

Homework 8.1

Find the exact value x in each of the following logarithmic expressions without the aid of a calculator. Show your work by writing each as an exponential equation.

1. $\log_2 32 = x$ $2^x = 32$ $2^x = 2^5$ $x = 5$	2. $\log_5 5 = x$ $5^x = 5^1$ $x = 1$	3. $\log_3 81 = x$ $3^x = 81$ $3^x = 3^4$ $x = 4$	4. $\log_5 125 = x$ $5^x = 125$ $5^x = 5^3$ $x = 3$
5. $\log_{10} 100 = x$ $10^x = 100$ $10^x = 10^2$ $x = 2$	6. $\log_{10} 0.0001 = x$ $10^x = 10^{-4}$ $x = -4$	7. $\log_4 4^{-2} = x$ $4^x = 4^{-2}$ $x = -2$	8. $\log_2 (2\sqrt[3]{2}) = x$ $2^x = 2 \cdot \sqrt[3]{2}$ $2^x = 2^1 \cdot 2^{1/3}$ $2^x = 2^{4/3}$ $x = 4/3$
9. $\log_2 (4 \cdot 8^2) = x$ $2^x = 4 \cdot 8^2$ $2^x = 2^2 \cdot (2^3)^2$ $2^x = 2^2 \cdot 2^6$ $2^x = 2^8$ $x = 8$	10. $\log_6 (6 \cdot 6^{1/2}) = x$ $6^x = 6^1 \cdot 6^{1/2}$ $6^x = 6^{3/2}$ $x = 3/2$	11. $\log_2 \left(\frac{1}{8}\right) = x$ $2^x = \frac{1}{8}$ $2^x = 2^{-3}$ $x = -3$	12. $\log_3 \left(\frac{1}{81}\right) = x$ $3^x = \frac{1}{81}$ $3^x = 3^{-4}$ $x = -4$

Given the logarithmic expression, (a) determine between which two integers that value should lie without using a calculator, with reasoning, and (b) the value to three decimal places using a calculator, showing your work.

13. $\log_3 5 = x$ $3^x = 5$	(a) The argument, 5, is between $3^1 = 3$ and $3^2 = 9$ $\therefore 1 < \log_3 5 < 2$	(b) $\log_3 5 = \frac{\log 5}{\log 3} \approx 1.465$
14. $\log_2 21 = x$ $2^x = 21$	(a) The argument, 21, is between $2^4 = 16$ and $2^5 = 32$ $\therefore 4 < \log_2 21 < 5$	(b) $\log_2 21 = \frac{\log 21}{\log 2} \approx 4.392$
15. $\log_5 156 = x$ $5^x = 156$	(a) The argument, 156, is between $5^3 = 125$ and $5^4 = 625$ $\therefore 3 < \log_5 156 < 4$	(b) $\log_5 156 = \frac{\log 156}{\log 5} \approx 3.138$

Solve each of the following equations. Leave your answers in exact form when possible. Otherwise, round your answers to three decimal places.

<p>16. $\log_3(x+2) = 2$ (Log Form) $3^2 = x+2$ (Exp Form) $9 = x+2$ $7 = x$</p>	<p>17. $\ln(x-3) = 2$ (Log Form) $e^2 = x-3$ (Exp Form) $e^2 + 3 = x$ $x \approx 10.389$</p>	<p>18. $\log_9(x) = -1$ (Log Form) $9^{-1} = x$ (Exp Form) $\frac{1}{9} = x$</p>
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<p>19. $\ln(2x+3) = 3$ (Log Form) $e^3 = 2x+3$ (Exp Form) $e^3 - 3 = 2x$ $\frac{1}{2}(e^3 - 3) = x$ $x \approx 8.543$</p>	<p>20. $\log_2(3x) = -3$ (Log Form) $2^{-3} = 3x$ (Exp Form) $\frac{1}{8} = 3x$ (Exp Form) $\frac{1}{24} = x$</p>	<p>21. $\ln(x+2) = -2$ (Log Form) $e^{-2} = x+2$ (Exp Form) $\frac{1}{e^2} = x+2$ $\frac{1}{e^2} - 2 = x$ $x \approx -1.865$</p>
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