ALGEBRA 2 PACKET – ARNETT, GARCIA, TAYLOR

WEEKS 3 & 4 (APRIL 13 – APRIL 23)

Students are encouraged to use the suggested pacing schedule as we move forward and learn NEW material. We are going to finish the chapter on Logarithms and then assess 4/21-4/22. For each lesson, teachers have provided a video with instruction and a completed power point with examples. (The resources listed below provide additional support through video lessons and practice activities.) The intent is for you to **FIRST**, watch the video and work through the examples. **SECOND**, do the attached assignments. **THIRD**, reach out to your teacher if you have questions. **FOURTH**, submit the assignment via Remind, Email, Teams (Taylor) or Focus. Parents and students are encouraged to connect with the teachers via Remind or email.

ADDITIONAL RESOURCES

ClassLink >> Pearson Realize (Textbook)
ClassLink >> Algebra Nation
https://www.khanacademy.org/resources/teacher-essentials

CONTACT INFORMATION

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DAILY PACING SCHEDULE

4/13 – 4/14	Watch video 7.5, complete notes on 7.5, Do WS 7.5
4/15	WS 7.5 DUE
4/16 – 4/17	Watch video 7.6, complete notes on 7.6, Do WS 7.6
4/20	WS 7.6 DUE
4/21-4/22	Quiz on Ch 7 (More info to follow via Remind or teacher websites)
4/23-4/24	Watch video 8.1 & 2.2, complete notes on 8.1 & 2.2, Do WS 8.1 & 2.2

7.5
Exponential and Logarithmic Equations

Learning goals
- solve logarithmic and exponential equations

1

Solving Methods

For exponential equations
- if possible, get common bases
- if not possible, take the log of both sides

For logarithmic equations
- if necessary, condense using properties
- write in exponential form!

DO NOT ROUND UNTIL THE END!!!

2

Ex 1 Solve

$3^{4x} = 9$

WRITE AS POWERS OF 3

$3^{4x} = 3^2$

SET EXPONENTS EQUAL

$4x = 2$

$\div 4 \quad \div 4$

$x = \frac{1}{2}$

$27^{3x} = 81$

WRITE AS POWERS OF 3

$3^{3x} = 3^4$

SET EXPONENTS EQUAL

$3x = 4$

$\div 3 \quad \div 3$

$x = \frac{4}{3}$

3

Ex 2 Solve

$7^{3x} = 20$

LOG BOTH SIDES

$\log(7^{3x}) = \log(20)$

EXPONENT RULE

$3x \cdot \log(7) = \log(20)$

$\div \log(7) \quad \div \log(7)$

$3x = \frac{\log(20)}{\log(7)}$

CALCULATOR

$3x \approx 1.5395$

$\div 3 \quad \div 3$

$x \approx 0.5132$

$5^{2x} = 16$

LOG BOTH SIDES

$\log(5^{2x}) = \log(16)$

EXPONENT RULE

$2x \cdot \log(5) = \log(16)$

$\div \log(5) \quad \div \log(5)$

$2x = \frac{\log(16)}{\log(5)}$

CALCULATOR

$2x \approx 1.7227$

$\div 2 \quad \div 2$

$x \approx 0.8614$

4

Ex 3 Solve

$2 \cdot 4^{3x-1} = 1100$

$\div 2 \qquad \div 2$

$4^{3x-1} = 550$

LOG BOTH SIDES

$\log(4^{3x-1}) = \log(550)$

EXPONENT RULE

$(3x-1) \cdot \log(4) = \log(550)$

$\div \log(4) \qquad \div \log(4)$

$3x - 1 = \dfrac{\log(550)}{\log(4)}$

CALCULATOR

$3x - 1 \approx 4.5516$

$+1 \qquad +1$

$3x \approx 5.5516$

$\div 3 \qquad \div 3$

$x \approx 1.8505$

5

Ex 4 Solve

$\log_2 5 + \log_2 x = \log_2 15$

PRODUCT RULE

$\log_2(5x) = \log_2 15$

CANCEL $\log_2$

$5x = 15$

$\div 5 \quad \div 5$

$x = 3$

CHECK THAT LOGS ARE DEFINED!

