

MTH 161 CHAPTER 4 WORKSHEET

Use pencil. Show steps. Place answers in the blanks provided on right side of page.

I. Evaluate each exponential expression using the power tables which you have completed. If the exponent is negative, use the reciprocal tool to change it into positive. If a fraction is the base, recall that the exponent applies to the top and the bottom. This exercise will help you with going back and forth between exponent form and log form which is in the next part of the worksheet. No decimals allowed.

1. $9^{(1/2)}$

1. _____

2. $25^{(-1/2)}$

2. _____

3. $16^{(3/4)}$

3. _____

4. $(-343)^{(2/3)}$

4. _____

5. $(\frac{8}{27})^{(-2/3)}$

5. _____

6. $(\frac{1}{216})^{(1/3)}$

6. _____

7. $100^{(3/2)}$

7. _____

II. Solve by using the shortcut rules and the definition of "log". No calculator. No decimals allowed.

8. $x = \log_{125} 5$

8. _____

9. $\log_x 64 = 3$

9. _____

10. $\log_{81} 27 = x$

10. _____

11. $\log_{17} 17 = x$

11. _____

12. $\log_4 64 = x$

12. _____

III. Solve these equations by forcing the bases on left and right sides of equals marks to be the same number. Then you will be able to set the exponents equal to each other.

13. $36^{x-2} = 216^{x+1}$

13. _____

14. $9^{(6+2x)} = \left(\frac{1}{27}\right)^{(x-2)}$

14. _____

IV. Word Problems. The function is given. All you need to do is plug the appropriate number into its place, simplify, use calculator. Round answers to the indicated places. READ!

15. Sales (in thousands of units) of a new product are approximated by the function:

$F(t) = 100 + 30[\log_3(2t+1)]$ where t is the number of years after the product is introduced. Find the sales after 4 years. Express answer to nearest whole number.

15. _____

16. The cost-benefit equation is: $T = -0.642 - 189[\ln(1-p)]$

T describes the approximate tax T in dollars per ton that would result in a $p\%$ (in decimal form) reduction in carbon dioxide emissions. What tax will reduce emissions 25%? Round answer to nearest whole number.

16. _____

17. Sulfur dioxide emissions in the United States, in millions of tons, from 1970 through 2007 can be approximated by this function: $f(x) = 33.07 \text{ times } (1.0241)^{-x}$ where $x=0$ corresponds to 1970. So $x=5$ corresponds to 1975. So $x=10$ corresponds to 1980. You get it? Use this function to approximate the amount of sulfur dioxide emitted in 2000. Round answer to nearest tenth.

17. _____

18. Students in an accounting class took a final exam and then took equivalent forms of the exam at monthly intervals thereafter. The average score function:

$F(x) = 78 - 15[\log(x+1)]$ $f(x)$ represents the average score of the class in a percent answer. the x represents the number of months after the initial test was given.

a. Find the average score of the class for the initial test. Here $x=0$

b. Find the average score of the class 5 months after taking the initial test.

a. _____

b. _____

19. A model for advertising response is given by the function

$F(x) = 1000 + 200[\ln(x)]$ $f(x)$ represents the number of units sold when x is the amount spent on advertising, in thousands of dollars.

a. How many units were sold after spending \$1000 in advertising? Here $x=1$

b. How many units were sold after spending \$5000 in advertising? Here $x=5$

a. _____

b. _____

ANSWERS:

$$1. (3^2)^{\frac{1}{2}} = 3^1 = 3 \quad \text{or} \quad \sqrt{9} = 3$$

$$2. (5^2)^{-\frac{1}{2}} = 5^{-1} = \frac{1}{5} \quad \text{or} \quad \frac{1}{\sqrt{25}} = \frac{1}{5}$$

