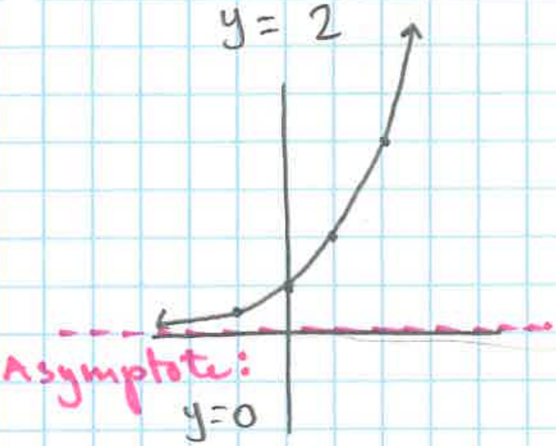
# 6.1 GRAPHING EXPONENTIALS

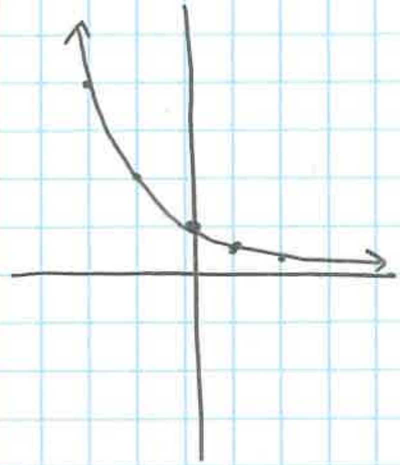
$y = 2^x$




| x | y |
|---|---|
| -1 | 1/2 |
| 0 | 1 |
| 1 | 2 |
| 2 | 4 |

D: $x \in \mathbb{R}$
R: $y \in (0, \infty)$
EB: as $x \to \infty$, $y \to \infty$
as $x \to -\infty$, $y \to 0$

$y = (1/2)^x$



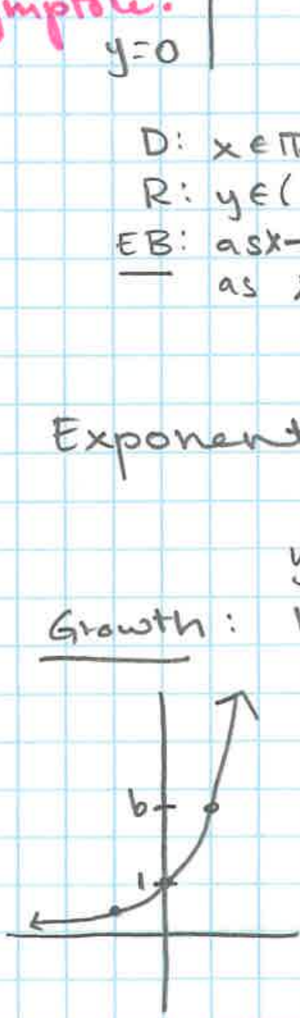
| x | y |
|---|---|
| -2 | 4 |
| -1 | 2 |
| 0 | 1 |
| 1 | 1/2 |
| 2 | 1/4 |

