

$$a^b = x \Rightarrow \log_a x = b$$

Base exponent = Answer

Log Base Answer = exponent

Name

Answer key

Date

per

Write each equation in log form.

1. $5^3 = 125$

$\log_5 125 = 3$

2. $27^{\frac{4}{3}} = 81$

$\log_{27} 81 = \frac{4}{3}$

Write each equation in exponential form

3. $\log 0.00001 = -5$

$10^{-5} = .00001$

4. $\log_{\frac{3}{2}} \frac{\sqrt{6}}{3} = -\frac{1}{2}$

$\left(\frac{3}{2}\right)^{-\frac{1}{2}} = \frac{\sqrt{6}}{3}$

Write the inverse of each of the following functions.

5. $f(x) = \log_5 x + 2$

$x = \log_5 y + 2$

$x - 2 = \log_5 y$

$5^{x-2} = y$

$y = 5^{x-2}$

6. $f(x) = 3^{x-4} - 6$

$x = 3^{y-4} - 6$

$x + 6 = 3^{y-4}$

$\log_3(x+6) = y-4$

$y = \log_3(x+6) + 4$

7. $f(x) = -3 \ln x + 4$

$x = -3 \ln y + 4$

$x - 4 = -3 \ln y$

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

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

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

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

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

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

$\log_{\frac{1}{2}}(x+6) = -y+1$

$y = -\log_{\frac{1}{2}}(x+6) - 1$

Evaluate the following.

9. $\log_4 64 =$

$4^x = 64$

$4^x = (4^3)$

$x = 3$

10. $\log \frac{1}{10} =$

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

$10^x = (10^{-1})$

$x = -1$

11. $\log_4 \frac{1}{16} =$

$4^x = \frac{1}{16}$

$4^x = (16^{-1})$

$4^x = (4^2)^{-1}$

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

$x = -2$

12. $\log_{1/2} 4\sqrt{2} =$

$2^{-x} = 2^{2.5}$

$\left(\frac{1}{2}\right)^x = 4\sqrt{2}$

$\left(\frac{1}{2}\right)^x = 2^2 \cdot 2^{\frac{1}{2}}$

$-x = 2.5$

$x = -2.5$

13. $\log_{1/25} \sqrt{125} =$

$(5^2)^{-x} = (5^3)^{\frac{1}{2}}$

$5^{-2x} = 5^{\frac{3}{2}}$

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

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

14. $\log_{27} \left(\frac{\sqrt{3}}{3}\right) =$

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

$27^x = \frac{\sqrt{3}}{3}$

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

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

$x = -\frac{1}{6}$

Solve for x.

