

Name: _____

Key

Exponents and Logarithms Practice

Rewrite each in exponential form.

1. $\log_6 36 = 2$

$$6^2 = 36$$

2. $\log_w v = -16$

$$w^{-16} = v$$

Rewrite each in logarithmic form.

3. $(1/12)^2 = 1/144$

$$\log_{1/12} 1/144 = 2$$

4. $8^b = a$

$$\log_8 a = b$$

Evaluate each without a calculator.

5. $\log_4 64 =$

$$4^x = 64 \quad x = 3$$

6. $\log_3 (1/243) =$

$$3^x = 1/243 \quad x = -5$$

Solve for x.

7. $\log_x 16 = 4$

$$x^4 = 16 \quad x = 2$$

8. $\log_x 1/2 = -1$

$$x^{-1} = 1/2 \quad x = 2$$

9. $\log_3 27 = x$

$$3^x = 27 \quad x = 3$$

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

$$125^x = 5 \quad x = 1/3$$

Expand each.

11. $\log (6/11)^5$

$$5 \log 6 - 5 \log 11$$

12. $\ln (xyz^2)^2$

$$2 \ln x + 2 \ln y + 4 \ln z$$

Condense each.

13. $\log 3 - \log 8$

$$\log(3/8)$$

14. $20 \ln u + 5 \ln v$

$$\ln (u^{20} v^5)$$

Rewrite each so that it could be computed using a calculator.

13. $\log_6 40$

$$\frac{\log 40}{\log 6}$$

14. $\log_{13} 12.9$

$$\frac{\log 12.9}{\log 13}$$

Rewrite in exponential form.

1. $\log_x n = 2/3$

$$x^{2/3} = n$$

Rewrite in logarithmic form.

2. $8^y = x/64$

$$\log_8 x/64 = y$$

Solve for x.

3. $\log_2 32 = x$

$$\log_2 (2^5) = x \quad x=5$$

or $2^x = 32$

4. $\log_3 (1/81) = x$

$$\log_3 (3^{-4}) = x \quad x=-4$$

or $3^x = 1/81$

5. $\log_x 4 = 2/3$

$$x^{2/3} = 4 \quad x=8$$

6. $\log_x 1/2 = -2$

$$x^{-2} = 1/2 \quad x=\sqrt{2}$$

7. $\log_6 x = 0$

$$6^0 = x \quad x=1$$

8. $\log_{16} x = 1/4$

$$16^{1/4} = x \quad x=2$$

Expand.

9. $\ln (y/z)^4$

$$4 \ln y - 4 \ln z$$

Condense

10. $3 \log x - \log y + 3 \log z$

~~$$\log \left(\frac{x^3}{y z^3} \right)$$~~

$$\log \frac{x^3 z^3}{y}$$

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Expand.

9. $\ln (y/z)^4$

Condense

10. $3\log x - \log y + 3\log z$

Key

Solving exponential/logarithmic equations practice

1. $\log(n+9) = \log 4n$

$10^{\log(n+9)} = 10^{\log 4n}$

$n+9 = 4n$

$9 = 3n$

$n = 3$

2. $\ln(a^2 - 6a) = \ln(10 + 3a)$

$e^{\ln(a^2 - 6a)} = e^{\ln(10 + 3a)}$

$a^2 - 6a = 10 + 3a$

$a^2 - 9a - 10 = 0$

$(a-10)(a+1) = 0$

$a = 10 \text{ and } -1$

3. $4^{2x+3} = 1$

$\log_4 4^{2x+3} = \log_4 1 \leftarrow 4^x = 1$

$2x+3 = 0$

$2x = -3$

$x = -3/2$

* 4. $5(e^{6x}) = 26$

$e^{6x} = 26/5$

$\ln e^{6x} = \ln 26/5$

$6x = \ln 26/5$

$x = 1/6 \ln 26/5$

5. $e^{x-1} - 5 = 5$

$e^{x-1} = 10$

$\ln e^{x-1} = \ln 10$

$x-1 = \ln 10$

$x = \ln 10 + 1$

6. $\ln x + \ln(x-2) = \ln 3$

$\ln x + \ln(x-2) - \ln 3 = 0$

$\ln \frac{x(x-2)}{3} = 0$

$e^{\ln \frac{x^2-2x}{3}} = e^0$

$\frac{x^2-2x}{3} = 1$

$x^2 - 2x = 3$

$x^2 - 2x - 3 = 0$

$(x-3)(x+1) = 0$

~~$x = 1 \text{ and } 3$~~

$x = 3$

7. $3\ln x - 2\ln(y-1) = t$ [solve for x]

