HW 9-10

1. (3)
2. (4)
3. .5%
4. .327%
5. (4)
6. (a) $f(t) = .917^t$ c. See explanation

   (b) See graph

Feb 11-2:50 PM

Name_____________________________________ Alg 2 HW 9-10

1. Julia deposits $2000 into a savings account that earns 4% interest per year. The exponential function that models this savings account is $y = 2000(1.04)^t$, where t is the time in years. Which equation correctly represents the amount of money in her savings account in terms of the monthly growth rate?
   1. $Y = 166.67(1.04)^{0.12t}$
   2. $y = 2000(1.01)^t$
   3. $y = 2000(1.0032737)^{12t}$
   4. $y = 166.67(1.0032737)^t$

2. If a credit card company charges 13.5% yearly interest, which of the following calculations would be used in the process of calculating the monthly interest rate?

$(1.135)^{1/12t}$

(1) $\frac{0.135}{12}$ (3) $(1.135)^{12}$

(2) $\frac{1.135}{12}$ (4) $(1.135)^{1/12}$

Feb 8-7:43 AM

3. A population of llamas is growing at a constant yearly rate of 6%. At what rate is the llama population growing per month? Please assume all months are equally sized and that there are 12 of these per year. Round to the nearest tenth of a percent.

$m : (1.06)^{1/12}$

$m : 1.00486 = 1 + r$

$.5\%$ .00486 .486% .5%

4. Suppose the annual interest rate at a bank is 4%. We can write the function $f(t) = 1.04^t$ to describe this. What would the equivalent monthly rate be?

Rounded to the nearest thousandth

$f(t) = 1.04^{1/12t}$

$f(x) \cdot 1.00327^t$

$.327\%$

Feb 8-7:45 AM

5. On average, college seniors graduating in 2012 could compute their growing student loan debt using the function, $D(t) = 29{,}400(1.068)^t$, where t is time in years. Which expression is equivalent to $29{,}400(1.068)^t$ and could be used by students to identify an approximate daily interest rate on their loans?

1. $29{,}400(1.068^{\frac{1}{365}})^t$
2. $29{,}400\left(\frac{1.068}{365}\right)^{365t}$
3. $29{,}400\left(1+\frac{0.068}{365}\right)^t$
4. $29{,}400\left(1.068^{\frac{1}{365}}\right)^{365t}$

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6. Radioactive iodine, I-131, is used to treat thyroid disease. Its half-life is 8 days, which means after 8 days, the amount of I-131 remaining is half the original amount. The function to model the remaining I-131 in a system is

$f(t) = \left(\frac{1}{2}\right)^{\frac{\cancel{x}\,t}{8}}$.

(a) Write $f(t) = \left(\frac{1}{2}\right)^{\frac{\cancel{x}\,t}{8}}$ with only x as an exponent

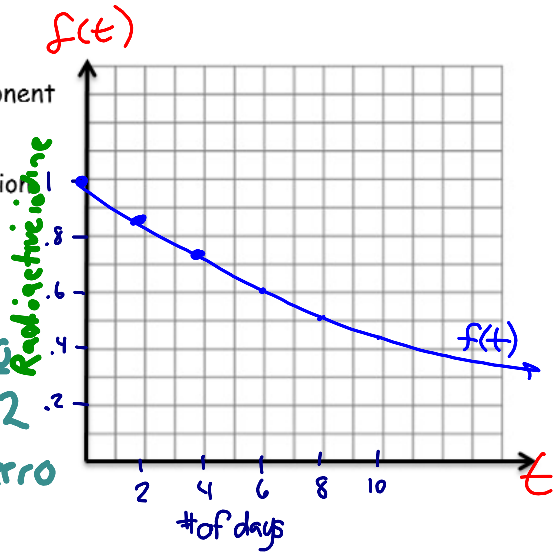
(b) Graph the function from Part A.

(c) Describe the end behavior of the function.

(a) $f(t) = \left(\frac{1}{2}^{\frac{1}{8}}\right)^t \approx .917^t$

(b)

x	0	2	4	6	8	10
y	1	.84	.71	.6	.5	.42



(c) The graph will approach zero

$x \to \infty, y \to 0$

$t \to \infty, f(t) \to 0$

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Go to HW 9-9

4. Ben's parents gave him \$10,000 for his 18th birthday. He is considering two investment options. Option A will pay him 3.50% interest compounded annually. Option B will pay him 3.25% interest compounded quarterly. Write a function of Option A and Option B that calculates the value after n years.

