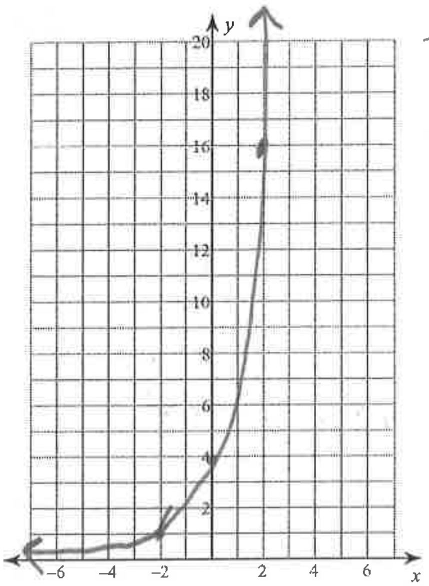
Chapter 6 Review

No Calculators

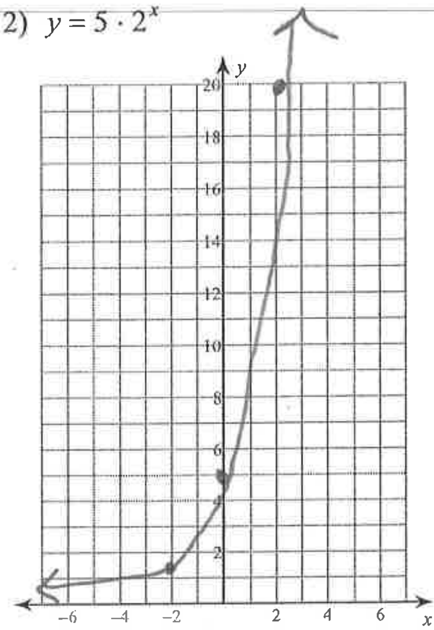
Sketch the graph of each function.

1) $y = 4 \cdot 2^x$



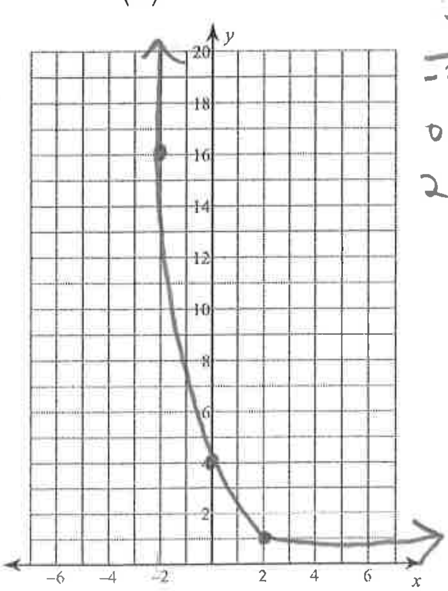
x	y
-2	1
0	4
2	16

2) $y = 5 \cdot 2^x$



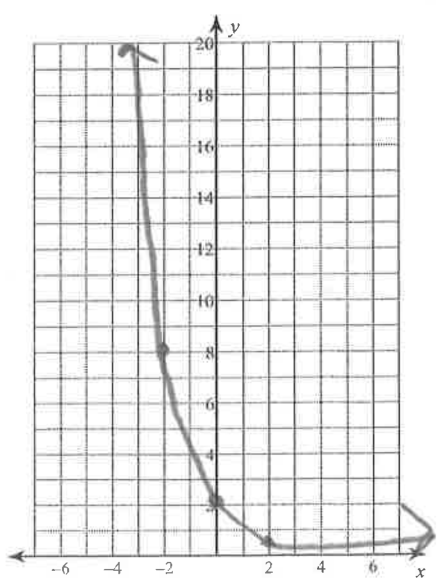
x	y
-2	5/4
0	5
2	20

3) $y = 4 \cdot \left(\frac{1}{2}\right)^x$



x	y
-2	16
0	4
2	1

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



x	y
-2	8
0	2
2	1/2

No Calculators ! !

Identify the domain and range of each. Then sketch the graph.

