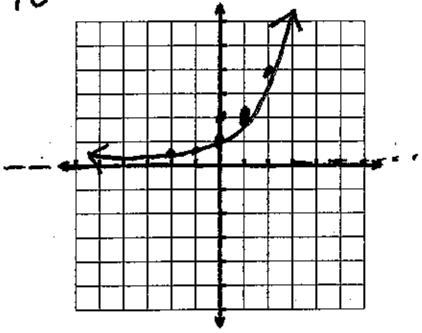
AC CCGPS Alg/Geo

Name Key

Graphing Exponential Equations

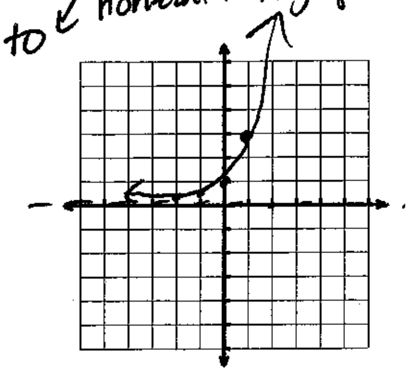
1. $y = 2^x$ +0 ↙ horizontl asymptote

X	y
-2	.25
-1	.5
0	1
1	2
2	4



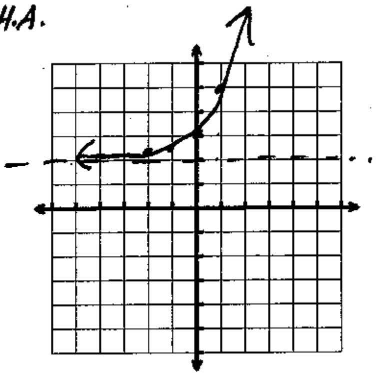
2. $y = (3)^x$ +0 ↙ Horizontl Asymptote

X	y
-2	.11
-1	.33
0	1
1	3
2	9



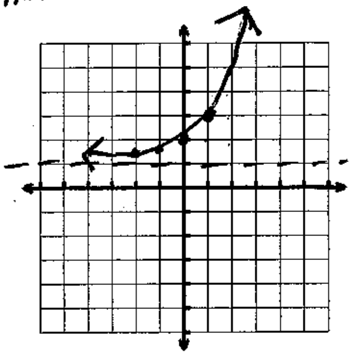
3. $y = 3^x + 2$ ↙H.A.

X	y
-2	2.11
-1	2.33
0	3
1	5
2	11



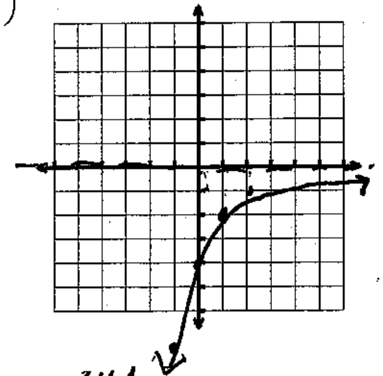
4. $y = 2^x + 1$ ↙H.A.

X	y
-2	1.25
-1	1.5
0	2
1	3
2	5



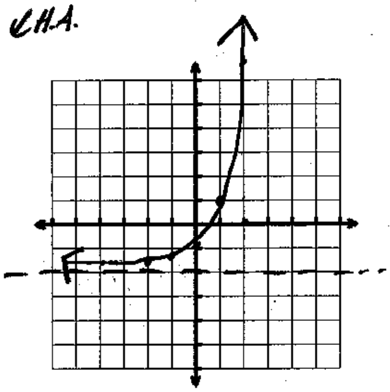
5. $y = -\left(\frac{1}{2}\right)^{x-2}$ +0 ↙HA.

X	y
-2	-16
-1	-8
0	-4
1	-2
2	-1



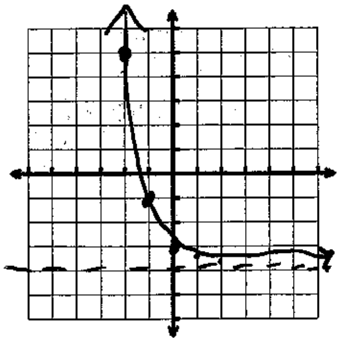
6. $y = 3^x - 2$ ↙H.A.