$A(t) = a\left(1 \pm \frac{r}{n}\right)^{nt}$

Option A $A(n) = 10{,}000(1.035)^n$

Option B $B(n) = 10{,}000\left(1 + \frac{.0325}{4}\right)^{4n}$

Ben wants to use the money in 22 years to buy a sports car. Determine which plan would yield the greatest return and by how much.

$A(22) = 10{,}000(1.035)^{22} = \$21{,}315.12$

$B(22) = 10{,}000\left(1 + \frac{.0325}{4}\right)^{4(22)} = \$20{,}382.89$

Option A by \$932.23.

Feb 11-4:05 PM

4. Ben's parents gave him \$10,000 for his 18th birthday. He is considering two investment options.

Option A will pay him 3.50% interest compounded annually. Option B will pay him 3.25% interest compounded quarterly. Write a function of Option A and Option B that calculates the value after n years.

4

Option A $A(n) = 10000(1.035)^n$

Option B $B(n) = 10000\left(1 + \frac{.0325}{4}\right)^{4n}$

Ben wants to use the money in 22 years to buy a sports car. Determine which plan would yield the greatest return and by how much.

$A(22) = 10000(1.035)^{22}$

$= \$21315.11$

Option A by \$932.22

$B(22) = 10000\left(1 + \frac{.0325}{4}\right)^{4(22)} = \$20382.89$

Jan 10-4:29 PM

Review Answers:

1) $\frac{64x^9}{27y^{12}}$ 2) $80x^{16}y^{12}$ 3) $-30x^8y^{16}z^6$

4) C 5) 320_6

6a) $7\sqrt[3]{x}$ b) $\sqrt[3]{7}$ c) $(\sqrt[4]{7x})^3$ or $\sqrt[4]{(7x)^3}$

7a) $(2x)^{1/4}$ b) $3x^{5/6}$ c) $(8x)^{1/2}$

8a) $\frac{1}{\sqrt[3]{x}}$ b) $\frac{1}{\sqrt{x}^7}$ or $\left(\frac{1}{\sqrt{x}}\right)^7$ or $\frac{1}{\sqrt{x^7}}$

9a) $-27/8$ b) $-2x^2$ c) $1/250$

11) $b^{7/4}$ 12a) $4/7$ b) $3x^2$ 13) a) $x^{2/3}$ b) $\frac{y^{1/15}}{x^{2/5}}$

14) $\{8\}$ 15a) $3x^3y^7$ b) $3a^2b^2\sqrt{3bc}$

c) $2^{4/3}x^{5/3}y^{11/15}$

16) a. decreasing b. increasing

c. increasing d. decreasing

17) a. left 1, up 3 b. $r_{x\text{-axis}}$, right 3, down 4

18) inc, 95, 35% ↑, 1.35

19) dec., 250, 64% ↓, .36 20) D

21) Option 1 22) a) $M(t) = 500(1.00327374)^{12t}$

b) $M(t) = 500(1.00075529)^{52t}$

23) 5.4% 24) a) See graph

b) $V(t) = 1000\left(1 + \frac{.045}{12}\right)^{12t}$

$V(10) = \$1566.99$

Feb 8-7:50 AM

Name________________________________ Alg 2 CC

Date________________________ Unit 9 Review

Simplify each expression.

1. $\left(\frac{4x^3}{3y^4}\right)^3 = \frac{64x^9}{27y^{12}}$

2. $5(-2x^4y^3)^4$
$= 5(16x^{16}y^{12})$
$= 80x^{16}y^{12}$

3. $(6x^5y^{10}z^4)(-5x^3y^6z^2)$
$= -30x^8y^{16}z^6$

4. Which of the following expressions is not equivalent to x^{30}?

a. $(x^{10})^3$ b. $(x^6)^5$ c. $(x^5)(x^6)$ d. $(x^{20})(x^{10})$

$x^{5+6} = x^{11}$

5. If $a = 5x^3$ and $x = 4b^{1/3}$, express a in terms of b.

$a = 5(4b^{1/3})^3 = 5(64b) = 320b$

$\frac{1}{3}(3) = 1$

Dec 7-11:15 AM

6. Rewrite each exponential expression as an nth root.

a. $7x^{1/3}$ b. $7^{1/3}$ c. $(7x)^{3/4}$

$= 7\sqrt[3]{x}$ $= \sqrt[3]{7}$ $= \left(\sqrt[4]{(7x)}\right)^3$ or $\sqrt[4]{(7x)^3}$