$\log_2 5 + \log_2(3) = \log_2 15$

✓ ✓ ✓

6

Ex 5 Solve

$\log_8 7 + \log_8(n-2) = \log_8(6n)$

PRODUCT RULE

$\log_8\big(7(n-2)\big) = \log_8(6n)$

CANCEL $\log_8$

$7(n-2) = 6n$

DISTRIBUTE

$7n - 14 = 6n$

$-6n + 14 \qquad -6n + 14$

$n = 14$

CHECK THAT LOGS ARE DEFINED!

$\log_8 7 + \log_8(12) = \log_8 84$

✓ ✓ ✓

7

Ex 6 Solve

$\log_2 8 + \log_2 2 = x$

PRODUCT RULE

$\log_2 16 = x$

CONVERT TO EXPONENTIAL EQUATION

$2^x = 16$

REWRITE AS POWERS OF 2

$2^x = 2^4$

SET EXPONENTS EQUAL

$x = 4$

CHECK THAT LOGS ARE DEFINED!

$\log_2 8 + \log_2 2 = 4$

✓ ✓

8

Ex 7 Solve

$4\log_8 x = \log_8 81$

EXPONENT RULE

$\log_8(x^4) = \log_8 81$

CANCEL $\log_8$

$x^4 = 81$

RAISE TO RECIPROCAL EXPONENT

$(x^4)^{1/4} = (81)^{1/4}$

SIMPLIFY

$x = \pm 3$

CHECK THAT LOGS ARE DEFINED!

$4\log_8(3) = \log_8 81$

✓ ✓

$4\log_8(-3) = \log_8 81$

X ✓

$x = -3$ is extraneous

$x = 3$ is the only solution

9

Ex 8 Solve

$\log x + \log(x+3) = 1$

PRODUCT RULE

$\log\big(x(x+3)\big) = 1$

CONVERT TO EXPONENTIAL EQUATION

$10^1 = x(x+3)$

SIMPLIFY AND DISTRIBUTE

$10 = x^2 + 3x$

SOLVE QUADRATIC EQUATION

$x = -5, 2$

CHECK THAT LOGS ARE DEFINED!

$\log(-5) + \log(-5+3) = 1$

X X

$x = -5$ is extraneous

$\log(2) + \log(2+3) = 1$

✓ ✓

$x = 2$ is the only solution

10

Homework
7.5TB

- pg 473
- #7-43 odd

11

7.5
Exponential and Logarithmic Equations

Learning goals
- solve logarithmic and exponential equations

1

Solving Methods

For exponential equations
- if possible, get common bases
- if not possible, take the log of both sides

For logarithmic equations
- if necessary, condense using properties
- write in exponential form!

DO NOT ROUND UNTIL THE END!!!

2

Ex 1 Solve

$3^{4x} = 9$

$27^{3x} = 81$

3

Ex 2 Solve

$7^{3x} = 20$

$5^{2x} = 16$

4

Ex 3 Solve

$2 \cdot 4^{3x-1} = 1100$

5

Ex 4 Solve

$\log_2 5 + \log_2 x = \log_2 15$

CHECK THAT LOGS ARE DEFINED!

6

Ex 5 Solve

$\log_8 7 + \log_8(n-2) = \log_8(6n)$

CHECK THAT LOGS ARE DEFINED!

7

Ex 6 Solve

$\log_2 8 + \log_2 2 = x$

CHECK THAT LOGS ARE DEFINED!

8

Ex 7 Solve

$4 \log_8 x = \log_8 81$

CHECK THAT LOGS ARE DEFINED!

9

Ex 8 Solve

$\log x + \log(x + 3) = 1$

CHECK THAT LOGS ARE DEFINED!

