asymptote. The base, b , is ALWAYS a constant value that is NEVER equal to one, and the exponent is always a variable. Exponential functions are non-linear. A horizontal asymptote is a line that the graph approaches but NEVER touches.

Examples of Exponential Growth Functions:

$f(x) = 6^{x-1}$

$y = 4^x$

$y = 2^x - 6$

$y = 4(7)^x$

Properties of Exponential Growth:**I. Properties**

- If it goes up and increases the entire time, then it is an exponential growth.
- The base, b , will be greater than 1
- One y -intercept, no x -intercept.
- End Behavior:
 - As x increases, $f(x)$ increases; as x decreases, $f(x)$ approaches the horizontal asymptote.

II. Horizontal Asymptote: $y = k$

- Recall, an asymptote is a **line** that a graph approaches, but never crosses. Horizontal asymptotes are **ALWAYS** written as a LINEAR EQUATION.

III. Domain and Range:

- For exponential functions, the domain is ALL REAL NUMBERS.
- For exponential functions, the range depends on the horizontal asymptote.

IV. To Graph

- Make an xy table
- Plot points and draw the horizontal asymptote

Examples of Exponential Growth Functions:

1) $y = 5^x$

Base: 5Initial Value: 1H.A: $y=0$

2) $y = \frac{1}{2}(3^x)$

Base: 3Initial Value: $\frac{1}{2}$ H.A: $y=0$

3) $y = 2^x - 4$

Base: 2Initial Value: 1H.A: $y=-4$

Guided Example 4:

Graph the exponential function $y = 2^x$

x	y
-3	0.125
-2	0.25
-1	0.5
0	1
1	2
2	4
3	8

Growth or Decay? growth

Initial Value: 1 Base: 2

HA: $y=0$ $y > 0$

Domain: $(-\infty, \infty) \mathbb{R}$ Range: $(0, \infty)$

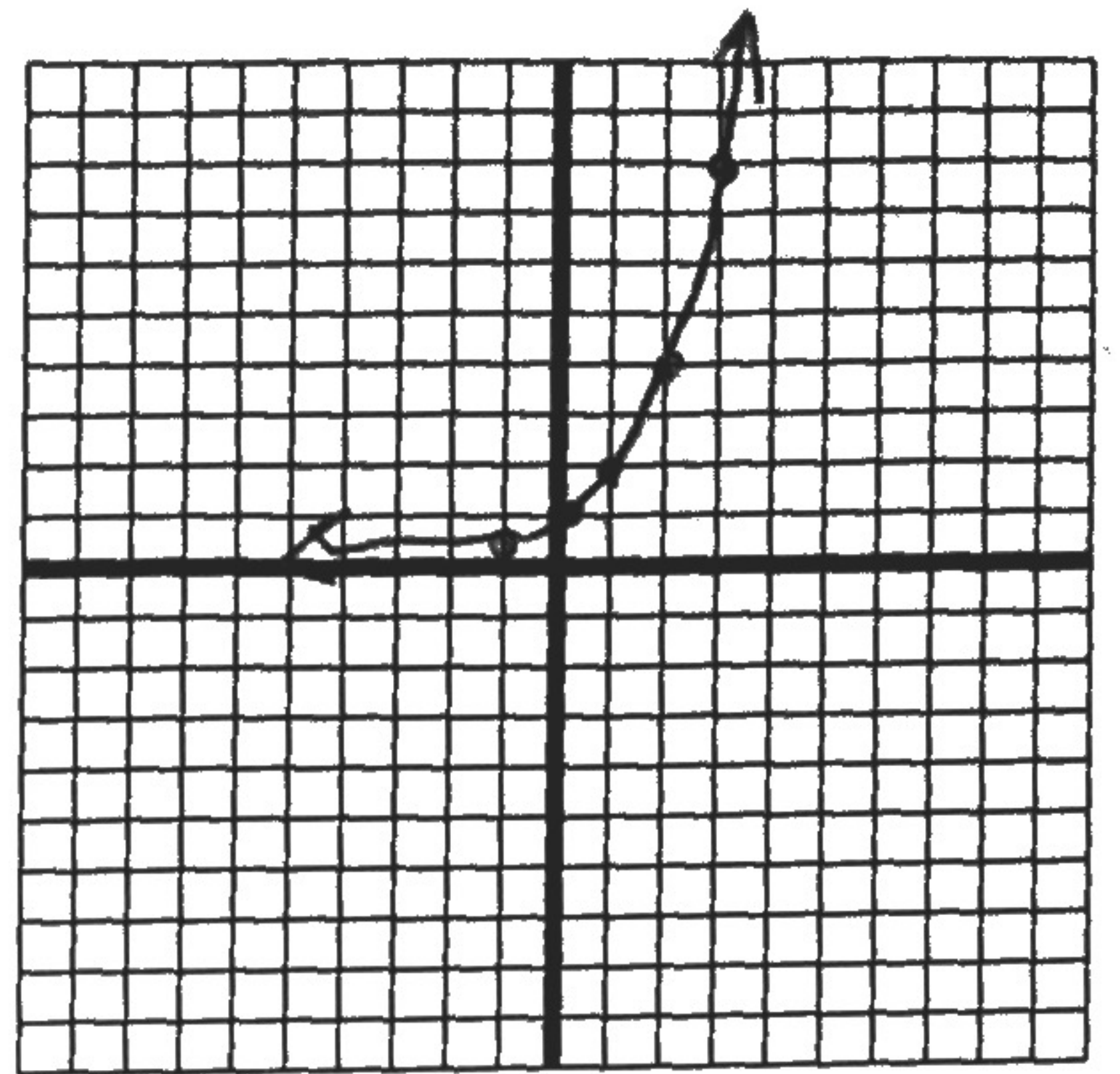
Max: none Min: none

Y-Intercept: $(0, 1)$

Increasing: \mathbb{R} Decreasing: none

End Behavior: As x increases, y approaches ∞

As x decreases, y approaches 0



Guided Example 5:

Graph the exponential function $y = 3^x$

x	y
-3	$1/27$
-2	$1/9$
-1	$1/3$
0	1
1	3
2	9
3	27

Growth or Decay? growth

Initial Value: 1 Base: 3

HA: $y=0$ $y > 0$

Domain: \mathbb{R} Range: $(0, \infty)$

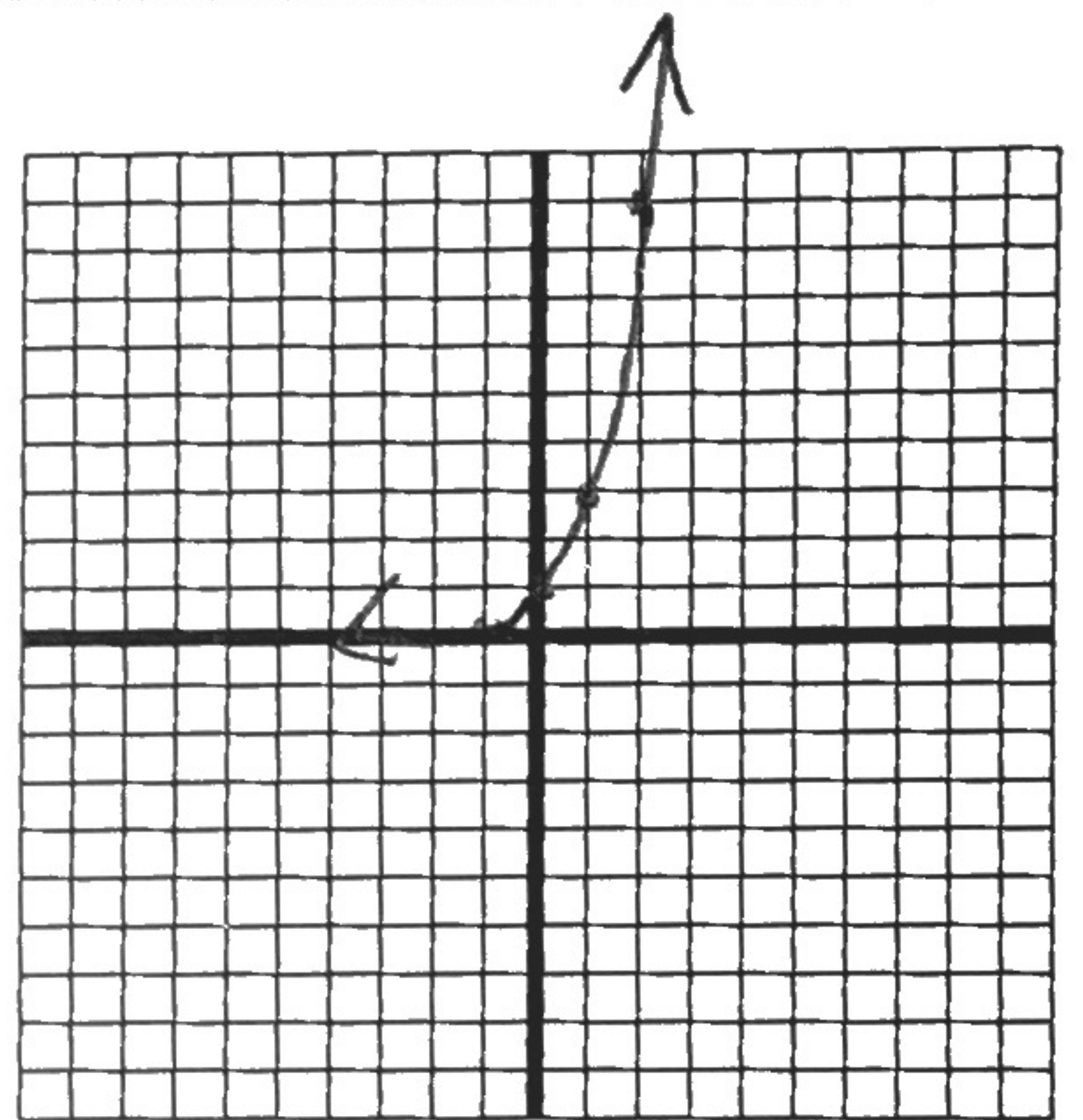
Max: none Min: none

Y-Intercept: $(0, 1)$

Increasing: \mathbb{R} Decreasing: none

End Behavior: As x increases, y approaches ∞

As x decreases, y approaches 0



Guided Example 6:

Graph the exponential function $y = 2^x - 3$

x	y
-2	-2.75
-1	-2.5
0	-2
1	-1
2	1
3	5
4	13

Growth or Decay? growth

Initial Value: 1 Base: 2

HA: $y = 0$ $y > -3$

Domain: \mathbb{R} Range: $(-3, \infty)$

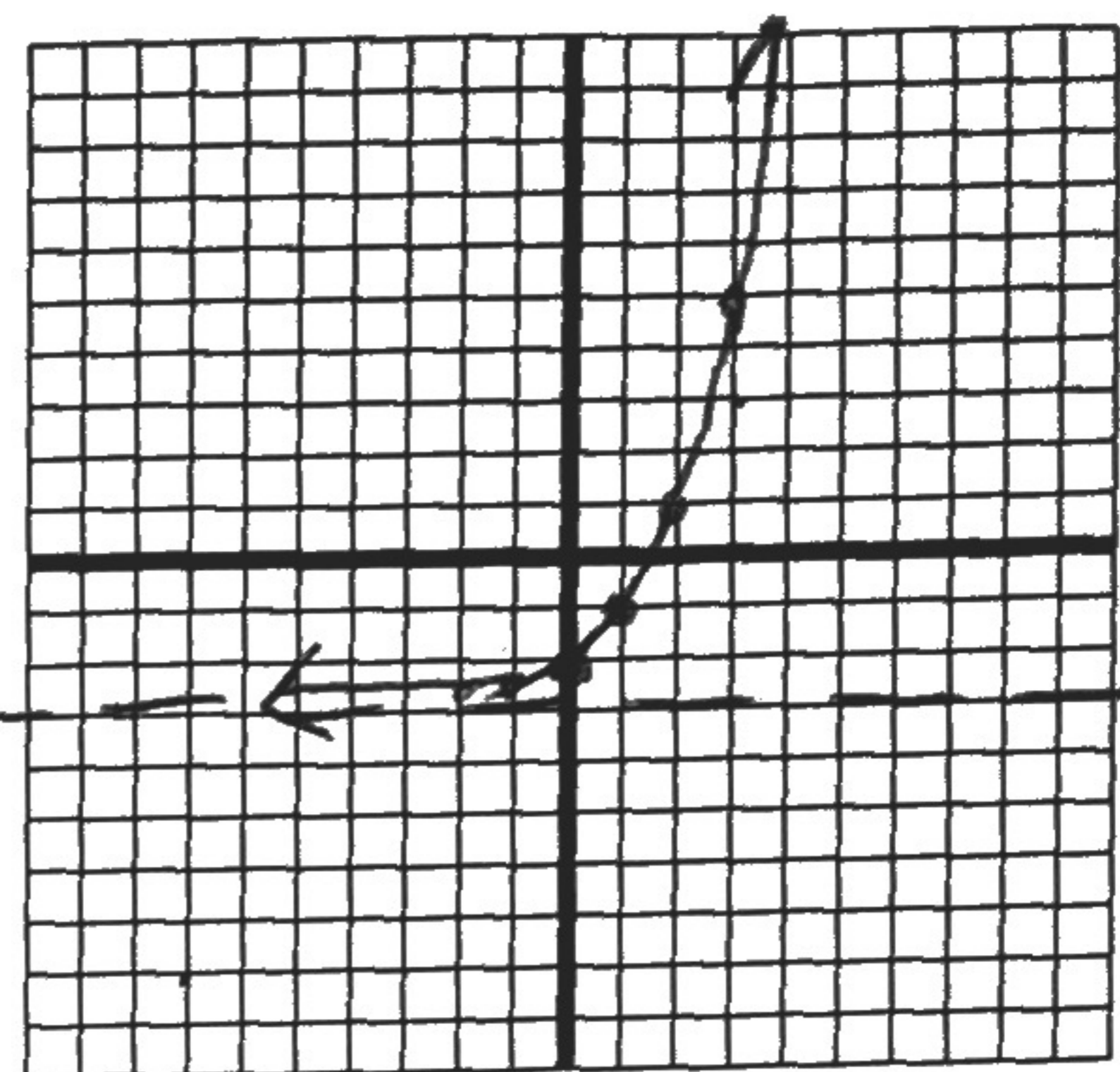
Max: none Min: none

Y-Intercept: $(0, -2)$

Increasing: \mathbb{R} Decreasing: none

End Behavior: As x increases, y approaches ∞

As x decreases, y approaches -3



Guided Example 7:

Graph the exponential function $y = \frac{1}{3}(3^x) - 2$

x	y
-2	-1.96
-1	-1.89
0	-1.67
1	-1
2	1
3	7
4	25

Growth or Decay? growth

Initial Value: $\frac{1}{3}$ Base: 3

HA: $y = -2$ $y > -2$

Domain: \mathbb{R} Range: $(-2, \infty)$

Max: none Min: none

Positive: _____ Negative: _____

Y-Intercept: $(0, -5/3)$

End Behavior: As x increases, y approaches ∞

As x decreases, y approaches -2

