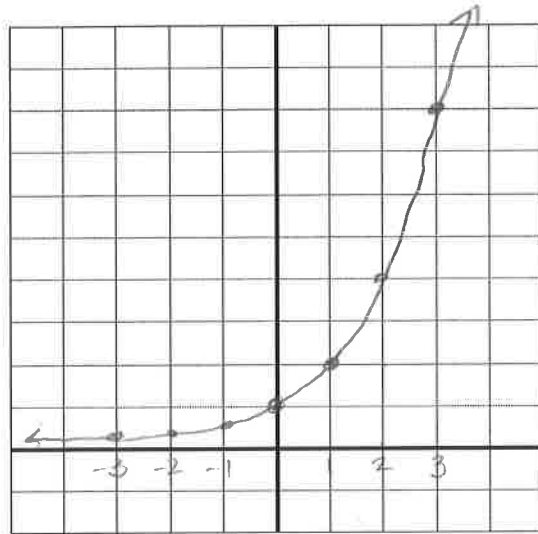


3.1 Graphing Exponentials

Exponential curve: $y = a^x$

$y = 2^x$

x	y	$= 2^x$
-3	$\frac{1}{8}$	2^{-4}
-2	$\frac{1}{4}$	2^{-2}
-1	$\frac{1}{2}$	2^{-1}
0	1	2^0
1	2	2^1
2	4	2^2
3	8	2^3



Asymptote: $y = 0$

using graphing Calc; move windows(?)

Compare each of the following to the parent graph $y = 2^x$

$y = 2^x$

1) $y = 3^x$ closer to y-axis; (narrower; vertical stretch)