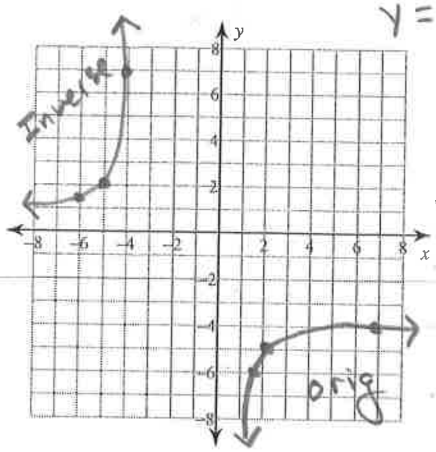
1) $y = \log_6 (x - 1) - 5$

Inverse

$y = 6^{x+5} + 1$

orig

x	y
$1\frac{1}{6}$	-6
2	-5
7	-4
37	-3

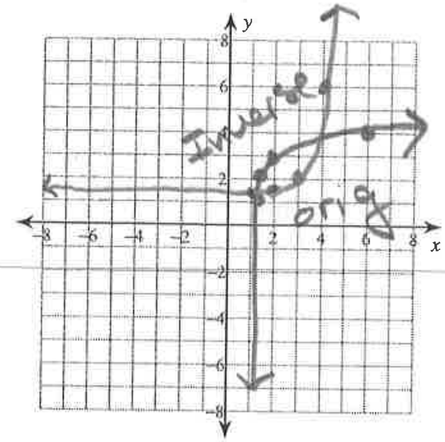


x	y
-6	$1\frac{1}{6}$
-5	2
-4	7
-3	37

2) $y = \log_5 (x - 1) + 3$

Inverse

$y = 5^{x-3} + 1$

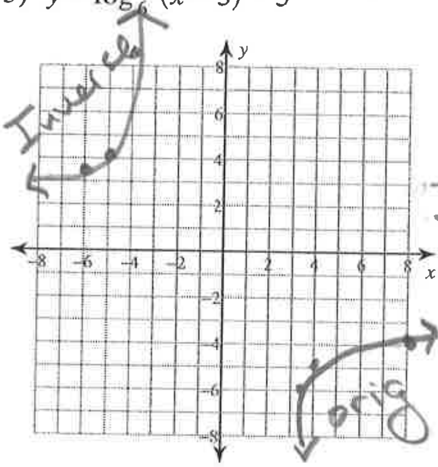


x	y
4	6
3	2
2	$1\frac{1}{5}$
1	$1\frac{1}{25}$

3) $y = \log_6 (x - 3) - 5$

Inverse

$y = 6^{x+5} + 3$

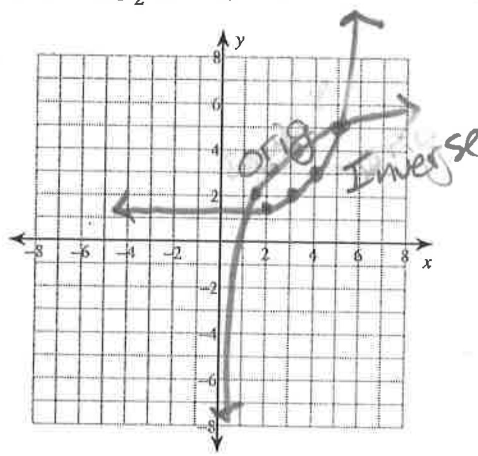


x	y
-6	$3\frac{1}{6}$
-5	4
-4	9
-3	39

4) $y = \log_2 (x - 1) + 3$

Inverse

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



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

No Calculators !

Rewrite each equation in exponential form.

1) $\log_6 36 = 2$

$6^2 = 36$

2) $\log_{289} 17 = \frac{1}{2}$

$\sqrt{289} = 17$

3) $\log_{14} \frac{1}{196} = -2$

$14^{-2} = \frac{1}{196}$

4) $\log_3 81 = 4$

$3^4 = 81$

no Calculators

Rewrite each equation in logarithmic form.

5) $64^{\frac{1}{2}} = 8$ $\log_{64} 8 = 1/2$

6) $12^2 = 144$ $\log_{12} 144 = 2$

7) $9^{-2} = \frac{1}{81}$ $\log_9 \frac{1}{81} = -2$

8) $\left(\frac{1}{12}\right)^2 = \frac{1}{144}$ $\log_{\frac{1}{12}} \frac{1}{144} = 2$

Rewrite each equation in exponential form.