10

A#_____

Algebra 2
7.5 Exponential and Logarithmic Equations WS

Name _____

Date _____ Period _____

Solve each equation.

1. $8^{2x} = 32$

2. $7^{n} = 343$

3. $9^{2x} = 27$

4. $25^{2n+1} = 625$

5. $36^{-2x+1} = 216$

6. $64^{x} = 4096$

Solve each equation; round your answer to the nearest hundredth.

7. $5^{2x} = 20$

8. $8^{n+1} = 3$

9. $4^{n-2} = 3$

10. $4^{3n} = 5$

11. $15^{2n-3} = 245$

12. $4^{x} - 5 = 12$

Estimate to the nearest year.

13. The equation $y = 281(1.01)^{x}$ is a model for the population of the United States in millions of people x number of years after the year 2000. Estimate when the United States population will reach 400 million people.

Solve each equation.

14. $\log 4x = -1$

15. $8\log x = 16$

16. $\log(2x+5) = 3$

17. $\log(3x-2) = 3$

18. $3\log(1-2x) = 6$

19. $2\log(2x+5) = 4$

20. $2\log x + \log 4 = 16$

21. $\log(x+21) + \log x = 2$

22. $\log 3x - \log 5 = 1$

23. $2\log x - \log 3 = 1$

For each problem, write an equation and answer each question.

24. Suppose the population of a country is currently 8,100,000. Studies show this country's population is increasing 2% each year.
- **a.** What exponential function would be a good model for this country's population?
- **b.** Using the equation from part a, how many years will it take for the country's population to reach 9 million? Round your answer to the nearest hundredth.

25. Suppose you deposit $2500 in a savings account that pays you 5% interest per year.
- **a.** How many years will it take for you to double your money?
- **b.** How many years will it take for your account to reach $8,000?

a natural logarithm (ln) is when the base is e.

$\log_e x = \ln x$

7.6
Natural Logarithms

Learning goals
- evaluate and simplify natural logarithm expressions
- solve equations using natural logarithms

1

Vocabulary

Recall e is approximately 2.71828

natural logarithm function
inverse of $y = e^x$

if $y = e^x$, then $\log_e y = x$ or $\ln y = x$

2

all the same properties apply!

use your calculator!

Ex 1
Condense: (use same properties as common logarithms)

$2\ln 12 - \ln 9$

$\ln 12^2 - \ln 9$

$\ln 144 - \ln 9$

$\ln \frac{144}{9} = \ln 16$

3

Ex 2
A spacecraft can attain a stable orbit 300 km above Earth if it reaches a velocity of 7.7 km/s.

The formula for the rocket's maximum velocity (V) is

$$V = -0.0098t + c\ln R$$

where t is firing time in seconds, c is the exhaust velocity, and R is the ratio of the rocket's mass with fuel to its mass without fuel.

- Find the maximum velocity in km/s if the mass ratio (R) is 22, exhaust velocity is 2.3 km/s and firing time is 50 s.

$V = -.0098(50) + 2.3\ln 22 =$ 6.6194

- Can the spacecraft achieve stable orbit 300 km above the Earth?

NO bc

4

* always round at the very end of the problem so that we all get the same answers *

Write in exponential form

Ex 3
Solve $\ln(2x-4)^3 = 6$

$e^6 = (2x-4)^3$

take cubed root of both sides

$e^2 = 2x - 4$

5

Solve for x
1. do e^2 (or 2nd then button)
2. add 4
3. ÷ by 2

5.6945

Ex 4
Solve $\ln\left(\frac{x+2}{3}\right) = 12$ $\quad e^{12} = \frac{x+2}{3}$

1. Do e^{12}
2. times 3
3. minus 2 =

6

488,262.3743

to solve an equation with ln → use 'e'

to solve an equation with 'e' – use ln

Ex 5

Solve using natural logarithms

$4e^{3x} + 1.2 = 14$

$-1.2 \quad -1.2$

$\frac{4e^{3x}}{4} = \frac{12.8}{4}$

$e^{3x} = 3.2$

Change of base formula: $\exp = \frac{\ln \arg}{\ln \text{base}}$

so

$3x = \frac{\ln 3.2}{\ln e}$

$e = .3877$

7

Ex 6

Solve using natural logarithms

$e^{\frac{2x}{5}} + 7.2 = 9.1$

$e^{\frac{2x}{5}} = 1.9$

$\frac{2x}{5} = \frac{\ln 1.9}{\ln e}$

$x = 1.6046$

8

Do you remember your formulas ???

