

## Exponential Expressions

**Simplify. Your answer should contain only positive exponents.**

1)  $4k^{-3} \cdot k^2$

2)  $x^4 \cdot 2x^{-2}$

3)  $v^3 \cdot 2uv^2$

4)  $2yx^0 \cdot 2x^{-4}y^2$

5)  $(2k^{-2})^{-2}$

6)  $(p^4)^{-4}$

7)  $(2x^4y^2z^2)^2$

8)  $(3yx^2z^2)^3$

9)  $\frac{r^0}{r}$

10)  $\frac{m^{-1}}{m^{-2}}$

11)  $\frac{4x^{-2}y^3}{x^4y^{-1}}$

12)  $\frac{4m^4n^2}{2n}$

13)  $v(v^{-3})^4$

14)  $(b^{-4} \cdot 2b^3)^4$

15)  $(2x^4y^4)^{-1}(xy^4)^4$

16)  $(2x^{-4}y^3)^3 \cdot 2x^3y^4$

17)  $\frac{2a^4}{(a^{-2})^3}$

18)  $\frac{(k^3)^0}{2k^4}$

19)  $\left(\frac{2h^0j^4k^0}{(2h^3j^0)^{-1}}\right)^0$

20)  $\frac{y^3z^2}{(xyz^{-1})^2}$

21)  $\frac{n^{-3}}{n^3 \cdot 2n^4}$

22)  $\frac{m^2 \cdot 2m^{-2} \cdot m^{-1}}{(2m^4)^2}$

23)  $\frac{(2a^{-2}b^{-1})^3}{a^0(b^3)^0}$

24)  $\frac{xy^2 \cdot (x^3y^2)^{-3}}{2x^4y^{-3} \cdot 2x^4y^3}$

## Exponential Equations

**Rewrite each equation in logarithmic form.**

1)  $2^5 = 32$

2)  $6^3 = 216$

3)  $y^x = z$

4)  $17^v = u$

**Solve each equation.**

5)  $5^{-k} = 5^{-3k}$

6)  $3^{-n-1} = 81$

7)  $4^{-3p} \cdot 4^{p+3} = 16$

8)  $9^{3x} \cdot 9^{-x+2} = 9^2$

9)  $\left(\frac{1}{4}\right)^{2n} = \frac{1}{64}$

10)  $625^{2m} = 125$

11)  $125^{-r} \cdot 25^{-3r} = \frac{1}{125}$

12)  $216^{-x-2} \cdot \left(\frac{1}{6}\right)^{2x} = 36^{3x}$

13)  $13^v = 17$

14)  $e^a = 0$

15)  $10^x = 5$

16)  $8^x = 93$

17)  $7^{b+9} = 15$

18)  $16^{-7v} = 64$

19)  $-4e^{8x} = -16$

20)  $11^{x+5} + 2 = 93$

21)  $10 \cdot 18^{-4k-4} = 60$

22)  $6 \cdot 8^{-10a-3} = 40$

23)  $-6 \cdot 3^{-10x-2} + 6 = -57$

24)  $-6 \cdot 6^{6v-4} - 7 = -52$

## Logarithmic Expressions & Equations

Use a calculator to approximate each to the nearest thousandth.

1)  $\log_6 46$

2)  $\log_4 21$

3)  $\log_2 3.3$

4)  $\log_6 2.1$

Evaluate each expression without a calculator. (You must show your work for full credit.)

5)  $\log_7 49$

6)  $\log_2 16$

7)  $\log_3 27$

8)  $\log_7 \frac{1}{343}$

Rewrite each equation in exponential form.

9)  $\log_{13} 169 = 2$

10)  $\log_{81} \frac{1}{9} = -\frac{1}{2}$

11)  $\log_6 r = 18$

12)  $\log_{12} 61 = n$

Solve each equation. Round to the nearest thousandth if necessary.

