Name: _____ Date: _____

Exponential functions (practice makes perfect)

In order to help you use your notes better, this activity will have you FULLY answer each problem at the top of the section (with work AND correct answer) and then you will complete similar problems below

Example: For the sequence given **a)** determine the explicit formula **b)** Find the next two terms and **c)** find a_{10}

a) $a_n = 2(-6)^{n-1}$

2, -12, 72, -432..., 2592, -15552 (b)

(x-6, x-6, -6)

c) $a_{10} = 2(-6)^{10-1} = 120,932,351$

1) 1, 3, 9, 27, ...

(x3, 3, 3)

a) $a_n = 1(3)^{n-1}$

b) 81, 243

c) $a_{10} = 1(3)^{10-1} = 19,683$

2) -3, -15, -75, -375...

a) $a_n = -3(5)^{n-1}$

b) -1875, -9375

c) $a_{10} = -3(5)^{10-1} = -5859375$

3) 4, 8, 16, 32....

a) $a_n = 4(2)^{n-1}$

b) 64, 128

c) $a_{10} = 4(2)^{10-1} = 2048$

4) -1, 4, -16, 64...

a) $a_n = -(-4)^{n-1}$

b) -256, 1024

c) $a_{10} = -(-4)^{10-1} = 262,144$

Example: **a)**Determine the *percent* change in the sequence given **b)** determine if it is a growth or a decay function

200, 230, 264.50, 304.18...

1.15 MEANS GROWTH BECAUSE IT IS GREATER THAN 1

$\frac{230}{200} = 1.15$ $\frac{264.50}{230} = 1.15$ $\frac{304.18}{264.50} = 1.15$

1.15

15% IS THE PERCENT CHANGE

5) 80, 72, 64.8, 58.32...

.90

DECAY

10%.

6) 50, 65, 84.50, 109.85....

1.30

GROWTH

30%.

7) 2, 2.02, 2.04, 2.06....

1.01

GROWTH

1%.

8) 60, 45, 33.75, 25.31....

.75

DECAY

25%.

Example: Determine all of the transformations of the exponential function given

$f(x) = -3(.75)^{x+2} - 5$

REFLECTION — STRETCH BY 3 — DECAY — LEFT 2 — DOWN 5

9) $f(x) = 4(2)^x + 7$

STRETCH OF 4

GROWTH

UP 7

10) $f(x) = -\frac{1}{3}(4)^{x-3}$

REFLECTION

SHRINK OF 1/3

GROWTH

RIGHT 3

11) $y = -3(.9)^{x+1} + 2$

REFLECTION

STRETCH OF 3

DECAY

LEFT 1

UP 2

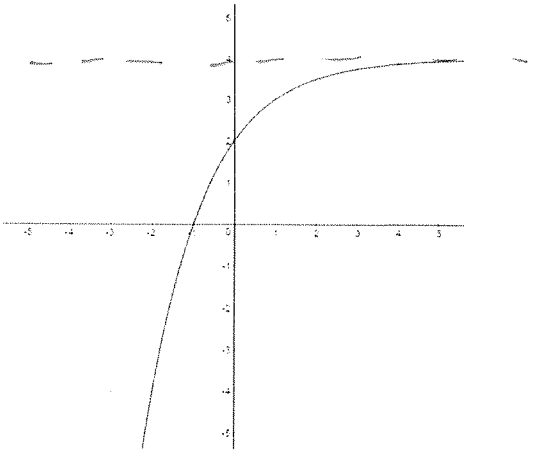
12) $y = 7^{x-1} + 2$

GROWTH

RIGHT 1

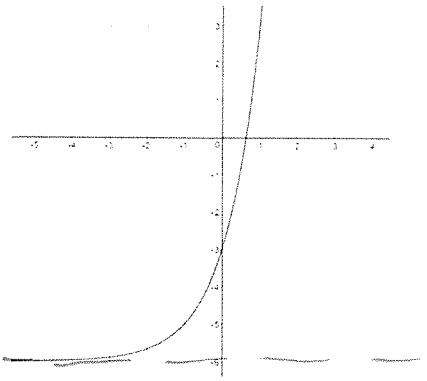
UP 2

Example: Analyze all of the key features of the graph



Domain: $(-\infty, \infty)$
Range: $(-\infty, 4)$
Y-intercept: $(0, 2)$
X-Intercept: $(-1, 0)$
Asymptote: $y = 4$
Growth or Decay?
Increasing/Decreasing?
End Behavior $As\ x \to -\infty, y \to -\infty$
$As\ x \to +\infty, y \to 4$