9) $\log_u \frac{15}{16} = v$ $u^v = \frac{15}{16}$

10) $\log_v u = 4$ $v^4 = u$

11) $\log_{\frac{7}{4}} x = y$ $\frac{7}{4}^y = x$

12) $\log_2 v = u$ $2^u = v$

13) $\log_u v = -16$ $u^{-16} = v$

14) $\log_y x = -8$ $y^{-8} = x$

Rewrite each equation in logarithmic form.

15) $u^{-14} = v$ $\log_u v = -14$

16) $8^b = a$ $\log_8 a = b$

Evaluate each expression.

21) $\log_4 64$

3

22) $\log_6 216$

3

23) $\log_4 16$

2

24) $\log_3 \frac{1}{243}$

-5

25) $\log_5 125$

3

26) $\log_2 4$

2

Simplify each expression.

31) $12^{\log_{12} 144}$

144

32) $5^{\log_5 17}$

17

33) $x^{\log_x 72}$

NO Calculators

Expand each logarithm.

1) $\log (6 \cdot 11)$

$\log 6 + \log 11$

2) $\log (5 \cdot 3)$

$\log 5 + \log 3$

3) $\log \left(\frac{6}{11}\right)^5$

$5\log 6 - 5\log 11$

4) $\log (3 \cdot 2^3)$

$\log 3 + 3\log 2$

5) $\log \frac{2^4}{5}$

$4\log 2 - \log 5$

6) $\log \left(\frac{6}{5}\right)^6$

$6\log 6 - 6\log 5$

7) $\log \frac{x}{y^6}$

$\log x - 6\log y$

8) $\log (a \cdot b)^2$

$2\log a + 2\log b$

Condense each expression to a single logarithm.

13) $\log 3 - \log 8$

$\log \frac{3}{8}$

14) $\frac{\log 6}{3}$

$\log \sqrt[3]{6}$

15) $4\log 3 - 4\log 8$

$\log \left(\frac{3}{8}\right)^4$

16) $\log 2 + \log 11 + \log 7$

$\log 154$

17) $\log 7 - 2\log 12$

$\log \frac{7}{144}$

18) $\frac{2\log 7}{3}$

$\log \sqrt[3]{7^2}$

19) $6\log_3 u + 6\log_3 v$

$\log (uv)^6$

20) $\ln x - 4\ln y$

$\ln \frac{x}{y^4}$

Use a calculator to approximate each to the nearest thousandth.

1) $\log_3 3.3$

1.087

2) $\log_2 30$

4.907

3) $\log_4 5$

1.161

4) $\log_2 2.1$

1.07

5) $\log 3.55$

0.55

6) $\log_6 13$

1.432

Use the properties of logarithms and the values below to find the logarithm indicated. Do not use a calculator to evaluate the logs.

1) $\log 12 \approx 1.1$
$\log 8 \approx 0.9$
$\log 7 \approx 0.8$
Find $\log \frac{7}{8}$

-0.1

2) $\log 12 \approx 1.1$
$\log 8 \approx 0.9$
$\log 7 \approx 0.8$
Find $\log \frac{2}{3}$

-0.2

3) $\log 12 \approx 1.1$
$\log 7 \approx 0.8$
$\log 8 \approx 0.9$
Find $\log 64$

1.8

4) $\log 8 \approx 0.9$
$\log 12 \approx 1.1$
$\log 7 \approx 0.8$
Find $\log 96$

2

5) $\log 7 \approx 0.8$
$\log 12 \approx 1.1$
$\log 8 \approx 0.9$
Find $\log \frac{1}{64}$

-1.8

6) $\log 8 \approx 0.9$
$\log 7 \approx 0.8$
$\log 12 \approx 1.1$
Find $\log \frac{1}{7}$

-0.8

Solve each equation.

No calc.