$\ln x^3 - \ln(y-1)^2 = t$

$\ln \frac{x^3}{(y-1)^2} = t$

$e^{\ln \frac{x^3}{(y-1)^2}} = e^t$

$\frac{x^3}{(y-1)^2} = e^t$

$x^3 = e^t (y-1)^2$

$x = \sqrt[3]{e^t (y-1)^2}$

* 8. $5^x = \sqrt{125}$

make both with a base of 5

$5^x = \sqrt{5^3}$

$5^x = 5^{3/2}$

$x = 3/2$

9. $(1/4)^{2x-3} = 8$

$\log_{1/4} (1/4)^{2x-3} = \log_{1/4} 8 \leftarrow 1/4^x = 8$

$x = -3/2$

~~$2x-3 = -3/2$~~

$2x-3 = -3/2$

~~$4x-3 = -6$~~

~~$4x+3 = 0$~~

~~$4x = -3$~~

~~$x = -3/4$~~

$2x = 3/2$

$x = 3/4$

10. $\log 8 + \log x = \log(x+18) + \log 2$

$\log 8 + \log x - (\log(x+18) + \log 2) = 0$

$\log \frac{8x}{2(x+18)} = 0$

$10^{\log \frac{8x}{2(x+18)}} = 10^0$

$\frac{8x}{2x+36} = 1$

$8x = 2x + 36$

$6x = 36$

$x = 6$

$$11. e^{x(x+2)} = e^{3x}$$

$$\ln e^{x(x+2)} = \ln e^{3x}$$

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

$$x^2 + 2x = 3x$$

$$x^2 - x = 0$$

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

$$x = 0 \text{ and } 1$$

$$* 12. \ln(5x+4) = 3$$

$$e^{\ln(5x+4)} = e^3$$

$$5x+4 = e^3$$

$$5x = e^3 - 4$$

$$x = \frac{1}{5}e^3 - \frac{4}{5} \text{ or } x = \frac{1}{5}(e^3 - 4)$$

$$13. \ln(x^2 - 10) = \ln(3) + \ln(x)$$

$$\ln(x^2 - 10) - (\ln(3) + \ln(x)) = 0$$

$$\ln \frac{x^2 - 10}{3x} = 0$$

$$e^{\ln \frac{x^2 - 10}{3x}} = e^0$$

$$\frac{x^2 - 10}{3x} = 1$$

$$x^2 - 10 = 3x$$

$$x^2 - 3x - 10 = 0$$

$$(x-5)(x+2) = 0$$

$$x = 5 \text{ and } -2$$

$$* 14. \log(x) + \log(x) = 2$$

$$\log x^2 = 2$$

$$2 \log x = 2$$

$$\log x = 1$$

$$10^{\log x} = 10^1$$

$$x = 10$$

$$* 15. 3^{2x-1} = 27$$

↖ ↗
rewrite with same bases

$$3^{2x-1} = 3^3$$

$$2x-1 = 3$$

$$2x = 4$$

$$x = 2$$

$$* 16. \left(\frac{1}{3}\right)^x = 81$$

$$\frac{1}{3}^x = 81$$

$$\downarrow$$

$$\frac{1}{3}^x = 81$$

$$x = -4$$

$$17. 3 \ln x - \ln(y-1) = 4 \text{ [solve for } x]$$

$$\ln x^3 - \ln(y-1) = 4$$

$$\ln \frac{x^3}{y-1} = 4$$

$$e^{\ln \frac{x^3}{y-1}} = e^4$$

$$\frac{x^3}{y-1} = e^4$$

$$x^3 = e^4(y-1)$$

$$x = \sqrt[3]{e^4(y-1)}$$

$$* 18. 2^x = 32$$

↖ ↗
same base

$$2^x = 2^5$$

$$x = 5$$

$$* 19. (\sqrt{27})^x = 3^{x+3}$$

$$(\sqrt[3]{3^3})^x = 3^{x+3}$$

$$\log_3 (3^{3/2})^x = \log_3 3^{x+3}$$

$$\frac{3}{2}x = x+3$$

$$\frac{1}{2}x = 3$$

$$x = 6$$

$$20. \ln x = \frac{5}{2} \ln 9$$

$$\ln x = \ln 9^{5/2}$$

$$e^{\ln x} = e^{\ln 9^{5/2}}$$

$$x = 9^{5/2}$$

$$x = (\sqrt{9})^5$$

$$x = 3^5$$

$$x = 243$$

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3. $4^{2x+3} = 1$

4. $5(e^{6x}) = 26$

5. $e^{x-1} - 5 = 5$

6. $\ln x + \ln(x - 2) = \ln 3$

7. $3\ln x - 2\ln(y - 1) = t$ [solve for x]

8. $5^x = \sqrt{125}$

9. $(\frac{1}{4})^{2x-3} = 8$

10. $\log 8 + \log x = \log(x + 18) + \log 2$

$$11. e^{x(x+2)} = e^{3x}$$

$$12. \ln(5x + 4) = 3$$

$$13. \ln(x^2 - 10) = \ln(3) + \ln(x)$$

$$14. \log(x) + \log(x) = 2$$

$$15. 3^{2x-1} = 27$$

$$16. \left(\frac{1}{3}\right)^x = 81$$

$$17. 3\ln x - \ln(y - 1) = 4 \text{ [solve for } x\text{]}$$

$$18. 2^x = 32$$

$$19. (\sqrt{27})^x = 3^{x+3}$$

$$20. \ln x = \frac{5}{2} \ln 9$$