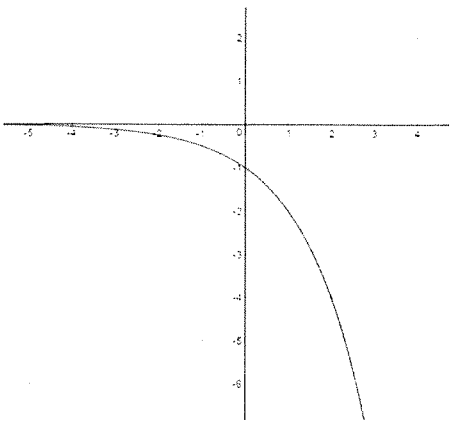
13)



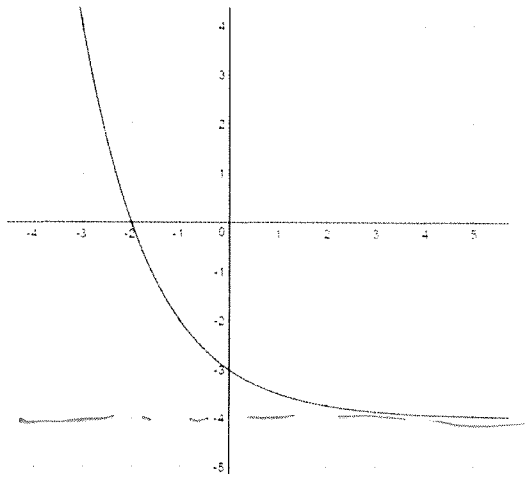
Domain: $(-\infty, \infty)$
Range: $(-5, \infty)$
Y-intercept: $(0, -3)$
X-Intercept: $(.5, 0)$
Asymptote: $y = -6$
Growth or Decay?
Increasing/Decreasing?
End Behavior $As\ x \to -\infty, y \to -6$
$As\ x \to +\infty, y \to \infty$

14)

Domain: ALL REAL NUMBERS OR $(-\infty, \infty)$
Range: $(-\infty, 0)$
Y-intercept: $(0, -1)$
X-Intercept: NONE
Asymptote: $y = 0$
Growth or Decay?
Increasing/Decreasing?
End Behavior $As\ x \to -\infty, y \to 0$
$As\ x \to +\infty, y \to -\infty$



15)



Domain: $(-\infty, \infty)$
Range: $(-4, \infty)$
Y-intercept: $(0, -3)$
X-Intercept: $(-2, 0)$
Asymptote: $y = -4$
Growth or Decay?
Increasing/Decreasing?
End Behavior $As\ x \to -\infty, y \to \infty$
$As\ x \to +\infty, y \to -4$

Example: Graph the exponential function and answer the questions provided

$y = -2(3)^x + 1$

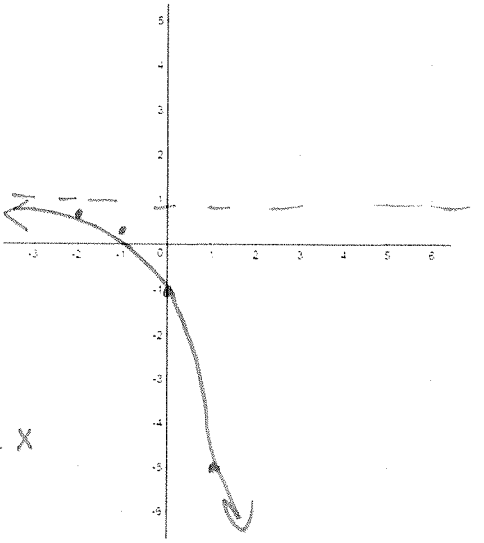
x	y
-2	.78
-1	.33
0	-1
1	-5

Asymptote: $y = 1$

Growth/Decay?