15. $\log_3(3x-5) = 2$

$3^2 = 3x-5$

$x = \frac{14}{3}$

$9 = 3x-5$

$+5 \quad +5$

$14 = 3x$

17. $\log_{17} 17^{(2x+3)} = 4$

$17^4 = 17^{2x+3}$

$4 = 2x+3$

$-3 \quad -3$
 $1 = 2x$

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

16. $\log \frac{\sqrt{10}}{10} = x-3$

$10^{x-3} = \frac{\sqrt{10}}{10}$

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

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

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

$+3 \quad +3$
 $x = 2.5$

18. $\log_x 27\sqrt[3]{9} = \frac{1}{6}$

$x^{\frac{1}{6}} = 27 \cdot \sqrt[3]{9}$

$x^{\frac{1}{6}} = 3^3 \cdot (3^2)^{\frac{1}{3}}$

$x^{\frac{1}{6}} = 3^3 \cdot 3^{\frac{2}{3}}$

$x^{\frac{1}{6}} = 3^{\frac{11}{3}}$

$(x^{\frac{1}{6}})^6 = (3^{\frac{11}{3}})^6$

$x = 3^{22}$

$x = 31381059609$

19. $7^{6x} = 7^{2x-20}$

$6x = 2x-20$

$-2x \quad -2x$

$4x = -20$

$\frac{4x}{4} = \frac{-20}{4}$
 $x = -5$

20. $4^{3x-1} \cdot 2 = (\frac{1}{8})^x$

$(2^2)^{3x-1} \cdot 2^1 = (2^{-3})^x$

$2^{6x-2} \cdot 2^1 = 2^{-3x}$

$2^{6x-1} = 2^{-3x}$

$2^{6x-1} = 2^{-3x}$

$6x-1 = -3x$

$9x = 1$

$x = \frac{1}{9}$

21. $4\log_2 x + \log_2 5 = \log_2 80$

22. $\log_8(x-3) + \log_8(x+4) = 1$

23. $9^{2x-1} = 27^{x+4}$

$(3^2)^{2x-1} = (3^3)^{x+4}$

$3^{4x-2} = 3^{3x+12}$

$4x-2 = 3x+12$

$-3x+2 \quad -3x+2$
 $x = 14$

$x = 14$

24. $\log_9 \frac{(3x+14)}{5} = \log_9 2x$

$5 \cdot \frac{3x+14}{5} = 2x \cdot 5$

$3x+14 = 10x$

$-3x \quad -3x$
 $14 = 7x$

$\frac{14}{7} = \frac{7x}{7}$
 $x = 2$

25. $(\frac{1}{16})^{x+1} = (\frac{1}{8})^{2x-1}$

$(16)^{-x-1} = (8)^{-2x+1}$

$(2^4)^{-x-1} = (2^3)^{-2x+1}$

$2^{-4x-4} = 2^{-6x+3}$

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

$+6x+4 \quad +6x+4$
 $2x = 7$

$\frac{2x}{2} = \frac{7}{2}$
 $x = \frac{7}{2}$

26. $5^{2x+3} = (\sqrt{5})^{x+4}$

$5^{2x+3} = (5^{\frac{1}{2}})^{x+4}$

$5^{2x+3} = 5^{\frac{1}{2}x+2}$

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

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

$-\frac{1}{2}x \quad -\frac{1}{2}x$
 $1.5x = -1$

$\frac{1.5x}{1.5} = \frac{-1}{1.5}$
 $x = -\frac{2}{3}$

27. $\log_7 x^{\frac{3}{2}} = \log_7 8$

$(x^{\frac{3}{2}})^{\frac{2}{3}} = (8)^{\frac{2}{3}}$

$x = 8^{\frac{2}{3}}$

$x = 4$

$$28. 2 \cdot 10^{2x-3} - 4 = 196$$

$$\frac{2 \cdot 10^{2x-3}}{2} = \frac{200}{2}$$

$$10^{2x-3} = 100$$

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

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

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

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

$$29. 16^{3x+1} = 8$$

$$(2^4)^{3x+1} = (2^3)$$

$$2^{12x+4} = 2^3$$

$$\frac{12x+4}{-4 \quad -4} = \frac{3}{-4 \quad -4}$$

$$\frac{12x}{12} = \frac{-1}{12}$$

$$x = -\frac{1}{12}$$

$$30. 4^{2x} = 32$$

$$(2^2)^{2x} = (2^5)$$

$$2^{4x} = 2^5$$

$$\frac{4x}{4} = \frac{5}{4}$$

$$x = \frac{5}{4}$$

$$31. e^{x+1} = 4$$

$$\ln 4 = x+1$$

$$x = \ln(4) - 1$$

$$x = 0.386294$$

Graph the following and provide the other information requested.

$$32. f(x) = \log_2(x+2) - 4$$

a) Domain $x > -2$

b) Range $y = \mathbb{R}$

c) x intercept $(14, 0)$

d) y intercept $(0, -3)$

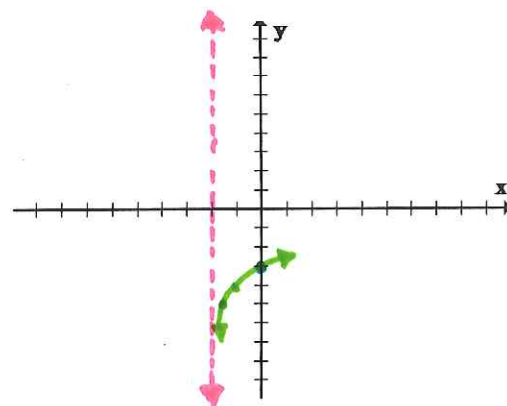
e) asymptote $x = -2$

f) increasing or decreasing

Transformations:
Horiz shift left 2
Vert shift down 4

$$y = \log_2 x$$

x-2	x	y	y-4
-1.5	$\frac{1}{2}$	-1	-5
-1	1	0	-4
0	2	1	-3



$$33. y = 2\left(\frac{1}{3}\right)^{x-3} - 9$$

a) Domain $x = \mathbb{R}$

b) Range $y > 9$

c) x intercept $(1.63, 0)$

d) y intercept $(0, 45)$

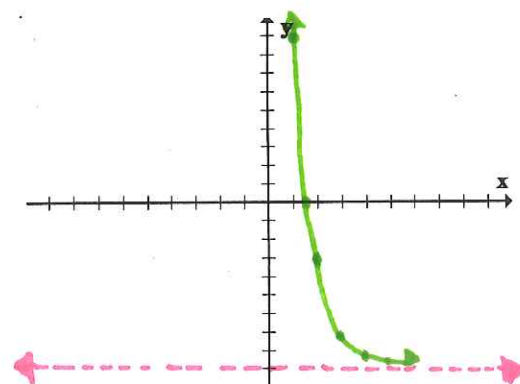
e) asymptote $y = -9$

decreasing

Transformations:
Vertical stretch by 2
Horiz shift right 3
Vert shift down 9

$$y = \left(\frac{1}{3}\right)^x$$

x+3	x	y	y-2	y-9
1	-2	9	18	9
2	-1	3	6	-3
3	0	1	2	-7
4	1	$\frac{1}{3}$	$\frac{2}{3}$	-8.33
5	2	$\frac{1}{9}$	$\frac{2}{9}$	-8.88