7. Write using exponents.

a. $\sqrt[4]{2x}$ b. $3\sqrt[6]{x^5}$ c. $\sqrt{8x}$

$= (2x)^{1/4}$ $= 3x^{5/6}$ $= (8x)^{1/2}$

8. Rewrite each of the following without the use of fractional or negative exponents.

a. $x^{-1/3}$ b. $x^{-7/2}$

$= \frac{1}{x^{1/3}} = \frac{1}{\sqrt[3]{x}}$ $= \frac{1}{x^{7/2}} = \frac{1}{\sqrt{x^7}}$ or $\frac{1}{(\sqrt{x})^7}$

9. Simplify each expression. (Positive exponents only!)

a. $\left(-\frac{2}{3}\right)^{-3}$ b. $\frac{-18x^{-3}}{9x^{-5}}$ c. $\frac{(5x^2)^{-2}}{10x^{-4}}$

$= \left(-\frac{3}{2}\right)^3 = -\frac{27}{8}$

$= \frac{-18x^5}{9x^3}$
$= -2x^2$

$= \frac{x^4}{10(5x^2)^2}$
$= \frac{x^4}{10 \cdot 25x^4} = \frac{1}{250}$

Dec 7-11:18 AM

~~10. Given the equ... $\sqrt[4]{x^3}$ and $y^{\frac{2}{3}}$, determine an... in terms of x.~~

~~$x^{3/4} = y^{2/3}$ ... $y = x^{9/8}$~~

11. Write the following expression as a single term with a rational exponent.

$\sqrt[4]{b} \bullet \sqrt{b^3} = b^{1/4} \cdot b^{3/2} = b^{1/4} \cdot b^{6/4} = b^{7/4}$

12. Simplify each of the following expressions.

a. $\left(\frac{49}{36}\right)^{-\frac{1}{2}} = \left(\frac{36}{49}\right)^{1/2} = \sqrt{\frac{36}{49}} = \frac{6}{7}$

b. $(27x^6)^{\frac{1}{3}} = \sqrt[3]{27x^6} = 3x^2$

13. Simplify each of the following expressions.

a. $\dfrac{x^{\frac{1}{3}}x^{\frac{1}{2}}}{x^{\frac{1}{6}}} = \dfrac{x^{2/6}x^{3/6}}{x^{1/6}} = \dfrac{x^{5/6}}{x^{1/6}} = x^{4/6} = x^{2/3}$

b. $\dfrac{\sqrt[5]{x^3y^2}}{\sqrt[3]{x^3y}} = \dfrac{x^{3/5}y^{2/5}}{x^{3/3}y^{1/3}} = x^{-2/5}y^{1/3} = \dfrac{y^{1/15}}{x^{2/5}}$

c. $2x^{\frac{1}{3}}y^{\frac{2}{5}} \bullet \sqrt[3]{2x^4y} = 2x^{1/3}y^{2/5} \cdot 2^{1/3}x^{4/3}y^{1/3} = 2^{4/3}x^{5/3}y^{11/15}$

Dec 7-11:18 AM

14. Solve and check.

a. $\sqrt{x+8} - x = -4$ $\{8\}$

[redacted]

$+x \quad +x$

$(\sqrt{x+8})^2 = (x-4)^2$

$x+8 = (x-4)(x-4)$

$x+8 = x^2 - 8x + 16$

$-x-8 \qquad -x \quad -8$

$x^2 - 9x + 8 = 0$

$(x-8)(x-1) = 0$

$x-8=0$

$x=8$

Check

$\sqrt{8+8} - 8 = -4$

$4 - 8 = -4$

$-4 \overset{\checkmark}{=} -4$

$x-1=0$

$x=1$ reject

$\sqrt{1+8} - 1 = -4$

$3 - 1 = -4$

$2 \neq -4$

Dec 7-11:19 AM

15. Simplify.

a. $\sqrt[3]{27x^9y^{21}}$

$= 3x^3y^7$

b. $\sqrt{27a^4b^5c}$

$= \sqrt{9a^4b^4}\sqrt{3bc}$

$= 3a^2b^2\sqrt{3bc}$

16. State whether the following functions are increasing or decreasing.

a. $f(x) = 2^{-0.3x}$ decreasing

b. $f(x) = 1.2^{3x}$ increasing

c. $g(x) = \left(\frac{1}{2}\right)^{-x}$ increasing

d. $h(x) = 2^{-x}$ decreasing

17. Given the parent function f(x) = 2^x describe the transformation. Use your calculator to verify your answer.

a. $h(x) = 2^{x+1} + 3$

left 1

up 3

b. $g(x) = -2^{x-3} - 4$

r x-axis

right 3

down 4

For 18 & 19, given the equation, determine

a. increasing or decreasing
b. the initial amount
c. the rate of change
d. growth/decay factor

