Unit 4 *Study Guide*

What you need to know and be able to do	Things to remember	Problem	Problem
Describe Characteristics of Exponential Functions	• Interval of Inc/Dec • Domain • Range • Asymptote • B ____ 1 • Growth/Decay • X-int • Y-int • End behaviors • Rate of Change $\dfrac{y_2 - y_1}{x_2 - x_1}$	1. 	Domain $(-\infty, \infty)$ Range: $y > 3$ or $(3, \infty)$ Asymptote: $y = 3$ X-int: none Y-int: $(0, 4)$ Int. of Increase or Decrease B $\geq$ 1 Growth or Decay End Behaviors: $\to 3$ $\to \infty$ Rate of Change from $0 < x < 2$ $3/2$
		2. $(0, -1)$ $b = \dfrac{-1}{3}$ $= 1/3$ $(-1, -3)$	Domain: $\mathbb{R}$ Range: $(-\infty, 0)$ Asymptote: $y = 0$ X-int: none Y-int: $(0, -1)$ Int. of Increase or Decrease B $\leq$ 1 Growth or Decay End Behaviors: $-\infty$ 0 Rate of Change from $-2 < x < 0$ $8/2 = \boxed{4}$

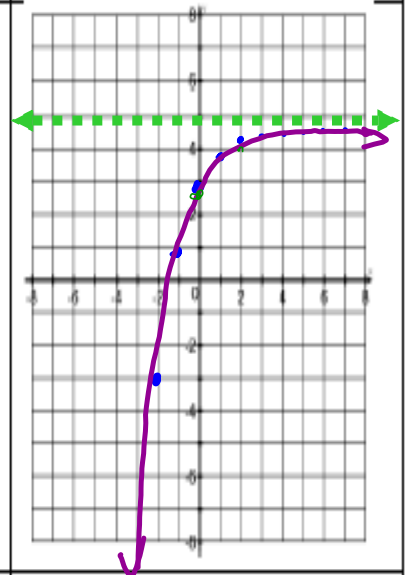| Identify Transformations of Exponential Functions	• Describe the transformations on the parent function $y = 2^x$	3. $y = -2(2)^{x-3}$ • reflects over x-axis • Vertical stretch by 2 • Right by 3 units	4. $y = \frac{1}{3}(2)^x + 8$ • Vertical compress by 1/3 • Up by 8 units
	• Write the equation for the function $y = 3^x$ with given transformations	5. Vertically compress by a factor of 1/3, shift left 3, and shift down 8 $y = \frac{1}{3}(3)^{x+3} - 8$	6. Reflect across the x-axis, vertically stretch by a factor 5, and shift up 7 $y = -5(3^x) + 7$

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Graph Exponential Functions	• Use -2, -1, 0, 1, 2 for the x-values • Graph the asymptote	

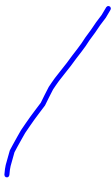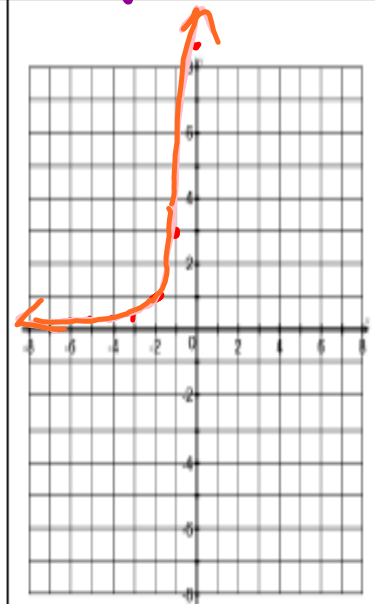7. $f(x) = -2\left(\frac{1}{2}\right)^{x} + 5$

x	f(x)
-2	-3
-1	1
0	3
1	4
2	4.5

8. $g(x) = (3)^{x+2}$

x	f(x)
-2	1
-1	3
X_1 ⓪	⑨ Y_1
1	27
X_2 ②	81 Y_2

Comparing exponential characteristics	• Compare y-intercepts • Compare rates of change	*Use the graphs from Problems 7 and 8*	
		9. Which function has a greater rate of change from $0 \leq x \leq 2$? Why? $f(x) = \dfrac{1 \cdot 5}{2} = 0.75$ $g(x) = \dfrac{81-9}{2-0} = \dfrac{72}{2} = 36$ ⟨g(x)⟩	10. Which function has a lower y-intercept? Why? $f(x) = (0,3)$ $g(x) = (0,9)$ ⟨f(x)⟩
Solve Exponential Functions	• Isolate the base • Create like bases	11. $7^{x-9} = 49^{2x-3}$	12. $64^{3x+5} = 1024^x$
		13. $6^{x-3} + 5 = 41$	14. $8^{3x-1} - 3 < 13$

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• Find your initial value 'a' (x = 0) • Calculate your rate 'b' • If there are percentages, it is either (1 +r) or (1 − r)	15. The population of Marietta in 2003 was estimated to be 35,000 people with a rate of increase of about 24%. $y = a(1+r)^t$ $a = 35000 \quad r = 0.24$ a. Write an equation to represent the population of Marietta. $y = 35000(1.24)^t$ b. Use your equation to estimate the population in 2015 to the nearest hundred people. $t = 2015 - 2003$ $t = 12$ $y = 35000(1.24)^{12}$ $y = 462,517$ People in 2015.	16. A certain bacteria that is growing on your kitchen counter doubles every 5 minutes. Assuming that there was only 1 bacteria in the beginning, how many bacteria would there be after 2 hours? $y = a(1+r)^t$ $a = 1$ $t = (2 \times 60) \div 5 = 24$ $y = 1(2)^{24}$ $y = 16,777,216$ Bacteria after 2 hrs.

