

Let $f(x) = x^2$ and $g(x) = \sqrt{x-5}$ and $h(x) = \frac{6-x}{3}$. Perform the indicated operation and state the domain when necessary.

1. $f(g(6))$

2. $g(f^{-1}(3))$

3. $f(g(6))$

4. $f(g(x))$

5. $f(f^{-1}(x))$

6. $g(g(x))$

7. $g(f(x))$

8. $(f^{-1}(x))$

9. $(g(x))$

Without Graphing, determine whether or not the following functions have inverse functions.

10. $f(x) = x^2 + 17$

11. $f(x) = 2x - 18 + \pi$

12. $f(x) = 5x^4 + 17x - 8$

Find the following inverse functions, if they exist.

13. $f(x) = \frac{x^4}{8} + 7$

14. $f(x) = \frac{3}{5}x + 8$

15. $f(x) = 2(x + 5)^{\frac{3}{2}}$

Find the inverse function for each of the following.

16. $f(x) = \log_3 x + 7$

17. $g(x) = e^{x-4}$

18. $(x) = \log_6(x + 5)$

Evaluate each of the following logarithms.

19. $\log_9 27$

20. $\log_3 \sqrt[4]{27}$

21. $\log_8(4\sqrt{32})^{3x}$

22. $\log \frac{1}{10,000}$

Solve each of the following equations, if a solution exists.

23. $\log_8 x = \frac{5}{2}$

24. $\log_9 x = \frac{3}{2}$

25. $\log_x 27 = \frac{3}{2}$

26. $\log_x 125 = \frac{1}{2}$

Condense the following logarithmic expressions into a single logarithm.

27. $4 - 2\log_6 a$

28. $2\log_3 m - \frac{1}{2}\log_3 n - 3\log_3 2$

Simplify the following logarithmic expressions.

29. $\log_5 \frac{1}{250} + 3 + \log_5 2$

30. $\frac{1}{6}(2\log_8 4 + 2\log_8 2)$

Solve the following logarithmic equations. Check for extraneous solutions. Round answers to the nearest thousandth.

31. $3 + 2 \ln x = 10$

32. $\log_4(3x) = \log_4 3 + \log_4 x$

33. $\log_4 x - \log_4(x - 1) = \frac{1}{2}$

34. $\log_6(2x - 5) - \log_6(7x + 10) = 1$

35. $\log(10x) - \log(2 + \sqrt{x}) = 1$

36. $\ln(x - 1) + \ln(x + 2) = 1$

Solve the following exponential equations. You must have an exact answer.

37. $25^{2x} = \frac{1}{125} 25^{x-1}$

38. $81^{3-x} = \left(\frac{1}{9}\right)^{5x-6} \sqrt{27}^x$

Solve the following exponential equations. Round answers to the nearest thousandth.

39. $e^{2-3x} = 12$

40. $4e^{2x} = 7$

41. $12^x = 5^{x+4}$

42. $4 + 3^{5x} = 8$

43. $\frac{50}{1+e^{-x}} = 4$

44. $100(1.04)^{2x} = 300$

45. $x^2 2^x - 2^x = 0$

46. $4x^3 e^{-3x} - 3x^4 e^{-3x} = 0$

47. $e^{4x} + 4e^{2x} - 21 = 0$

48. A man invests \$5,000 in an account that pays 8.5% interest per year, compounded quarterly on July 1, 2008.

a. Find the amount after 3 years.

b. During which month of what year will the amount double?

49. A man invests \$6,500 in an account that pays 6% interest per year, compounded continuously.

a. What is the amount after 2 years?

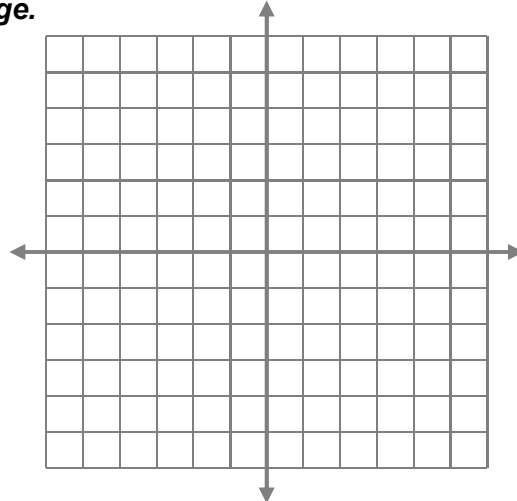
b. How long will it take for the amount to be \$8,000?