13)  $\log_{11} r = 1$

14)  $\log_6 n = 0$

15)  $\log x = 2$

16)  $\log_3 a = 4$

17)  $\log_3 (m - 8) + 7 = 6$

18)  $-\log_9 (r - 9) = -3$

19)  $-9 - \log_7 (-8v - 2) = -9$

20)  $-9 + 5 \log_3 (8x - 2) = 1$

21)  $\log_2 5r = \log_2 (4r + 8)$

22)  $\log_{19} (-5x - 6) = \log_{19} (-2x + 9)$

23)  $\ln (10n + 1) = \ln (n^2 + 22)$

24)  $\log_6 (b^2 - b) = \log_6 (63 + b)$

## Complex Logarithmic Equations

**Rewrite using properties of logarithms. Do NOT solve.**

1)  $\log_5 (12 \cdot 11^4)^4$

2)  $\log_6 \sqrt{8 \cdot 7 \cdot 3}$

3)  $4\log_9 11 + \frac{\log_9 10}{3}$

4)  $4\ln 11 - 12\ln 8$

5)  $\log_8 (uv^3)^2$

6)  $\log_2 \left(\frac{x}{y^2}\right)^4$

7)  $5\log_6 u + 25\log_6 v$

8)  $\frac{\log_6 a}{3} + \frac{\log_6 b}{3} + \frac{\log_6 c}{3}$

**Solve each equation.**

9)  $\log_5 10 + \log_5 x = 2$

10)  $\log_9 3 + \log_9 x = \log_9 66$

11)  $\ln x - \ln 5 = 1$

12)  $\log_8 x + \log_8 9 = \log_8 22$

13)  $\log_8 (2x + 4) + \log_8 3 = 2$

14)  $\log_3 (2x + 9) - \log_3 2 = 1$

15)  $\log_5 9 + \log_5 (3x - 8) = 3$

16)  $\log_5 (10 - 4x) - \log_5 10 = \log_5 28$

17)  $\log_6 (5x^2 + 7) - \log_6 7 = 4$

18)  $\log_2 (4x^2 - 4) - \log_2 3 = 5$

19)  $\log (3x^2 + 3) - \log 3 = 1$

20)  $\log_5 (3x^2 - 7) + \log_5 7 = \log_5 35$

21)  $\log_2 9 - \log_2 (x - 8) = 3$

22)  $\log_5 2 - \log_5 -3x = 1$

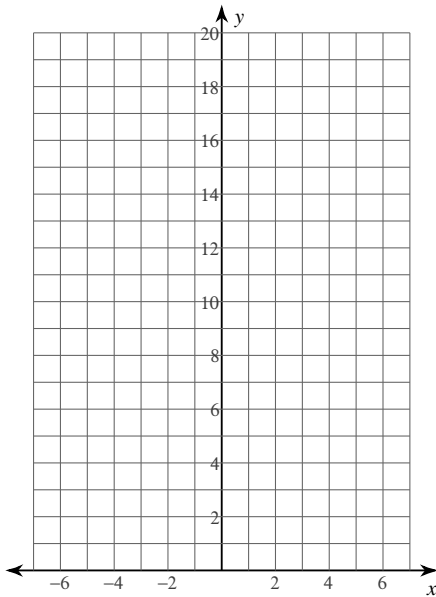
23)  $\log_4 7 - \log_4 (x - 5) = 1$

24)  $\log 8 - \log -5x = 2$

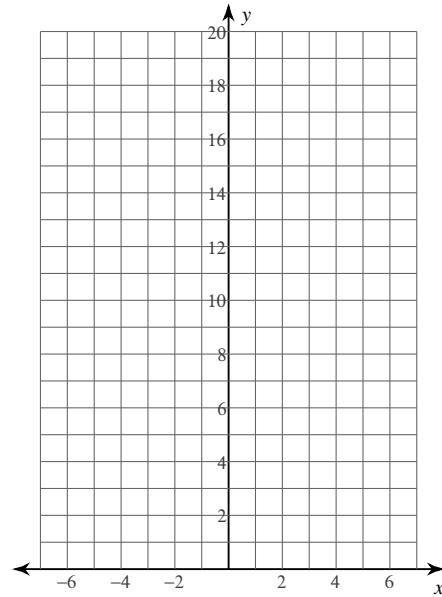
## Graphing Exponential & Logarithmic Functions

Sketch the graph of each function, and then find the domain/range, y-intercept, roots, and inverse.