Ex 7

If you invest \$200 and it is now worth \$254.25, at a rate of 6% compounded continuously, how long has the money been invested?

$A = Pe^{rt}$

$254.25 = 200e^{.06t}$

When solving for an exponent, we must use log or ln. We use ln for this one b/c there is an 'e' in the problem.

Change of base formula

$\frac{254.25}{200} = \frac{200e^{.06t}}{200}$

$1.27125 = e^{.06t}$

$.06t = \frac{\ln 1.27125}{\ln e}$

$t = \approx$ 4yrs

9

Ex 8

If you invest \$200 and it is worth \$315.24 after 7 years of continuous compounding, what is the rate?

$315.24 = 200e^{7r}$

$1.5762 = e^{7r}$

$7r = \frac{\ln 1.5762}{\ln e}$

Solving for r – Don't forget to change it to a percent.

Change of base formula

$r = .06500$

$r =$ 6.5%

10

Name_____ Class_____ Date_____

7-6 Practice

Form G

Natural Logarithms (Pearson)

Write each expression as a single natural logarithm.

1. $\ln 16 - \ln 8$

2. $3 \ln 3 + \ln 9$

3. $a \ln 4 - \ln b$

4. $\ln z - 3 \ln x$

5. $\frac{1}{2} \ln 9 + \ln 3x$

6. $4 \ln x + 3 \ln y$

7. $\frac{1}{3} \ln 8 + \ln x$

8. $3 \ln a - b \ln 2$

9. $2 \ln 4 - \ln 8$

Solve each equation. Check your answers. Round your answer to the nearest hundredth.

10. $4 \ln x = -2$

11. $2 \ln (3x - 4) = 7$

12. $5 \ln (4x - 6) = -6$

13. $-7 + \ln 2x = 4$

14. $3 - 4 \ln (8x + 1) = 12$

15. $\ln x + \ln 3x = 14$

16. $2 \ln x + \ln x^2 = 3$

17. $\ln x + \ln 4 = 2$

18. $\ln x - \ln 5 = -1$

Solve each equation. NO DECIMAL ANSWERS!

19. $\ln e^x = 3$

20. $3 \ln e^{2x} = 12$

21. $\ln e^{x+5} = 17$

22. $\ln 3x + \ln 2x = 3$

23. $5 \ln (3x - 2) = 15$

24. $7 \ln (2x + 5) = 8$

25. $\ln (3x + 4) = 5$

26. $\ln \frac{2x}{41} = 2$

27. $\ln (2x - 1)^2 = 4$

Use natural logarithms to solve each equation. Round your answer to the nearest hundredth.

28. $e^x = 15$

29. $4e^x = 10$

30. $e^{x+2} = 50$

31. $4e^{3x-1} = 5$

32. $e^{x-4} = 2$

33. $5e^{6x+3} = 0.1$

34. $e^x = 1$

35. $e^{\frac{x}{5}} = 32$

Solve each equation. NO DECIMAL ANSWERS!

36. $3e^{3x-5} = 49$

37. $7e^{5x+8} = 0.23$

38. $6 - e^{12x} = 5.2$

39. $e^{\frac{x}{2}} = 25$

40. $e^{2x} = 25$

41. $e^{\ln 5x} = 20$

42. $e^{\ln x} = 21$

43. $e^{x+6} + 5 = 1$

Simplify each expression.