50. During which month of what year will it take for an investment of \$1,000 deposited on February 1, 1998 to double in value if the interest rate is 8.5% per year, compounded continuously?

51. A sum of \$1,000 was invested for 4 years, and the interest was compounded semiannually. If this sum amounted to \$1,435.77 in the given time, what was the interest rate?
52. A culture contains 1,500 bacteria initially and doubles every 30 minutes.
- Find a function that models the number of bacteria at time t .
 - Find the number of bacteria after two hours.
 - After how many minutes will there be 4,000 bacteria?
53. Radium-226 has a half-life of 1,600 years. Suppose a sample of this substance has a mass of 22 mg.
- Find a function that models the amount of the sample remaining at time t .
 - Find the mass remaining after 4,000 years.
 - How long will it take for the sample to decay to a mass of 18 mg?
54. Cesium-137 has a half-life of 30 years. Suppose a sample of this substance has a mass of 10 g.
- Find a function that models the amount of the sample remaining at time t .
 - Find the mass remaining after 80 years.
 - How long will it take for the sample to decay to a mass of 2 g?

Without using a calculator, graph the exponential equation $f(x) = 2^x$. Then, graph each of the transformed functions. Be sure to list all transformations in the order in which they must be graphed. Then, find the Domain and Range.

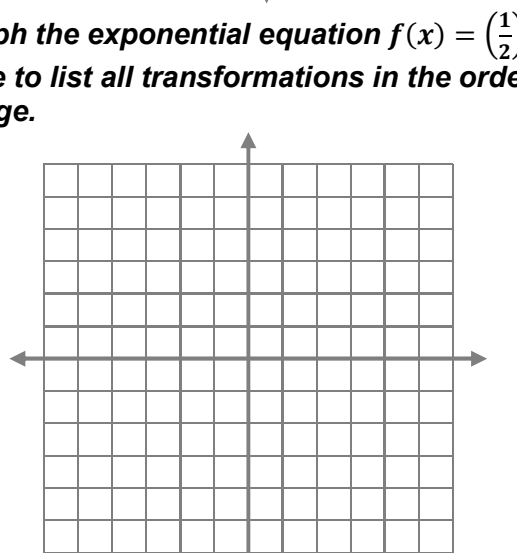
56. $g(x) = 2^x + 4$



Domain:

Range:

57. $h(x) = 2 \cdot 2^{x+5}$

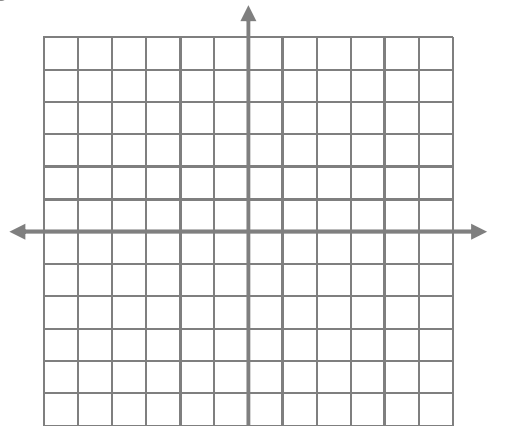


Domain:

Range:

Without using a calculator, graph the exponential equation $f(x) = \left(\frac{1}{2}\right)^x$. Then, graph each of the transformed functions. Be sure to list all transformations in the order in which they must be graphed. Then, find the Domain and Range.

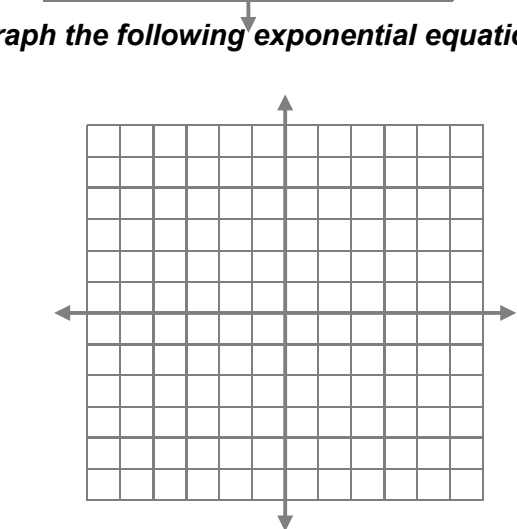
58. $g(x) = \left(\frac{1}{2}\right)^{x-3}$



Domain:

Range:

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

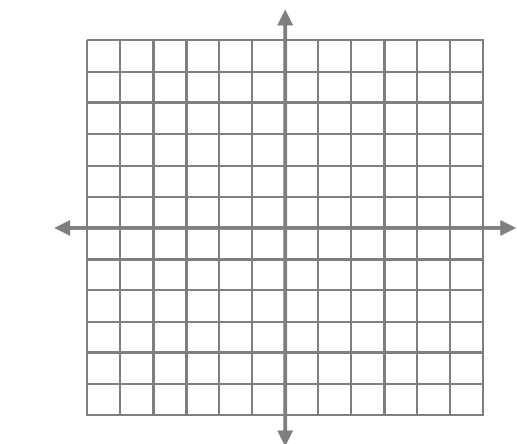


Domain:

Range:

Using a Graphing Calculator, graph the following exponential equations. Then, find the Domain and Range.

60. $f(x) = 2e^{x-5} + 1$



Domain:

Range:

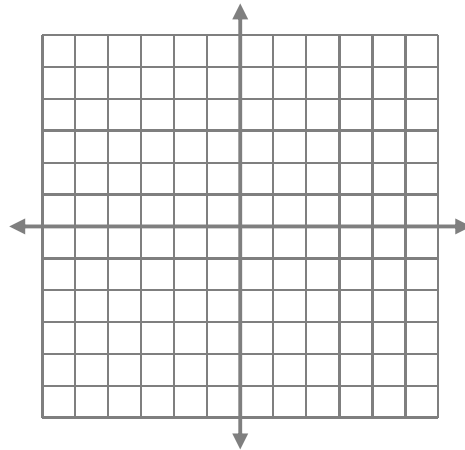
Without Graphing, identify the Domain and Range of each of the following functions. Simple sketches may help!!!!

61. $f(x) = 3^{x-9} + 7$

62. $f(x) = 3 \cdot 4^x - 6$

Without using a calculator, graph the logarithmic function $f(x) = \log_4 x$. Then, graph each of the transformed functions. Be sure to list all transformations in the order in which they must be graphed. Then, find the Domain and Range.

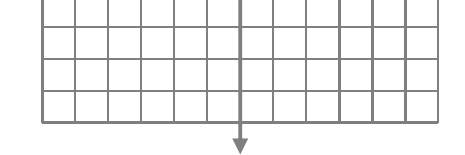
63. $g(x) = 2\log_4(x - 4)$



Domain:

Range:

64. $h(x) = \log_4 x + 4$

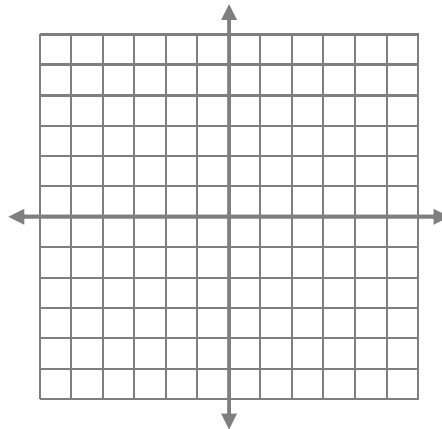


Domain:

Range:

Without using a calculator, graph the logarithmic function $f(x) = \log_{\frac{1}{2}} x$. Then, graph each of the transformed functions. Be sure to list all transformations in the order in which they must be graphed. Then, find the Domain and Range.

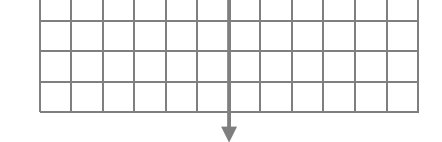
65. $f(x) = \log_{\frac{1}{2}}(x + 6)$



Domain:

Range:

66. $f(x) = 3\log_{\frac{1}{2}}(x - 5)$

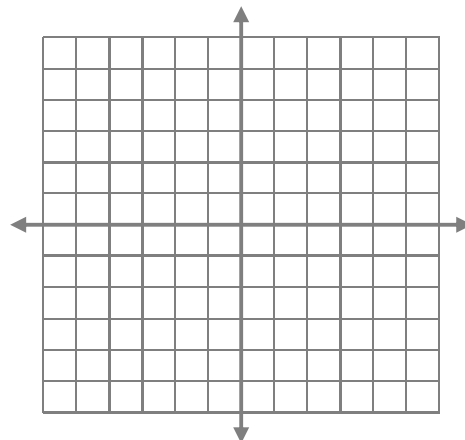


Domain:

Range:

Using a Graphing Calculator, graph the following exponential equations. Then, find the Domain and Range.

67. $f(x) = 3\ln(x - 6)$



Domain:

Range:

Without Graphing, identify the Domain and Range of each of the following functions.