X	y
-2	-1.89
-1	-1.67
0	-1
1	1
2	7



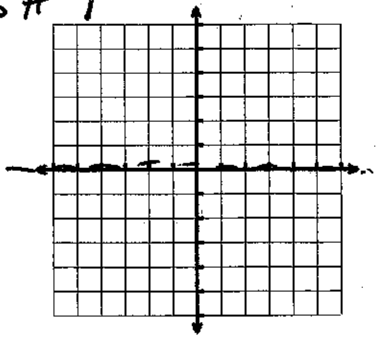
7. $y = \left(\frac{1}{3}\right)^x - 4$ ↙HA.

X	y
-2	9-4=5
-1	3-4=-1
0	1-4 = -3
1	.33-4=-3.67
2	.11-4 =-3.89



8. $y = 2^x$ +0 ↙H.A.

same as # 1



An **exponential function** has the form

$$y = ab^x$$

b is a positive number <u>other than</u> 1

If b is *<u>greater than</u>* 1

$$y = ab^x$$

b is the "growth factor"

exponential growth function.

If b is *<u>between 0 and</u>* 1

$$y = ab^x$$

b is the "decay factor"

exponential decay function.

In the bunny problem
a = 2 (because we initially had 2 bunnies)
b = 2 (because they were having 2 babies)
So our equation was $y = 2(2)^x$

***a* = initial amount**
***b* = growth/decay factor**
***x* = time**
***y* = ending amount**

In the meteorite problem:
a = 30 (we initially had 30 ounces)
b = ½ (it was decaying by ½)
So our equation was: $y = 30(\frac{1}{2})^x$

1. Each year the local country club sponsors a tennis tournament. Play starts with 128 participants. During each round, half of the players are eliminated. Write an equation that models this situation. $y=128(\frac{1}{2})^x$
How many players are left after 5 rounds? $y=128(\frac{1}{2})^5$ $=4$ (you can count OR plug in 5 for your x)

2. Bacteria can multiply at an alarming rate when each bacteria splits into two new cells, thus doubling. Write an equation that models one bacteria cell that splits into two new cells every hour. $y=1(2)^x$
How many bacteria would you have after 24 hours? $y=1(2)^{24}$
$=16777216$

In the following equations, identify the initial amount and growth or decay factor. CIRCLE whether it is growth or decay.

3. $y = 100(3)^x$
Initial amount = 100
Growth/decay factor = 3

4. $y = 15(.5)^x$
Initial amount = 15
Growth/decay factor = .5

5. $y = 4^x$
Initial amount = 1
Growth/decay factor = 4

6. $y = \frac{1}{2}(\frac{3}{2})^x$
Initial amount = $\frac{1}{2}$
Growth/decay factor = $\frac{3}{2}$

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AC CCGPS Alg/Geo
Exponential Growth and Decay

Name Key

Growth $b > 1$ decay $0 < b < 1$ (b = base) $y = \underset{\text{initial amount}}{a}\,\underset{\text{base}}{b}^{x}$

Identify whether the equation represents an exponential growth or decay.

1. $y = 2^x - 1$

Growth

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

decay

3. $y = -3^x$

inverted or reflected growth

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

growth

5. $y = 3x^2$

not an exponential function

6. $y = (-2)^x + 3$

reflected growth

Identify the asymptote and the y-intercept in the following equations.

7. $y = 2^x + 3$

Asymptote: $y = 3$

y-int: $(0, 4)$

$x = 0$

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

Asymptote: $y = -1$

y-int: $(0, 1)$

$x = 0$

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

Asymptote: $y = -4$

y-int: $(0, 5)$

$x = 0$

10. $y = -2^{x+3} + 0$

Asymptote: $y = 0$

y-int: $(0, -8)$

$x = 0$

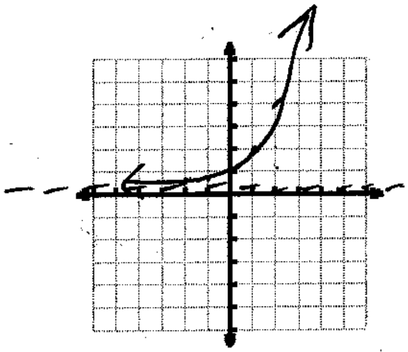
CCGPS A – Linear and Exponential Functions
Graphing Exponential Functions

Name Key

Exponential Functions: $\mathbf{y = b^x}$, where b is a positive number other than 1

Graph $y = 2^x$ using a t-chart.