44. $\ln e^4$

45. $5 \ln e^5$

46. $\frac{\ln e^2}{2}$

47. $\ln e^{100}$

Algebra 2
Assessment 7.4 – 7.6 Exponential & Logarithmic Equations

Name _____

Period _____

Condense each expression.

1. $log_3 24 + log_3 2$

2. $3\,log_2 8 - 5log_2 3$

l

Expand each logarithmic expression.

3. $\log_7 \frac{23}{4}$

4. $\log_2(32x^3)$

Use the Change of Base formula to evaluate .

5. $log_{125} 25$

6. $log_5 40$

Solve each equation. NO DECIMAL ANSWERS!

7. $27^{4x} = 9$

8. $log\ \ (6x - 2) = 3$

9. $log_8 x = -3$

10. $log_x \frac{16}{625} = \frac{4}{3}$

Choose the best answer choice for each question.

11. $9^x = 243$

a. 2 b. 5

c. 2.5 d. 10

12. $2^{3x+2} = 64$

a. $\frac{8}{3}$ b. $\frac{4}{3}$

c. 2 d. $\frac{3}{4}$

13. $log(3x + 25) = 2$

a. 25 b. 75

c. $41\frac{2}{3}$ d. 100

14. $16^{2x} = 124$

a. 0.869 b. 1.150

c. 1.739 d. 3.477

Answers

1. _____

2. _____

3. _____

4. _____

5. **expression**_____

value _____

6. **expression**_____

value _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

Choose the best answer choice for the problem.

15. $2^{3x+1} = 7$

a. $3\left(\frac{log\,7}{log\,2} - 1\right)$

b. $\frac{1}{3}\left(\frac{log\,2}{log\,7} - 1\right)$

c. $\frac{log\,7}{3log\,2} - 1$

d. $\frac{1}{3}\left(\frac{log\,7}{log\,2} - 1\right)$

Solve the equation. NO DECIMAL ANSWER!

16. $4^x = 19$

Condense the expression.

17. $3ln5 - \ln 2$

Solve each equation. NO DECIMAL ANSWERS!

18. $e^{x+1} = 13$

19. $ln(x-2)^2 = 6$

20. $e^{\frac{x}{2}+1} + 3 = 8$

Answers

15. _____

16. _____

17. _____

18. _____

19. _____

20. _____

two formulas:

$y = \frac{K}{x}$ — INVERSE

$y = Ky$ — DIRECT

line w/ y-int = 0

8.1 Inverse Variation & 2.2 Direct Variation

Learning goals
- recognize and use inverse variation
- write and interpret direct variation equations
- use joint and other variations

Inverse Variation

$y = \frac{k}{x}$

$k \neq 0$

So k = xy

'k' is the **constant of variation**

Direct Variation

a linear equation in the form y = kx where k cannot = 0

$k = \frac{y}{x}$

must find K for all points - do either $K = xy$ or $K = \frac{y}{x}$ to see which one gets all the same K values

$K = \frac{y}{x}$ | $K = xy$

.1/3 ; 3(7) = 21 ; = 2.1

.35/6 ; = 2.1 ✓

Ex 1

Direct, inverse, or neither?

x	y
3	0.7
6	0.35
21	0.1

INV

$y = \frac{2.1}{x}$

Ex 2

Direct, inverse, or neither?

x	y
−2	6
−1.3	5
7	−4

neither

$K = \frac{y}{x}$: $K = -3$, $K = -3.8$ NO

$K = xy$: $K = -12$, $K = -6.5$ NO

Ex 3

Direct, inverse, or neither?

x	y
−2	5
4	−10
6	−15

direct

$y = -\frac{5}{2}x$

$K = \frac{y}{x}$: $K = -2.5$, -2.5, -2.5 ✓

$K = xy$: -10, -40 NO

$y = \frac{K}{x}$; $4 = \frac{K}{7}$; $K = 28$

Ex 4

Suppose that x and y vary inversely. If x = 7 and y = 4, write a function.

$y = \frac{28}{x}$

Ex 5

Are these direct variations?