Simple sketches may help!!!!

68. $f(x) = 14\log_8(x + 9)$

69. $f(x) = \log_{12}(x + 19)$

70. $f(x) = \log_7(x - 4)$

71. $f(x) = 3\log_5(x - 8) + 2$

Write an exponential function $y = ab^x$ whose graph passes through the given points.

72. (1, 4) and (2, 16)

73. (1, 6) and (4, 162)

ANSWERS

1. $f(g(6)) = 1$
2. $g(-3) = \sqrt{10}$
3. $f(6) = 10$
4. $f(g(x)) = x$
5. $D: [5, \infty)$
5. $f^{-1}(x) = 9x^2 - 36x + 36$; $D: (-\infty, \infty)$
6. $g(x) = \sqrt{\frac{9-x}{3}}$; $D: (-\infty, 9]$
7. $g(f(x)) = \sqrt{x^2 - 5}$; $D: (-\infty, \sqrt{5}] \cup [\sqrt{5}, \infty)$
8. $f^{-1}(x) = \frac{6 \pm \sqrt{x}}{3}$; $D: [0, \infty)$
9. $(g(x)) = \frac{6 - \sqrt{x-5}}{3}$; $D: [5, \infty)$
10. No
11. Yes
12. No
13. Does Not Exist
14. $f^{-1}(x) = \frac{5}{3}x - \frac{40}{3}$
15. $f^{-1}(x) = \sqrt[3]{\frac{x^2}{4}}$
16. $f^{-1}(x) = 3^{x-7}$
17. $g^{-1}(x) = \ln x + 4$
18. $f^{-1}(x) = 6^x - 5$
19. $\frac{3}{2}$
20. $\frac{3}{4}$
21. $\frac{13x}{4}$
22. 4
23. $x = 2^7\sqrt{2}$
24. $x = \frac{1}{27}$
25. $x = 9$
26. $x = \frac{1}{5^6}$
27. $\log_6 \frac{6^4}{a^2}$
28. $\log_3 \frac{m^2}{54\sqrt{n}}$
29. 0
30. $\frac{1}{3}$
31. $x = 33.115$
32. $(0, \infty)$
33. $x = 2$
34. $x = 8$
35. $x = 4$
36. $x = 1.729$
37. $x = \frac{5}{2}$
38. $x = 0$
39. $x = 0.162$
40. $x = 0.280$
41. $x = 7.353$
42. $x = 0.252$
43. $x = 2.442$
44. $x = 14.006$
45. $x = \pm 1$
46. $x = 0, \frac{4}{3}$
47. $x = 0.549$
- 48a. \$6,435.09
- 48b. September of 2016
- 49a. \$7,328.73
- 49b. 3.46 years
50. Marc of 2006
51. $r \approx 9.25\%$
- 52a. $N = 1500(2)^{\frac{t}{30}}$
- 52b. 24,000 bacteria
- 52c. $t \approx 42.5 \text{ min}$
- 53a. $N = 22\left(\frac{1}{2}\right)^{\frac{t}{1600}}$
- 53b. 3.89 mg
- 53c. 463.21 years
- 54a. $N = 10\left(\frac{1}{2}\right)^{\frac{t}{30}}$
- 54b. 1.57 g
- 54c. 69.7 years
56. $D: (-\infty, \infty)$ $R: (-\infty, 4)$
57. $D: (-\infty, \infty)$ $R: (0, \infty)$
58. $D: (-\infty, \infty)$ $R: (-\infty, 0)$
59. $D: (-\infty, \infty)$ $R: (-6, \infty)$
60. $D: (-\infty, \infty)$ $R: (-\infty, 1)$
61. $D: (-\infty, \infty)$ $R: (-\infty, 7)$
62. $D: (-\infty, \infty)$ $R: (-6, \infty)$
63. $D: (4, \infty)$ $R: (-\infty, \infty)$
64. $D: (0, \infty)$ $R: (-\infty, \infty)$
65. $D: (-6, \infty)$ $R: (-\infty, \infty)$
66. $D: (0, \infty)$ $R: (-\infty, \infty)$
67. $D: (6, \infty)$ $R: (-\infty, \infty)$
68. $D: (-9, \infty)$ $R: (-\infty, \infty)$
69. $D: (-19, \infty)$ $R: (-\infty, \infty)$
70. $D: (0, \infty)$ $R: (-\infty, \infty)$
71. $D: (8, \infty)$ $R: (-\infty, \infty)$
72. $y = 1(4)^x$
73. $y = 2(3)^x$