X	Y
-2	.25
-1	.5
0	1
1	2
2	4
3	8
4	16



Asymptote - a line that a graph <u>approaches</u> as you move away from the origin; the graph hugs the asymptote

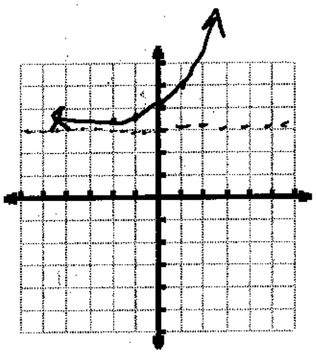
---

General Exponential Function $y = a(b^{x-h}) + k$

- Sketch the horizontal asymptote with a dashed line ($y = k$)
- Find the y-intercept of the graph by evaluating the function when x=0.
- Use a t-chart to sketch the graph of $y = ab^x$
- Transform the graph
  - Multiply y value of each coordinate in t-chart by a – move pencil to this point.
  - Shift h units horizontally
  - Shift k units vertically

1. $y = 2^x + 3$

x	y
-2	3.25
-1	3.5
0	4
1	5
2	7



Y-intercept (0,5)

Asymptote $y = 3$

Domain ℝ

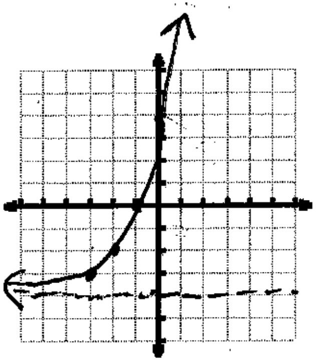
Range $y > 3$

[✓ Growth] or Decay

end behavior: $x \to -\infty, f(x) \to 3$
$x \to \infty, f(x) \to \infty$

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

x	y
-3	-3
-2	-2
-1	0
0	4
1	12



Y-intercept (0,4)

Asymptote $y = -4$

Domain ℝ

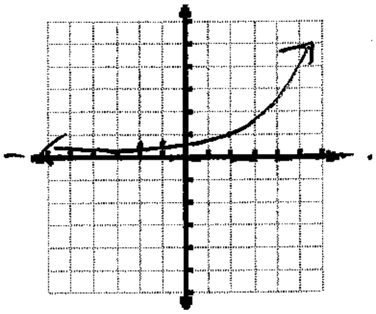
Range $y > -4$

[✓ Growth] or Decay

end behavior: $x \to -\infty, f(x) \to -4$
$x \to \infty, f(x) \to \infty$

3. $y = 3^{x-2} + 0$

x	y
-2	.012
-1	.04
0	.11
1	.33
2	1



Y-intercept $(0, .11)$

Asymptote $y = 0$

Domain $\mathbb{R}$

Range $y > 0$

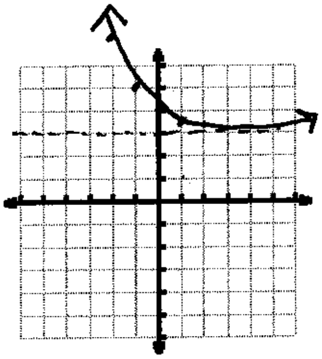
[✓ Growth] or Decay

end behavior: $x \to -\infty, f(x) \to 0$

$x \to \infty, f(x) \to \infty$

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

x	y
-2	7
-1	5
0	4
1	3.5
2	3.25



Y-intercept $(0, 4)$

Asymptote $y = 3$

Domain $\mathbb{R}$

Range $y > 3$

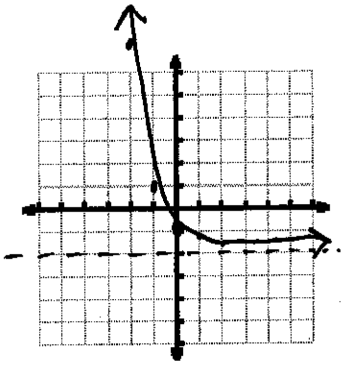
Growth or [✓ Decay]