f) increasing or decreasing

34. $f(x) = \ln(x+4)$

a) Domain $x > -4$

b) Range $y = \mathbb{R}$

c) x intercept $(-3, 0)$

d) y intercept $(0, 1.38)$

e) asymptote $x = -4$

f) increasing or decreasing

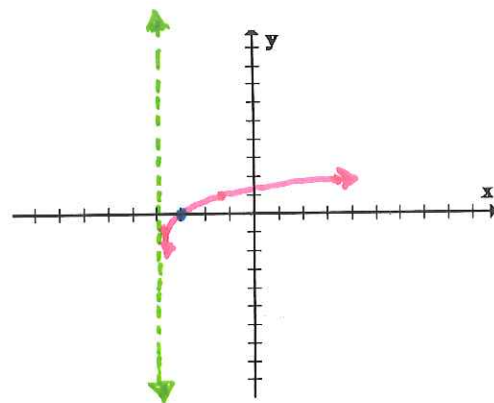
Transformations:

horiz shift left 4

$y = \ln(x)$

$x-4$

x	y
-3.64	-1
-3	0
-1.28	1
3.39	2



35. $f(x) = -3 \cdot 2^{x-1} + 6$

a) Domain $x = \mathbb{R}$

b) Range $y < 6$

c) x intercept $(2, 0)$

d) y intercept $(0, 4.5)$

e) asymptote $y = 6$

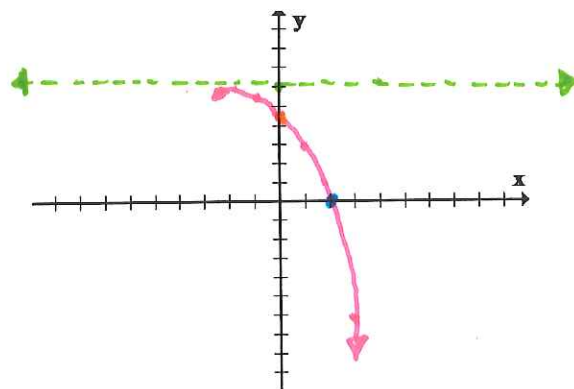
f) increasing or decreasing

Transformations:

reflection over x-axis
vert stretch by 3
horiz shift right 1
vert shift up 6

$y = 2^x$

x	y	y-3	y+6
-1	1/2	-1/2	5.5
0	1	-2	4.5
1	2	-3	3
2	4	-6	0
3	8	-12	-6



32 intercept work

x-int
 $0 = \log_2(x+2) - 4$
 $+4$
 $y = \log_2(x+2)$
 $2^4 = x+2$
 $16 = x+2$
 -2
 $x = 14$

y-int
 $y = \log_2(0+2) - 4$
 $+4$
 $y+4 = \log_2 2$
 $2^{y+4} = 2$
 $y+4 = 1$
 -4
 $y = -3$

33 intercept work

x-int
 $0 = 2 \left(\frac{1}{3}\right)^{x-3} - 9$
 $+9$
 $9 = 2 \cdot \left(\frac{1}{3}\right)^{x-3}$
 $\frac{9}{2} = \left(\frac{1}{3}\right)^{x-3}$
 $4.5 = \frac{1}{3}^{x-3}$
 $4.5 = 3^{-x+3} \Rightarrow \log_3 4.5 = -x+3 \Rightarrow x = -\log_3 4.5 + 3 \Rightarrow x = 1.63$

y-int
 $y = 2 \left(\frac{1}{3}\right)^{0-3} - 9$
 $+9$
 $y = 2 \cdot \left(\frac{1}{3}\right)^{-3} - 9$
 $y = 2 \cdot 27 - 9$
 $y = 45$

34 intercept work

x-int
 $0 = \ln(x+4)$
 $e^0 = x+4$
 $1 = x+4$
 -4
 $x = -3$

y-int
 $y = \ln(0+4)$
 $y = \ln 4$
 $y = 1.38$

35 intercept work

x-int
 $0 = -3 \cdot 2^{x-1} + 6$
 -6
 $-6 = -3 \cdot 2^{x-1}$
 $\frac{-6}{-3} = 2^{x-1}$
 $2 = 2^{x-1}$
 $1 = x-1$
 $+1$
 $x = 2$

y-int
 $y = -3 \cdot 2^{0-1} + 6$
 $y = -3 \cdot 2^{-1} + 6$
 $y = -3 \cdot \frac{1}{2} + 6$
 $y = -\frac{3}{2} + 6$
 $y = -1.5 + 6$
 $y = 4.5$