18. P(t) = $95(1.35)^x$

a. increasing

b. 95

c. 35% increase

d. 1.35

19. P(t) = $250(.36)^t$

a. decreasing

b. 250

c. loss of 64%

d. .36

Jan 10-5:21 PM

~~19.~~ 20. If the population of a town is decreasing by 4% per year and started with 12, 500 residents, which of the following is its projected population in 10 years?

Show the exponential model you use to solve this problem.

a. 9, 230 b. 76 c. 18, 503 d. 8, 310

$P(t) = 12{,}500(.96)^t$

$P(10) = 12{,}500(.96)^{10} = \$8310.41$

~~20.~~ 21. Ben just turned 15 years old and wants to buy a car on his 18th birthday. He currently has \$4500 in his bank account and wants to invest this amount to earn more money for the purchase. He has two options:

Option 1 pays 3.25% interest compounded semi-annually for 3 years.

Option 2 pays 3.1% compounded monthly for 3 years.

Which option will yield the greatest return by Ben's 18th birthday?

Option 1

$f(3) = 4500\left(1+\frac{.0325}{2}\right)^{2\cdot 3} = \$4956.97$

Option 2

$f(3) = 4500\left(1+\frac{.031}{12}\right)^{3\cdot 12} = \$4937.99$

Option 1 yields the largest return.

Jan 11-5:57 PM

22. Molly puts \$500 into a savings account that earns 4% annually. The amount in her account can be modeled by $M(t) = 500(1.04)^t$, where t is time in years. Create an equation which best approximates the amount of money in her account using

a. Monthly Growth Rate

$M(t) = 500(1.04^{1/12})^{12t}$

$M(t) = 500(1.00327374)^{12t}$

b. Weekly Growth Rate

$M(t) = 500(1.04^{1/52})^{52t}$

$M(t) = 500(1.000754529)^{52t}$

~~22.~~ 23. Mr. Walsh purchased a condominium in Cocoa Beach, Florida for \$250,000 in 2012. He sold it in 2017 for \$325,000. Assuming exponential growth, approximate the annual growth rate, to the nearest tenth of a percent.

$$\frac{325{,}000}{250{,}000} = \frac{250{,}000(1+r)^5}{250{,}000}$$

$$\sqrt[5]{1.3} = \sqrt[5]{(1+r)^5}$$

$$1.05387 = 1 + r$$

$$-1 \qquad -1$$

$$.05387$$

$$\approx 5.4\%$$

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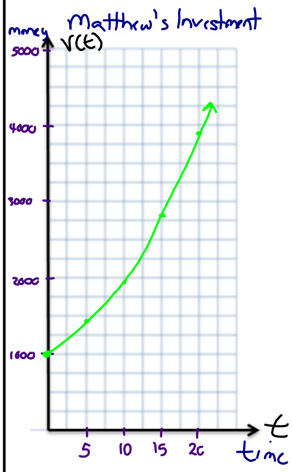
~~23.~~ 24. Matthew has invested \$1000 in a parts company. The value of his investment can be modeled by the function $V(t) = 1000(1.07)^t$, where t is the time, in years, since Matthew made his investment. Draw a well labeled graph to model V(t).



x	0	5	10	15	20
y	1000	1403	1967	2759	3870

x-min 0

x-max 20

y-min 0

y-max 5000

b. If Matthew took that same \$1000 investment and invested it into a fund that pays 4.5% compounded monthly for 10 years, how much money will be in the account after 10 years? First write a function that calculates the value in the account after t years and then evaluate for t=10.

(1) $V(t) = 1000\left(1 + \frac{.045}{12}\right)^{12t}$

(2) $V(10) = 1000\left(1 + \frac{.045}{12}\right)^{12(10)} = \$1566.99$

Jan 11-6:25 PM

Feb 1-2:21 PM