

Logarithms (Sec. 5.3 and 5.4)

Answer True or False for 1 – 11.

_____ 1. $y = \log_4 x$ is the inverse of $y = 4^x$

_____ 2. $y = \log_4 x$ is equivalent to $4^y = x$

_____ 3. You can take a log of a negative number.

_____ 4. The value (output) of a log can be a negative number.

_____ 5. $\log_2 0 = 1$

_____ 6. $\log_a (y + 4) = \log_a y + \log_a 4$

_____ 7. $\log_a w^{1/3} = \frac{1}{3} \log_a w = \frac{\log_a w}{3}$

_____ 8. $(\log_a w)^3 = 3 \log_a w$

_____ 9. $\frac{\log_a t^5}{\log_a t} = 5$

_____ 10. If $0 < N < 1$, then $\log N < 0$.

_____ 11. If $\log_{(1/4)} x = -3$, then $\log_4 \left(\frac{1}{x} \right) = -3$

_____ 12. $5(7)^x = 35^x$

_____ 13. $\log_a m - \log_a n = \frac{\log_a m}{\log_a n}$

Find a formula for $f^{-1}(x)$. Also state the domain and range of f and f^{-1} .

14. $f(x) = 7^x$

15. $f(x) = e^x$

16. $f(x) = \log_5 x$

17. $f(x) = \ln x$

Given $\log_b 2 = w$, $\log_b 3 = x$, $\log_b 5 = y$, and $\log_b 7 = z$, write each of the following in terms of w , x , y , and z .

18. $\log_b 250$

19. $\log_b \left(\frac{27}{49} \right)$

20. $\log_b \left(\frac{30}{7b} \right)$

Express each of the following in terms of $\log a$, $\log b$, and $\log c$. All logarithms in 19 – 21 are common logs.

21. $\log \left(\frac{c^5}{\sqrt[3]{b^2 a}} \right)$

22. $\log \sqrt[4]{\frac{c^2 \cdot \sqrt{b}}{a}}$

23. $\log(10^{\log a} \cdot 10^{\log b} \cdot 10^{\log c})$

Write each as a single log.

24. $\log_a 4 + \log_a \pi + 3\log_a r - \log_a 3$

25. $\log(w+1) + \log(w-1) - \log(w^2 + w + 1) + \log(w^3 - 1) - \log(w^2 - 1)$

26. $M - 4\log_b(bM) + 2\log_b M - \log_b(b^M k)$

Answers to Logarithms

1. T 2. T 3. F 4. T 5. F 6. F

7. T 8. F 9. T 10. T 11. T 12. F 13. F

14. $f^{-1}(x) = \log_7 x$ $\text{dom } f$: All real numbers $\text{range } f$: $(0, \infty)$
 $\text{dom } f^{-1}$: $(0, \infty)$ $\text{range } f^{-1}$: All real numbers

15. $f^{-1}(x) = \ln x$ $\text{dom } f$: All real numbers $\text{range } f$: $(0, \infty)$
 $\text{dom } f^{-1}$: $(0, \infty)$ $\text{range } f^{-1}$: All real numbers

16. $f^{-1}(x) = 5^x$ $\text{dom } f$: $(0, \infty)$ $\text{range } f$: All real numbers
 $\text{dom } f^{-1}$: All real numbers $\text{range } f^{-1}$: $(0, \infty)$

17. $f^{-1}(x) = e^x$ $\text{dom } f$: $(0, \infty)$ $\text{range } f$: All real numbers
 $\text{dom } f^{-1}$: All real numbers $\text{range } f^{-1}$: $(0, \infty)$

18. $w + 3y$ 19. $3x - 2z$ 20. $w + x + y - z - 1$

21. $5 \log c - \frac{2}{3} \log b - \frac{1}{3} \log a$ 22. $\frac{1}{2} \log c + \frac{1}{8} \log b - \frac{1}{4} \log a$

23. $\log a + \log b + \log c$ 24. $\log_a \left(\frac{4\pi r^3}{3} \right)$

25. $\log(w - 1)$ 26. $\log_b \left(\frac{1}{b^4 M^2 k} \right)$ or $-\log_b (b^4 M^2 k)$