$3y = 7x + 7$ — no

$5x = 2y$ — yes

$y = \frac{5}{2}x$

direct variation is JUST $y = Kx + 0$ there can't be a constant (y-int)

$y = Kx$ (3, 1)

Ex 6

A dripping faucet wastes a cup of water if it drips for three minutes. The amount of water wasted varies directly with the amount of time the faucet drips. Write an equation.

$y = \frac{1}{3}x$

(time, cups)

$1 = 3K$

$K = \frac{1}{3}$

How long must it drip to waste 4.5 cups?

$4.5 = \frac{1}{3}x$

$\frac{27}{2}$ min

or

13.5

must know these words

We will never mention the # in the problem

Combined Variations

- y varies directly with the square of x: $y = kx^2$
- y varies inversely with the cube of x: $y = \frac{k}{x^3}$
- z varies jointly with x and y and inversely with w: $z = \frac{kxy}{w}$
- z varies directly with x and inversely with the product of w and y: $z = \frac{kx}{wy}$

Ex 7

The mass m of a moving object is related to its kinetic energy k and its velocity v by $m = \frac{2k}{v^2}$

Describe the relationship using a combined variation.

m varies directly with K & inv w/ the square of v

(didn't mention the 2)

Ex 8

Describe the relationship using a combined variation.

$A = \frac{1}{2}h(b_1 + b_2)$

A varies jointly with h & the sum of b_1 & b_2

(didn't mention the $\frac{1}{2}$)

Ex 9

z varies directly as x and inversely as the square of y. When x = 35, y = 7, and z = 50, write a function and find z when x = 5 and y = 10.

$z = \frac{kx}{y^2}$ $z = \frac{x}{y^2}$

3.5

$z = \frac{kx}{y^2}$

$50 = \frac{K(35)}{49}$

$K = 70$

so $z = \frac{70x}{y^2}$

then $z = \frac{70(5)}{100}$

$z = 3.5$

Algebra 2 Name:_____

WS 8.1&2.2 Direct and Indirect Variation Date:_____ Pd:____

Determine whether *y* varies directly with *x*. If so, find the constant of variation.

1. $y = 12x$

2. $y = 4x - 3$

For problem numbers 3-4, *y* varies directly with *x*.

3. If $y = 4$ when $x = -2$, find *x* when $y = 6$.

4. If $y = 7$ when $x = 2$, find *x* when $y = 3$.

5. **Distance** For a given speed, the distance traveled varies directly with the time. Kate's school is 5 miles away from her home and it takes her 10 minutes to reach the school. If josh lives 2 miles from school and travels at the same speed as Kate, how long will it take him to reach the school?

Is the relationship between the values in each table a *direct variation*, and *inverse variation*, or *neither*? Write equations to model the direct and inverse variations.

6.

x	*y*
3	15
8	40
10	50
22	110

7.

x	*y*
3	14
5	8.4
7	6
10.5	4

Is the relationship between the values in each table a *direct variation*, and *inverse variation*, or *neither*? Write equations to model the direct and inverse variations.

8.

x	*y*
0.5	1
2.1	4.2
3.5	7
11	22

9.

x	*y*
0.1	3
3	0.1
6	0.05
24	0.0125

10. Painting The number of buckets of paint *n* needed to paint a fence varies directly with the total area *a* of the fence and inversely with the amount of paint *p* in a bucket. It takes three 1-gallon buckets of paint to paint 72 square feet of fence. How many 1-gallon buckets will be needed to paint 90 square feet of fence?

Write the function that models each variation. Find *z* when $x = 4$ and $y = 9$.

11. *Z* varies directly with *x* and inversely with *y*. When $x = 6$ and $y = 2$, $z = 15$.

12. *Z* varies jointly with *x* and *y*. When $x = 2$ and $y = 3$, $z = 60$.

13. *Z* varies inversely with the product of *x* and *y*. When $x = 2$ and $y = 4$, $z = 0.5$.