$y = 5^x$ even closer to y-axis

$y = 2^x$

2) $y = 2^{x+2}$ moves up 2 units

$y = 2^{x-2}$ moves down 2 units

3) $y = 2^{(x+2)}$ need parenthesis in Calc! moves left 2 units

$y = 2^{(x-2)}$ moves right 2 units

4) $y = \frac{1}{2}^x = 2^{-x}$ reflects over y-axis

5) $y = -2^x$ reflects over x-axis

Parent Graphs: $y=2^x$ $y=3^x$ $y=4^x$

Translations

$y = a^x + c$ moves up c units

add c to y -values

$y = a^x - c$ moves down c units

subtract c from y -values

$y = a^{x+c}$ moves left c units

subtract c from x -values

$y = a^{x-c}$ moves right c units

add c to x -values

$y = -a^x$ reflects over x axis

mult y -values by -1

$y = a^{-x}$ reflects over y axis

mult x -values by -1

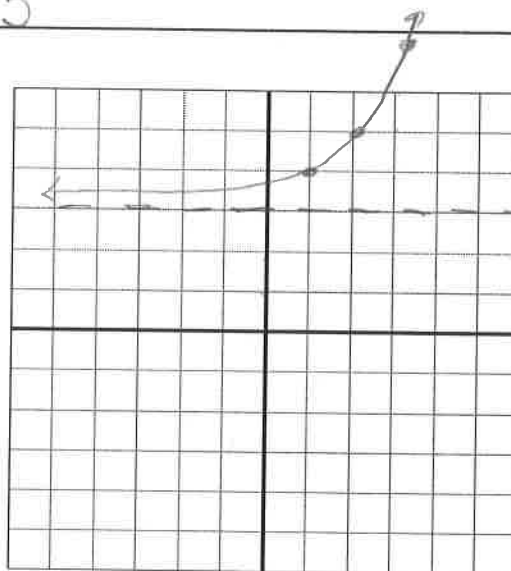
1) $y = 2^{x-1} + 3$

movements: right 1, up 3

x	y
-1	+3
0	1
1	2
2	4

x	y
1	4
2	5
3	7

plot these



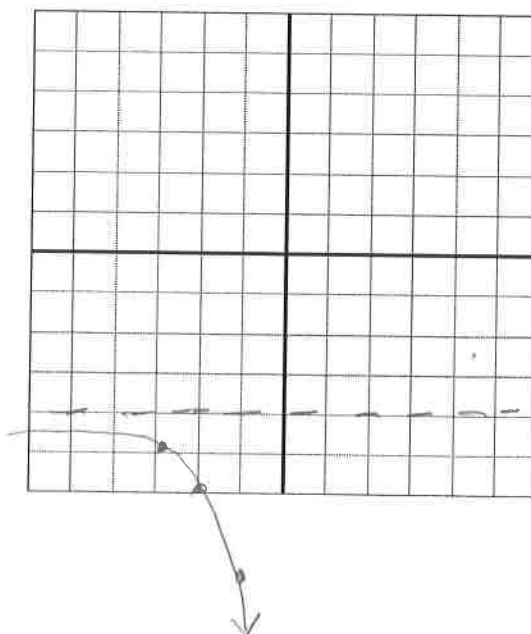
Asymptote: $y = 3$

2) $y = -2^{x+3} - 4$

movements: reflects over x -axis; left 3; down 4

x	y
-3	-4
0	-1
1	-2
2	-4

x	y
-3	-5
-2	-6
-1	-8



Asymptote: $y = -4$

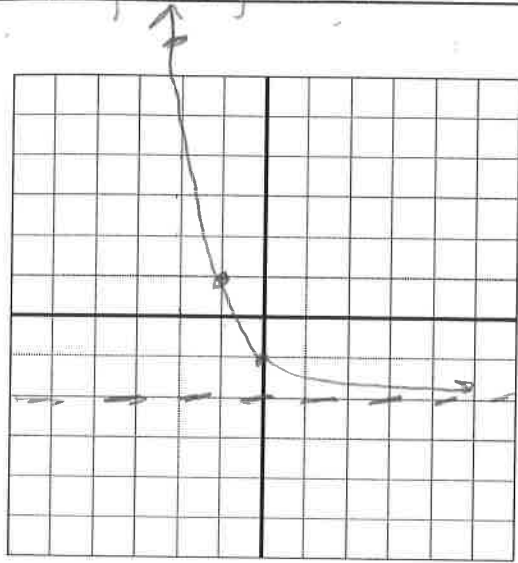
$$3) y = \left(\frac{1}{3}\right)^x - 2$$

movements: reflects over y-axis; down 2

reflect
x-axis
meet
by -1

x	y
0	1
-1	3
-2	9

x	y
0	-1
-1	1
-2	7



Asymptote: y = -2

$$-4^{-(x+1)} + 5$$

DO NOT distribute neg! NOT $-4^{-x-1} + 5$
 → stays outside (!)

$$4) y = -\left(\frac{1}{4}\right)^{x+1} + 5$$

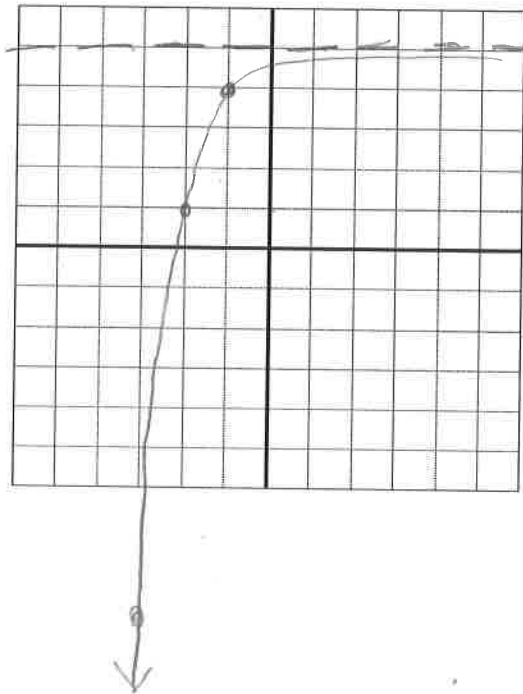
movements: reflects x and y, left +1, up 5

meet
x -1

x	y
-1	+5
0	-1
-1	-4
-2	-16

reflect
y so
meet
by -1

x	y
-1	4
-2	1
-3	-11



Asymptote: y = 5