$$3. (-2^4)^{\frac{3}{4}} = 2^3 = 8$$

$$4. (-7^3)^{\frac{2}{3}} = (-7)^2 = 49$$

$$5. \left(\frac{27}{8}\right)^{\frac{2}{3}} = \frac{(3^3)^{\frac{2}{3}}}{(2^3)^{\frac{2}{3}}} = \frac{3^2}{2^2} = \frac{9}{4}$$

$$6. \frac{1^{\frac{1}{3}}}{(6^3)^{\frac{1}{3}}} = \frac{1}{6}$$

$$7. (10^2)^{\frac{3}{2}} = 10^3 = 1000$$

$$8. 125^x = 5 \quad \begin{cases} 3x = 1 \\ x = \frac{1}{3} \end{cases}$$

$$(5^3)^x = 5^1$$

$$9. \log_x 64 = 3$$

$$x^3 = 64$$

$$(x^3)^{\frac{1}{3}} = (64)^{\frac{1}{3}}$$

$$x = 4$$

$$10. \log_{81} 27 = x$$

$$81^x = 27$$

$$(3^4)^x = (3)^3$$

$$4x = 3$$

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

$$11. \log_{17} 17 = x$$

$$17^x = 17^1$$

$$x = 1$$

or use
first rule
for shortcuts

$$\log_{17} 17 = 1$$

match

$$12. \log_4 64 = x$$

$$4^x = 64$$

$$4^x = 4^3$$

$$x = 3$$

OR

$\log_4 4^3 \rightarrow$ match
use 2nd
rule of
shortcut
answer is 3

$$13. (6^2)^{(x-2)} = (6^3)^{(x+1)}$$

When the bases are equal, the exps
are equal

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

$$2x - 4 = 3x + 3$$

$$-7 = x$$

$$14. (3^2)^{(6+2x)} = \left(\frac{1}{3^3}\right)^{x-2}$$

the bases must be on same
level

$$(3^2)^{(6+2x)} = (3^{-3})^{x-2}$$

$$2(6+2x) = -3(x-2)$$

$$12 + 4x = -3x + 6$$

$$7x = -6$$

$$x = -6/7$$

$$15. F = 100 + 30 [\log_3 (2 \cdot 4 + 1)]$$

$$F = 100 + 30 \cdot \log_3 9$$

$$F = 100 + 30 \cdot \log_3 3^2 \text{ (second rule)}$$

$$F = 100 + 30(2)$$

$$F = 160 \text{ thousand units}$$

$$16. T = -0.642 - 189[\ln(1-p)]$$

$$p = 25\% = .25$$

$$T = -0.642 - 189[\ln(1-.25)]$$

$$T = -0.642 - 189(\ln .75)$$

calculator

$$- .642 - 189 \text{ times } \ln .75 \text{ enter } 53.72991169$$

ans. \$ 54 per Ton

$$17. f(x) = 33.07(1.0241)^{-x}$$

the year 2000 gives us $x = 30$

$$f(x) = 33.07(1.0241)^{-30}$$

$$\text{calculator } 33.07 \text{ times } 1.0241 \text{ } y^x - 30 \text{ enter } 16.18688237$$

answer: 16.2 million of tons

of sulfur dioxide

$$18. f(x) = 78 - 15 \log(x+1) \quad \text{shortcut rule}$$

$$a. f(x) = 78 - 15 \log 1 \quad \log 1 = 0$$

$$78 - 15 \text{ times } \log 1 \text{ enter}$$

answer 78%

$$b. x=5 \quad f(x) = 78 - 15 \log(5+1)$$

$$f(x) = 78 - 15 \log 6$$

$$78 - 15 \text{ times } \log 6 \text{ enter}$$

answer: 66% the grades lowered due to time

$$19. f(x) = 1000 + 200(\ln x) \quad \ln 1 = 0$$

$$a. f(x) = 1000 + 200(\ln 1)$$

$$f(x) = 1000 \text{ units}$$

$$b. f(x) = 1000 + 200 \ln 5$$

$$1000 + 200 \text{ times } \ln 5 \text{ enter}$$

answer: 1322 units