1) $\log 5x = \log (2x + 9)$

$5x = 2x + 9$

$x = 3$

2) $\log (10 - 4x) = \log (10 - 3x)$

$10 - 4x = 10 - 3x$

$x = 0$

3) $\log (4p - 2) = \log (-5p + 5)$

$4p - 2 = -5p + 5$

$p = 7/9$

4) $\log (4k - 5) = \log (2k - 1)$

$4k - 5 = 2k - 1$

$k = 2$

5) $\log (-2a + 9) = \log (7 - 4a)$

$-2a + 9 = 7 - 4a$

$a = -1$

6) $2 \log_7 -2r = 0$

$7^0 = (-2r)^2$

$1 = 4r^2$

$r = -1/2$

13) $\log (16 + 2b) = \log (b^2 - 4b)$

$16 + 2b = b^2 - 4b$

$0 = b^2 - 6b - 16$

$0 = (b-8)(b+2)$

$b = -2$

14) $\ln (n^2 + 12) = \ln (-9n - 2)$

$n^2 + 12 = -9n - 2$

$n^2 + 9n + 14 = 0$

$(n+7)(n+2)$

$n = -7 \quad n = -2$

15) $\log x + \log 8 = 2$

$\log 8x = 2$

$10^2 = 8x$

$x = 25/2$

16) $\log x - \log 2 = 1$

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

$10 = \frac{x}{2}$

$x = 20$

17) $\log 2 + \log x = 1$

$\log 2x = 1$

$10 = 2x$

$x = 5$

18) $\log x + \log 7 = \log 37$

$\log 7x = \log 37$

$x = 37/7$

19) $\log_8 2 + \log_8 4x^2 = 1$

$\log_8 8x^2 = 1$

$8 = 8x^2$

$x = \pm 1$

20) $\log_9 (x + 6) - \log_9 x = \log_9 2$

$\frac{x+6}{x} = 2$

$x + 6 = 2x$

$x = 6$

Find the inverse of each function.

1) $y = \log(-2x)$

$x = \log(-2y)$

$10^x = -2y$

$y = -\frac{1}{2}(10^x)$

2) $y = \log_{\frac{1}{4}} x^5$

$x = \log_{\frac{1}{4}} y^5$

$y = \sqrt[5]{\frac{1}{4}^x}$

3) $y = \log_{\frac{1}{5}} x - 4$

$x+4 = \log_{1/5} y$

$y = \frac{1}{5}^{x+4}$

4) $y = \log_3 (4^x - 4)$

$3^x = 4^y - 4$

$3^x + 4 = 4^y$

$y = \log_4(3^x+4)$

5) $y = \log_2 (3x^3)$

$2^x = 3y^3$

$y = \sqrt[3]{\frac{2^x}{3}}$

6) $y = -7\log_6 (-3x)$

$y = \frac{6^{\frac{-x}{7}}}{-3}$

13) $y = \frac{5^{1+x}+1}{5^x}$

$x = \frac{5^{1+y}}{5^y} + \frac{1}{5^y}$

$x = 5 + \left(\frac{1}{5}\right)^y$

$x - 5 = \left(\frac{1}{5}\right)^y$

$y = \log_{\frac{1}{5}}(x-5)$

14) $y = 5^x - 8$

$x + 8 = 5^y$

$y = \log_5(x+8)$

15) $y = 5^{\frac{x}{2}}$

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

$y = 2\log_5 x$

$y = \log_5 x^2$

16) $y = -\frac{1}{4^{1+x}}$

$x = -\frac{1}{4^{1+x}}$

$x = -\left(\frac{1}{4}\right)^{1+y}$

$-x = \left(\frac{1}{4}\right)^{1+y}$

$\log_{\frac{1}{4}}(-x) = 1+y$

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

Solve each equation. Round your answers to the nearest ten-thousandth.

1) $3^b = 17$

$\log_3 17 \approx$

2.5789

2) $12^r = 13$

$\log_{12} 13$

1.0322

3) $9^n = 49$

$\log_9 49$

1.7712

4) $16^v = 67$

$\log_{16} 67$

1.5165

5) $3^a = 69$

$\log_3 69$

3.854

6) $6^r = 51$

$\log_6 51$

2.1944

7) $6^n = 99$

$\log_6 99$

2.5646

8) $20^r = 56$

$\log_{20} 56 =$

1.3437

9) $5 \cdot 18^{6x} = 26$

$\log_{18} \frac{26}{5} = 6x$

$.0951$

10) $e^{x-1} - 5 = 5$

$\ln 10 = x-1$

3.3026

13) $16^{n-7} + 5 = 24$

$\log_{16} 19 = n-7$

8.062

14) $20^{-6n} + 6 = 55$

$\log_{20} 49 = -6n$

$-.2165$

15) $5 \cdot 6^{3m} = 20$

$\log_6 4 = 3m$

$.2579$

16) $8^{-5a} - 5 = 53$

$\log_8 58 = -5a$

$-.3905$

17) $3.4e^{2-2n} - 9 = -4$ $.8072$

18) $-6e^{8n+8} - 3 = -23$ $-.8495$

Solve each equation.