end behavior: $x \to -\infty, f(x) \to \infty$

$x \to \infty, f(x) \to 3$

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

x	y
-2	7
-1	1
0	-1
1	-1.67
2	-1.89



Y-intercept $(0, -1)$

Asymptote $y = -2$

Domain $\mathbb{R}$

Range $y > -2$

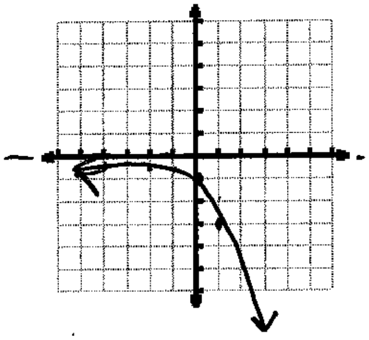
Growth or [✓ Decay]

end behavior: $x \to -\infty, f(x) \to \infty$

$x \to \infty, f(x) \to -2$

6. $y = -(3)^x + 0$

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



Y-intercept $(0, -1)$

Asymptote $y = 0$

Domain $\mathbb{R}$

Range $y < 0$

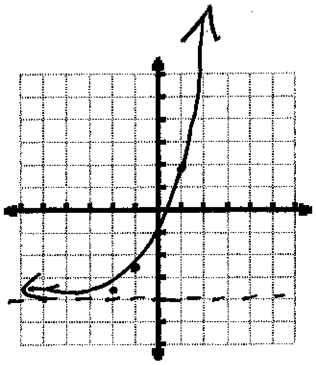
[✓ Growth] or Decay

end behavior: $x \to -\infty, f(x) \to 0$

$x \to \infty, f(x) \to -\infty$

7. $y = 3 \bullet (2)^x - 4$

x	y
-2	-3.25
-1	-2.5
0	-1
1	2
2	8



Y-intercept $(0, -1)$

Asymptote $y = -4$

Domain $\mathbb{R}$

Range $y > -4$

[✓ Growth] or Decay

end behavior: $x \to -\infty, f(x) \to -4$

$x \to \infty, f(x) \to \infty$

CCGPS A
Linear and Exponential Functions

Name Key

Graph the following by using transformations from the 'parent' graph. Graph 'parent points' in pencil and then apply transformation. Connect new points with curve.

1. $y = 2^x - 4$

x	y
-2	-3.75
-1	-3.5
0	-3
1	-2
2	0

y – int (0,-3)

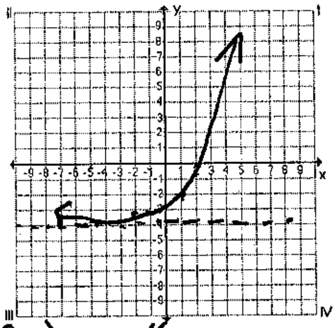
asymp y=-4

dom ℝ

range y>-4

[✓ growth]/decay

e.b. x→-∞, f(x)→-4
x→∞, f(x)→∞



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

x	y
-2	7
-1	5
0	4
1	3.5
2	3.25

y – int (0,4)

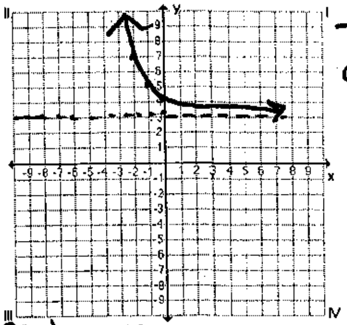
asymp y=3

dom ℝ

range y

growth/[✓ decay]

e.b. x→-∞, f(x)→∞
x→∞, f(x)→3



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

x	y
-2	7
-1	1
0	-1
1	-1.7
2	-1.9

y – int (0,-1)

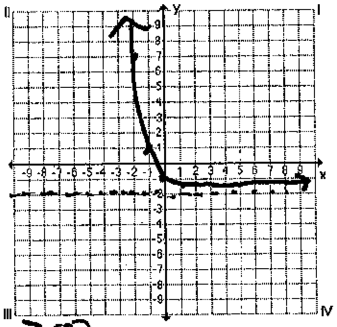
asymp y=-2

dom ℝ

range y>-2

growth/[✓ decay]

e.b. x→-∞, f(x)→∞
x→∞, f(x)→-1



4. $y = 3^x - 2$

x	y
-2	-1.9
-1	-1.7
0	-1
1	1
2	7

y – int (0,-1)