17. Chyna invests $300 at a bank that offers a rate of 5% compounded quarterly.

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

a. Write an equation to model the amount of money in Chyna's bank account.

$P = 300; \quad r = .05$

$n = 4$

$$A = 300\left(1 + \frac{0.05}{4}\right)^{4 \cdot t}$$

b. How much money will Chyna have in 4 years? $t = 4$

$$A = 300\left(1 + \frac{0.05}{4}\right)^{4 \times 4}$$

$$A = \$365.97$$

18. Caleb bought a new car at a cost of $25,000. The value of the car decreases about 25% every 2 years.

$a = 25000$

$r = 0.25 \quad t = 2$

a. How much will his car be worth about 2 years?

$$y = 25000(1 - 0.25)^2$$

$$y = \$14,062.50$$

b. How much will his car be worth after 10 years?

$$y = 25000(1 - 0.25)^{10/2}$$

$$\$5,932.62$$

19. Tina and her friends are having a party. The amount of people that know about the party throughout the week is shown in the table below.

Number of Days	Number of People
0	6
1	18
2	54
3	162

a. Write the equation of the amount of people that know about the party. $a = 6$

$r = 18/6 = 3$ $y = a \cdot b^x$

$y = 6(3)^x$

b. How many people will know about the party in a week?

$y = 6(3)^7$

$= 13{,}122 \text{ people}$

• Recursive Rule: $a_n = r * a_{n-1}$ • Explicit/Closed Rule: $a_n = a_1(r)^{n-1}$	20. Given the sequence below: 152, 76, 38, ... $r = \dfrac{76}{152} = \dfrac{1}{2}$ or 0.5 a. Use the recursive rule to find the 5th term $a_3 = 19$ $a_4 = 9.5$ $a_5 = 4.75$ b. Create the closed formula for the sequence. (Explicit) $a_n = 152\left(\tfrac{1}{2}\right)^{n-1}$ c. Use the explicit formula to find the 8th term $a_8 = 152\left(\tfrac{1}{2}\right)^{8-1}$ $a_8 = 152\left(\tfrac{1}{2}\right)^{7}$ $\boxed{a_8 = 1.1875}$	21. Given $a_1 = -2 \quad a_n = 2a_{n-1}$ a. Find the first 5 terms of the sequence. $a_2 = 2(-2) = -4$ $a_3 = 2(-4) = -8$ $a_4 = 2(-8) = -16$ $a_5 = 2(-16) = -32$ b. Create the explicit formula. $a_n = -2(2)^{n-1}$ c. Calculate the 8th and 10th terms. $a_8 = -2(2)^{8} = -256$ $a_{10} = -2(2)^{10-1}$ $\boxed{a_{10} = -1,024}$

| • Find the characteristics of each function in its own form. Use those characteristics to compare
• Y-intercepts occur where x = 0
• Rate of change requires 2 points to plug into the slope formula
• Greater rate of change is the magnitude of the number, not the sign | F(x) is represented by the graph below
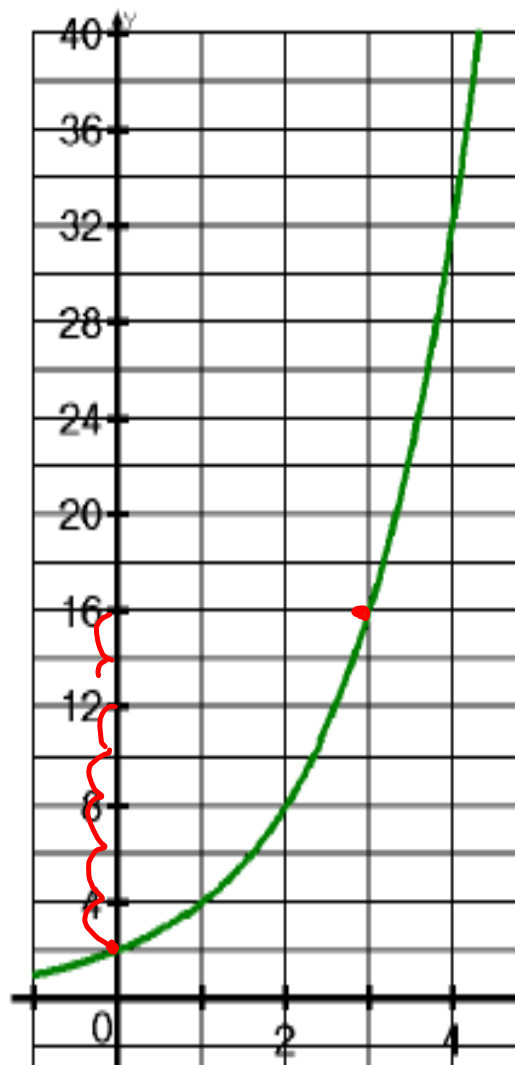
G(x) is represented by the equation
$$G(x) = 1(3)^x$$ | What is the y-intercept of f(x)?
$(0, 2)$
What is the y-intercept of g(x)?
$(0, 1)$
Which function has a lower y-intercept?
$g(x)$
What is the rate of change of f(x) for $0 \le x \le 3$?
$\boxed{\dfrac{14}{3} = 4.7}$
What is the rate of change for G(x) for $0 \le x \le 3$?
$g(0) = 1(3)^0 = 1$
$g(3) = 1(3)^3 = 27$
$\dfrac{27-1}{3-0} = \dfrac{26}{3} = \boxed{8.7}$
Which function has the greater rate of increase for $0 \le x \le 3$?
$\boxed{g(x)}$ |