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

$2x+3=0$

$x=-3/2$

2) $5^{3-2x} = 5^{-x}$

$3-2x=-x$

$x=3$

3) $3^{1-2x} = 243$

$3^{1-2x} = 3^5$

$1-2x=5$

$x=-2$

4) $3^{2a} = 3^{-a}$

$2a=-a$

$a=0$

5) $4^{3x-2} = 1$

$3x-2=0$

$x=2/3$

6) $4^{2p} = 4^{-2p-1}$

$2p=-2p-1$

$p=-1/4$

7) $6^{-2a} = 6^{2-3a}$

$-2a=2-3a$

$a=2$

8) $2^{2x+2} = 2^{3x}$

$2x+2=3x$

$x=2$

9) $6^{3m} \cdot 6^{-m} = 6^{-2m}$

$3m-m=-2m$

$2m=-2m$

$m=0$

10) $\dfrac{2^x}{2^x} = 2^{-2x}$

$0=-2x$

$x=0$

11) $10^{-3x} \cdot 10^{x} = \dfrac{1}{10}$

$-3x+x=-1$

$-2x=-1$

$x=1/2$

12) $3^{-2x+1} \cdot 3^{-2x-3} = 3^{-x}$

$-2x+1+-2x-3=-x$

$-4x-2=-x$

$-2=3x$

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

21) $\left(\dfrac{1}{6}\right)^{3x+2} \cdot 216^{3x} = \dfrac{1}{216}$

$-3x-2+9x=-3$

$6x=-1$

$x=-1/6$

22) $243^{k+2} \cdot 9^{2k-1} = 9$

$3^{5k+10} \cdot 3^{4k-2} = 3^2$

$5k+10+4k-2=2$

$9k+8=2$

$9k=-6$

$k=-2/3$

16. You purchased a baseball card for $8 when you were 10 years old. The value of the card increased by 5% each year. Write an exponential model that gives the value y (in dollars) of the card t years after you purchased it.

$y = 8(1+.05)^t$

$y = 8(1+.05)^t$

Solve the equation.

14. $3^{2x-3} = 27$

$2x-3=3$
$x=3$

15. $\log_3(4x - 7) = 2$

$9 = 4x-7$
$x=4$

16. $25^x = \left(\frac{1}{5}\right)^{x-3}$

$2x = -x+3$
$x=1$

17. $\ln(2x + 3) = \ln(5x - 6)$

$2x+3 = 5x-6$
$9 = 3x$
$x=3$

18. The average number of free throws a basketball player can make consecutively during practice is modeled by the function $f(x) = 1 + 1.3 \ln(x + 1)$, where x is the number of consecutive days the player has practiced for 1 hour. After how many days of practice can the basketball player make an average of five consecutive free throws? Round your answer to the nearest whole number of days.

$5 = 1 + 1.3\ln(x+1)$
$3.08 = \ln(x+1)$
$e^{3.08} - 1$
21 days

19. The function $P = 18e^{kt}$ models the population (in millions) of a particular country t years after 2013.

a. A recent change in the economy has made the k-value, or rate of change in population, 0.231. Write a function that gives the population of the country using this k-value.

$P = 18e^{.231t}$

b. Tell whether your function in part (a) represents exponential growth or exponential decay.

Growth

c. Estimate the population of this country in 2023. Round your answer to the nearest million.

$P = 18e^{.231(10)}$
180 mil.

20. The table shows the values (in thousands) of the average salary of NBA players x years after 1990. Write and use an exponential model to find the year when the average NBA player's salary will be more than $4 million.

Years (after 1990), x	1	2	3	4	5	6	7
Salary (thousands), y	25	50	100	200	400	800	1600

$y = 12.5(2^x)$
$4{,}000 = 12.5(2^x)$
$320 = 2^x$
$\log_2 320 = x$
$x = 8.3$ years