Exponential Functions: $y = b^x$

$b \neq 1$, $b > 0$

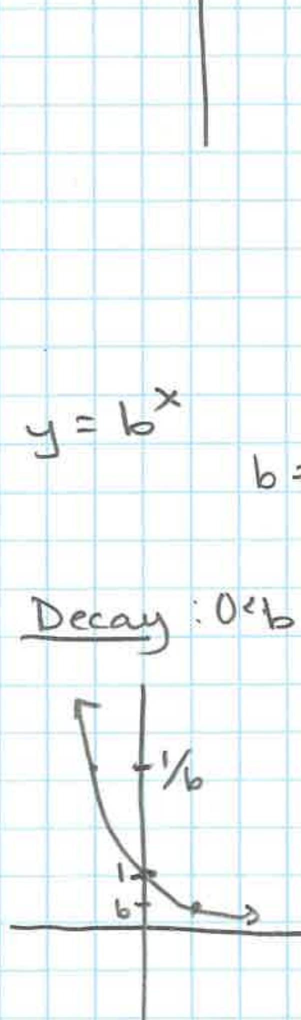
$y = b^x$

Growth: $b > 1$




| x | y |
|---|---|
| -1 | 1/b |
| 0 | 1 |
| 1 | b |

Decay: $0 < b < 1$




| X | y |
|---|---|
| -1 | 1/b |
| 0 | 1 |
| 1 | b |

## Transformed Equations

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

a: vertical dilation

h: horizontal translation    k: vertical translation

if $-a \to$ reflected over x axis, $-(x-h)$: reflected over y axis

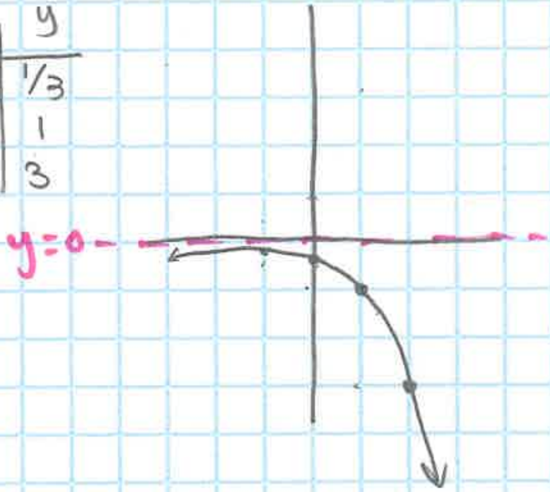
Ex 1

Asymptote $y=-4$

① $g(x) = -3^{x-1}$

Reflection over x-axis, translated right 1

| x | y |
|---|---|
| -1 | 1/3 |
| 0 | 1 |
| 1 | 3 |




| x | y |
|---|---|
| -1 | -1/9 |
| 0 | -1/3 |
| 1 | -1 |
| 2 | -3 |

D: $x \in \mathbb{R}$ R: $y \in (-\infty, 0)$

EB: as $x \to \infty$, $y \to -\infty$
as $x \to -\infty$, $y \to 0$

② $y = 2 \cdot 3^x - 4$

VD of 2
down 4

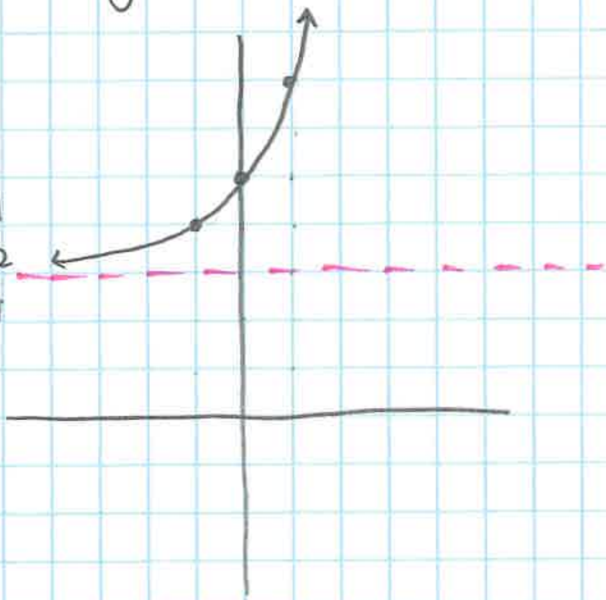

| x | y |
|---|---|
| -1 | $\frac{1}{3} \cdot 2$ |
| 0 | $1 \cdot 2$ |
| 1 | $3 \cdot 2$ |

| | |
|---|---|
| -1 | 2/3 |
| 0 | 2 |
| 1 | 6 |

① $y = 2 \cdot 2^{x} + 3$

VD of 2
up 3

| x | y |
|---|---|
| -1 | $1/2 \cdot 2 = 1$ |
| 0 | $1 \cdot 2 = 2$ |
| 1 | $2 \cdot 2 = 4$ |



Domain $x \in \mathbb{R}$

Range: $y \in (3, \infty)$

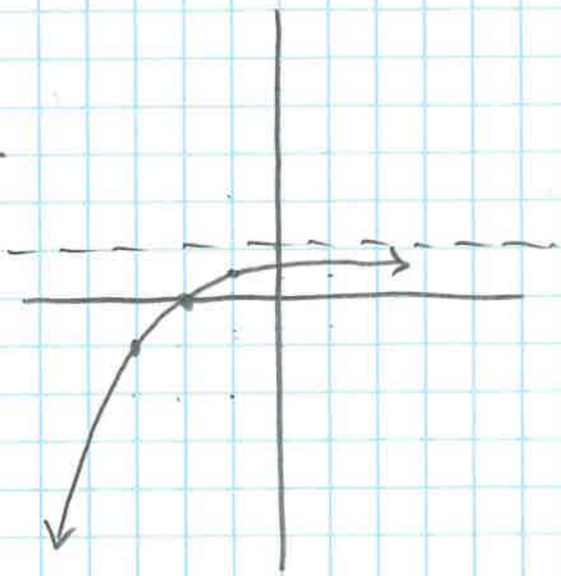
Asymptote $y = 3$

End Behavior
as $x \to \infty$, $y \to \infty$
as $x \to -\infty$, $y \to 3$

② $y = -(\frac{1}{2})^{x+2} + 1$

Reflected over xaxis
HT left 2, up 1

| x | y |
|---|---|
| -1 | -2 |
| 0 | -1 |
| 1 | $-1/2$ |



D: $x \in \mathbb{R}$

R $y \in (-\infty, 1)$

A $y = 1$

EB: as $x \to \infty$, $y \to 1$
as $x \to -\infty$, $y \to -\infty$

## Modeling w/ Growth & Decay

In 2010 the population of a large city is 4.6 million. The city is expected to grow at a rate of 1.3% for the next decade

$$A(t) = 4.6(1+.013)^t$$

Find population in 2014

$$A(4) = 4.6(1+.013)^4 = 4.844 \text{ million}$$

Find when population will be 5 million

$$5 = 4.6(1.013)^t$$

**GROWTH**

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

$a>0 \quad (1+r)>1$

**Decay**

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

$a>0 \quad 0<(1+r)<1$

a: initial amt
r: rate of increase / decrease
t: time

**Car model**

A car is purchased in 2015 for \$24,000. The car depreciates by 20% each year.

a) Write a function to model

$$y = 24000(0.8)^t$$

b) Find the value of car in 2025

$$y = 24000(.8)^{10} = \$2576.98$$

c) When will the car be worth nothing