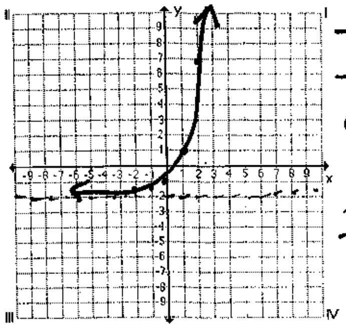
asymp y=-2

dom ℝ

range y>-1

[✓ growth]/decay

e.b.
x→-∞, f(x)→-1
x→∞, f(x)→∞



5. $y = 3\left(\frac{1}{3}\right)^x + 4$

x	y
-2	31
-1	13
0	7
1	5
2	4.3

y – int (0,7)

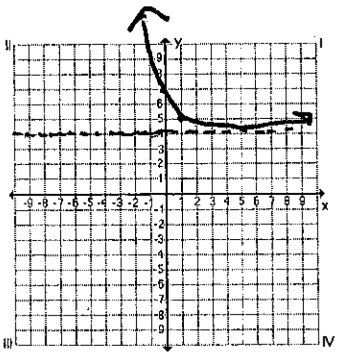
asymp y=4

dom ℝ

range y>4

growth/decay

e.b.
x→-∞, f(x)→∞
x→∞, f(x)→4



6. $y = 2(2^x) - 3$

x	y
-2	-2.5
-1	-2
0	-1
1	1
2	5

y – int (0,-1)

asymp y=-3

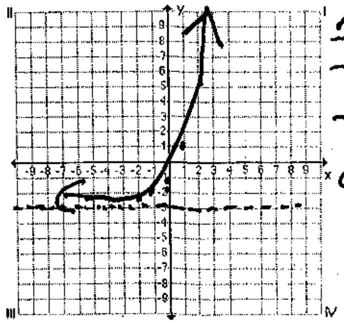
dom ℝ

range y>-3

[✓ growth]/decay

e.b.

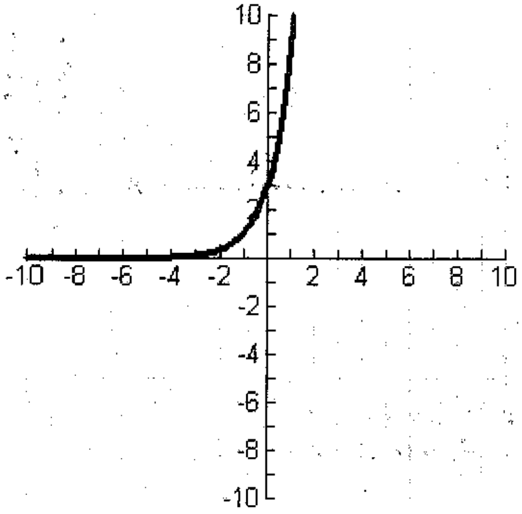
x→-∞, f(x)→-3
x→∞, f(x)→∞



Name: ______________________________ Homework

Analyzing Growth and Decay Exponential Functions

1. $y = 3^{x+1}$



Domain: $\mathbb{R}$

Range: $y > 0$

Asymptotes: $y = 0$

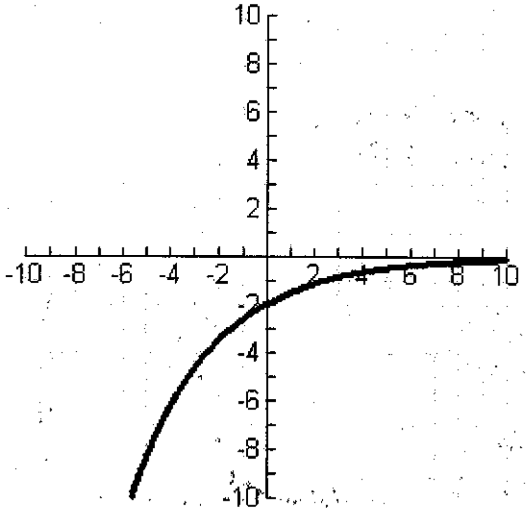
Zeros: none

Intercepts: $(0, 3)$

Intervals of increase and decrease

increase: $(-\infty, \infty)$

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



Domain $\mathbb{R}$

Range: $y < 0$

Asymptotes: $y = 0$

Zeros: none

Intercepts: $(0, -2)$

Intervals of increase and decrease

increase:

$(-\infty, \infty)$

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