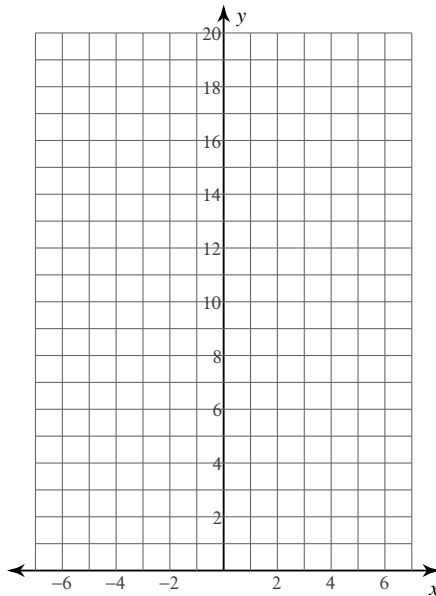
1)  $f(x) = 4^x$



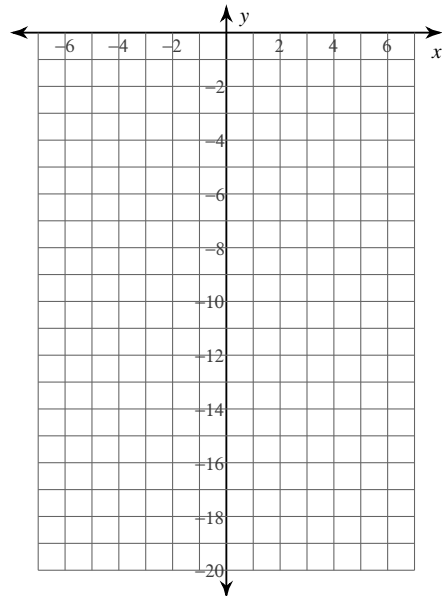
2)  $f(x) = \left(\frac{1}{3}\right)^x$



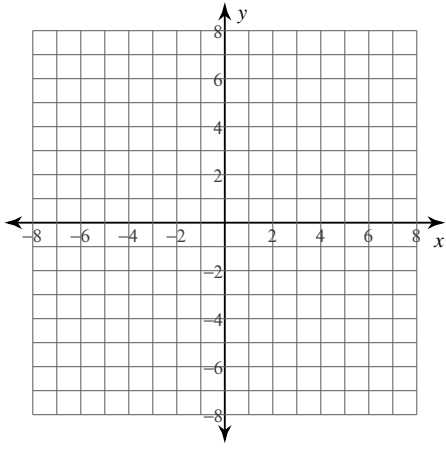
3)  $f(x) = 3 \cdot 2^x$



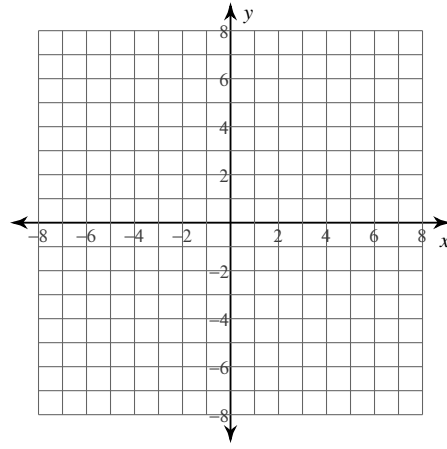
4)  $f(x) = -5 \cdot 2^x$



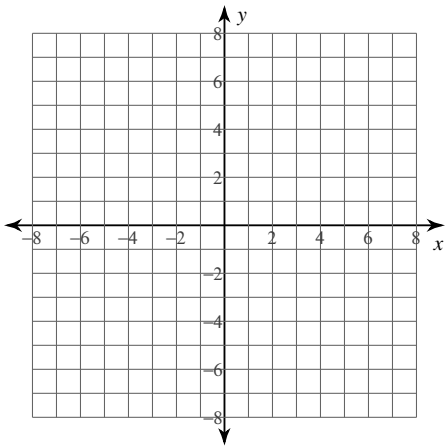
5)  $f(x) = \log_2(x + 5)$



6)  $f(x) = \log_3(x + 4) - 1$



7)  $f(x) = \log_6(x - 1) - 5$



8)  $f(x) = \ln(x - 2) - 4$