Y-intercept $(0, -1)$

Range $(-\infty, 1)$



YOU CAN ALWAYS FIND THIS BY PLUGGING IN 0 FOR X

$y = -2(3)^0 + 1$

$= -1$

16)

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

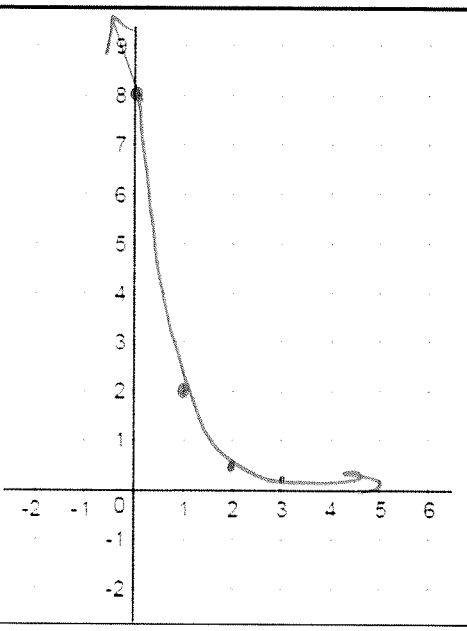
x	y
0	8
1	2
2	.5
3	.125

Asymptote: $y = 0$

Growth/Decay?

Y-intercept $(0, 8)$

Range $(0, \infty)$



Y-INTERCEPT

$y = 2\left(\frac{1}{4}\right)^{0-1}$

$= 8$

17)

$y = -2(0.5)^x + 4$

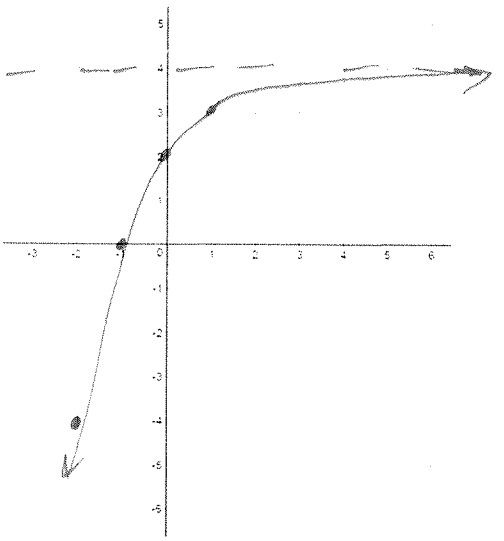
x	y
-2	-4
-1	0
0	2
1	3

Asymptote: $y = 4$

Growth/Decay?

Y-intercept $(0, 2)$

Range $(-\infty, 4)$



15 TO 18 IS 3 YEARS

Example: Mariana is currently 15 is saving up money for a laptop for college when she turns 18. Her bank offers her an interest rate of 6.8%. What is the least amount of money she can put into the savings account now in order to have enough if the laptop costs $600?

WANTS 600

TRYING TO FIND INITIAL VALUE → $a(1.068)^3$

TRY INITIAL VALUES!

$500(1.068)^3 = 609.09$ TOO HIGH

$490(1.068)^3 = 596.91$ TOO LOW.

$492(1.068)^3 = 599.35$ ALMOST!

$493(1.068)^3 = 600.57$ BINGO!

SHE NEEDS TO PUT ASIDE $493 INTO THE SAVINGS ACCOUNT TO HAVE $600 IN 3 YEARS

18) In 2016 there was an outbreak of E coli across 20 states from flour found in General Mills cereal. The amount of E coli bacteria present can double every hour. If you had cereal that was found to have six bacteria of E Coli, how many would be in your cereal in one day?

$y = 6(2)^x$

$y = 6(2)^{24}$

$= 100,663,296$ BACTERIA!

19) Jackson bought a new xbox one for $399. He expects the price to decrease by 21 % every year. How much could he expect to sell it for in two years (when he predicts there will be a new xbox console released)

.21

$1 - .21 = .79$

$y = 399(.79)^x$

$y = 399(.79)^2$

$= \$249.02$

20) Margaret invested $20,000 in a 401K retirement fund which pays 4.5% interest. How much **more** money will Margaret have when she retires in 30 years than what she started with?

$1 = 20,000(1.045)^x$

$20,000(1.045)^{30}$

$= 74906.36$

74,906.36

−20,000

$54,906.36 MORE THAN WHAT SHE STARTED WITH

21) The 64 GB iPhone 5 was released in 2012 which a price of $399. The phone depreciates in value by 15 % each year. If you bought an 64 GB iPhone 5 in 2012. How much could you expect to sell it for now? How much money did you lose on this investment?

$y = 399(.85)^x$

$= 399(.85)^5$

$177.04

.15

$1 - .15 = .85$

2012 TO 2017 = 5 YEARS

YOU PAID $399 - 177.04 =

YOU LOST $221.96!