HW 9-11

1. (3)
2. (4)
3. 7.1%, 18.8%, 41.1%
4. .5%
5. .3%
6. (4)
7. (a) $f(t) = .917^t$ c. See explanation

   (b) See graph

Name_____ Alg 2 HW 9-11

1. A quantity is growing at a constant 3% yearly rate. Which of the following would be its percent growth after 15 years?

(1) 45% (3) 56%

(2) 52% (4) 63%

$(1.03)^{15} = 1.557967$

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

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

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

3. The county debt is growing at an annual rate of 3.5%. What percent rate is it growing at per 2 years? Per 5 years? Per decade? Show the calculations that lead to each answer. Round each to the nearest tenth of a percent.

$(1.035)^2 = 1.071225$ 7.1% growth

$(1.035)^5 = 1.18768$ 18.8% growth

$(1.035)^{10} = 1.410598$ 41.1% growth

4. 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.

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

$m = 1.00486$

.5%

5. 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?

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

$f(x) = 1.00327^t$

.3%

6. 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. $29{,}400\left(1.068^{\frac{1}{365}}\right)^{365t}$

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

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

(b) Graph the function from Part A.

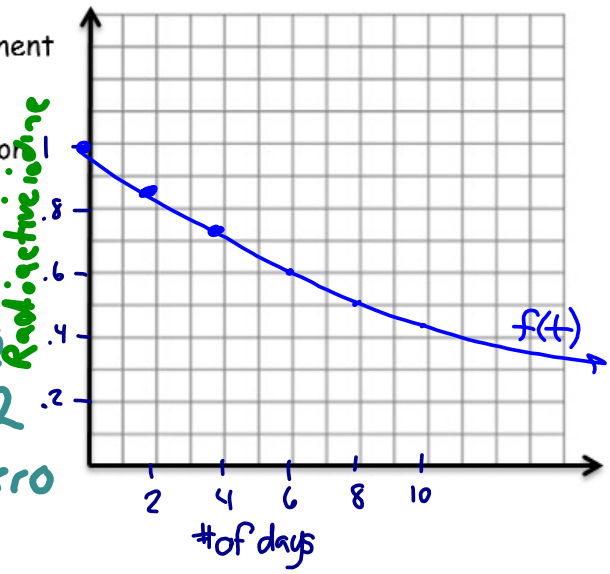
(c) Describe the end behavior of the function

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

(b)

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

(c) The graph will approach zero



Review Answers:

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

4) C 5) 3206

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) $1/250$

10) $y=x^{9/8}$ 11) $b^{7/4}$ 12a) $4/7$ b) $3x^2$ 13) $x^{2/3}$

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

16a) left 1, up 3 b) $r_{x\text{-axis}}$, Rt. 3

17) inc, 95, 35%↑, 1.35

18) dec, 250, 64%↓, .36 19) D

20) Option 1 21) 3 22) 5.4%

24) $1/3$, 7

Name_____ Alg 2 CC

Unit 9 Review

Date_____

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.

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

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

6. Rewrite each exponential expression as an nth root.

a. $7x^{1/3}$ $= 7\sqrt[3]{x}$

b. $7^{1/3}$ $= \sqrt[3]{7}$

c. $(7x)^{3/4}$ $= (\sqrt[4]{(7x)})^3$ or $\sqrt[4]{(7x)^3}$

7. Write using exponents.

a. $\sqrt[4]{2x}$ $= (2x)^{1/4}$

b. $3\sqrt[6]{x^5}$ $= 3x^{5/6}$

c. $\sqrt{8x}$ $= (8x)^{1/2}$

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

a. $x^{-1/3}$ $= \frac{1}{x^{1/3}} = \frac{1}{\sqrt[3]{x}}$

b. $x^{-7/2}$ $= \frac{1}{x^{7/2}} = \frac{1}{\sqrt{x^7}}$ or $\frac{1}{(\sqrt{x})^7}$

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

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

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

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

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

$x^{3/4 \cdot 3/2} = y^{2/3 \cdot 3/2}$ $y = x^{9/8}$

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. $\frac{x^{\frac{1}{3}}x^{\frac{1}{2}}}{x^{\frac{1}{6}}}$

$= \frac{x^{2/6}\ x^{3/6}}{x^{1/6}}$

$= \frac{x^{5/6}}{x^{1/6}} = x^{4/6}$

$= x^{2/3}$

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

c. $\frac{\left(4x^{\frac{2}{3}}\right)^3}{32x^8}$

14. Solve and check.

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

$+x \quad +x$

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

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

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

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

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

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

$x-8=0$ | $x-1=0$

$x=8$ | $x=1$ reject

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

$\sqrt{8+8} - 8 = -4$ | $3-1 = -4$

$4-8 = -4$ | $2 \neq -4$

$-4 = -4$

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

reflection over x-axis

right 3

For 17 & 18, given the equation, determine

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

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

a. increasing

b. 95

c. 35%

d. 1.35

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

a. decreasing

b. 250

c. 64%

d. .36

19. 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. 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.

21. If a population grows at a constant rate of 2.8% per year, then by what percent will it grow over the next 10 years?

(1) 17% (3) 32%

(2) 28% (4) 39%

$(1.028)^{10} = 1.318$

$\approx 31.8\%$

22. 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.

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

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

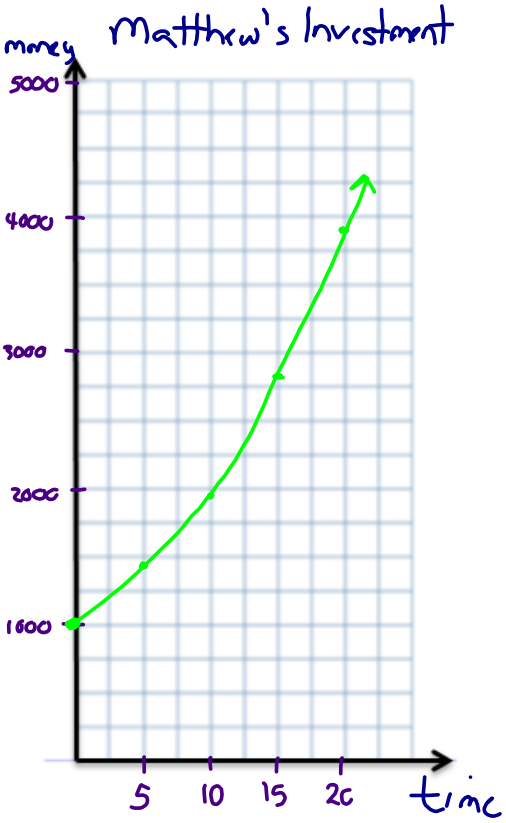
$1.05387 = 1+r$

$-1 \quad -1$

$.05387$

$\approx 5.4\%$

23. 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

24. Given the two functions, $f(x) = \sqrt{x-1}$ and $g(x) = x^2 + 3$, calculate the average rate of change over the interval $2 \le x \le 5$.

$f(x) = \sqrt{x-1}$

$$\frac{f(5) - f(2)}{5-2}$$

$$\frac{2-1}{5-2}$$

$$\frac{1}{3}$$

$g(x) = x^2 + 3$

$$\frac{g(5) - g(2)}{5-2}$$

$$\frac{28-7}{3} = \frac{21}{3} = 7$$