Simplify the following.

1. \((3x + 1) - (2x - 5)\)

2. \(x^2 + 3x - 1 + 4x + 9\)

3. \((x^2 - 2x + 1) - (2x + 1)\)

4. \((2x - 3)(3x + 1)\)

5. \((x + 3)^2\)

6. \((2x - 1)(2x + 1)\)

7. \((x - 5)^2\)

8. \((x - 3)^2 - 2(x - 3)\)

9. \((x + 1)^2 - 4(x + 1) - 5\)

Given the following functions \(f(x) = x^2 - 4\), \(g(x) = 3x - 1\) and \(r(x) = 2x - 5\). Calculate the following.

- a. \(f(-3)\)
- b. \(g(1)\)
- c. \(r(-2)\)

- d. \(f(x) - g(x)\)
- e. \(g(-2) + r(0)\)

- f. \(g(x)f(x)\)
- g. \(\frac{f(-1)}{g(6)}\)
Given the following functions $f(x) = 2x^2 - 3x + 1$, $g(x) = x^2 - 7x$ and $r(x) = -4x + 2$. Calculate the following.

a. $f(g(-2))$  

b. $g(r(0))$

c. $f(f(0))$  

d. $r(3) - g(-1)$

e. $\frac{f(-2)}{g(2)}$  

f. $g(a + 2)$

g. $r(2a - 1)$  

h. $f(a - 1)$

i. $2g(x) + 3r(x)$  

j. $-2r(x) + g(x)$

k. $f(x) - 2r(x)$  

l. $r(g(1))$
Given the following functions \( f(x) = 4x^2 + 3x - 1 \), \( g(x) = x^2 + 1 \), \( h(x) = 5x - 5 \). Calculate the following.

a. \(-f(-1)\) 

b. \(g(3) + h(7)\)

c. \(g(h(x))\) 

d. \(\frac{f(2)}{h(1)}\)

e. \(h(h(x))\) 

f. \(f(-1) + g(3) - h(0)\)

g. \(f(a + 4)\) 

h. \(g(2)f(1)\)

j. \(g(x) - 2h(x)\) 

k. \(3h(x) - g(x)\)

If \(f(x) = x^2 + 3\) and \(g(x) = x^3 - 1\), calculate the following.

a. \(2g(x) - f(x)\) 

b. \(3f(x) + g(x)\)

c. \(f(g(2))\) 

d. \(\frac{f(1)}{g(0)}\)
Simplify the following:

1. \(x^5 \cdot x^7\)

2. \(\frac{x^8}{x^3}\)

3. \((x^9)^4\)

4. \(\left(\frac{x^7}{x^3}\right)^2\)

5. \(\frac{2x^7y^3}{4xy^5}\)

6. \(\frac{9x^3y}{(3x^6y)^2}\)

7. \(\frac{4x^2y^3}{(2x^5y)^3}\)

8. \(5x^2(x^4)(-2x)\)

9. \(\frac{6x^3yz^4}{12x^5yz^2}\)

10. \(\left(\frac{5x^3y^4}{2xy^2}\right)^3\)

Rewrite the following in radical form.

1. \(x^{1/3}y^{3/4}z^{1/12}\)

2. \(x^{1/2}y^{1/3}z^{1/6}\)

3. \(x^{3/2}y^{5/4}z^{1/8}\)

4. \(\frac{x^{2/5}y^{2/3}}{z^{4/15}}\)
Rational Expressions

Simplify the following rational expressions.

1. \( \frac{x^2-4}{x-2} \quad x \neq 2 \)

2. \( \frac{5x+10}{x^2+2x} \)

3. \( \frac{5x-10}{x-2} \quad x \neq 2 \)

4. \( \frac{x^2-9}{x+3} \)

Evaluate the following expressions.

1. \( \frac{a^2+ab}{a^2+2ab+b^2} \) when \( a = 2 \) and \( b = -3 \).

2. \( 6a^2b^2 - 10a^2b^2 - 4ab^4 \) when \( a = 1 \) and \( b = 2 \).

3. \( \frac{a^3+ab+b^3}{a^3-b^3} \) when \( a = 2 \) and \( b = 1 \).

4. \( 2a^2b^2 + ab - 3 \) when \( a = 3 \) and \( b = -2 \).

5. \( \frac{a^2+b^2}{a^2+3ab+2b^2} \) when \( a = 4 \) and \( b = 2 \).
Factoring

Factor the following equations.

1. $x^2 - 81$  
2. $x^2 - x - 12$

3. $2x^2 - 10x$  
4. $x^2 - 3x - 10$

5. $x^2 - 36$  
6. $x^2 + 10x + 25$

7. $x^2 - 10x + 9$  
8. $9x^2 + 27x$

Solve the following equations.

1. $x^2 + 3x - 18 = 0$  
2. $x^2 + 6x + 5 = 0$

3. $x^2 - 5x + 6 = 0$  
4. $x^2 - x - 12 = 0$

5. $x^2 - 1 = 0$  
6. $x^2 + 6x + 8 = 0$
Application Problems

1. One measure of the wind chill factor, WC is calculated from the temperature, TF (in degrees Fahrenheit) and the wind speed, WS (in miles per hour). The wind chill is computed by the formula \( WC = TF - (0.8)WS \). What is the wind speed in miles per hour if the temperature is 16\(^\circ\) F and the wind chill is 0\(^\circ\) F?

2. A straight line can be described by the equation \( y = mx + b \) where \( m \) is the slope of the line, \( b \) is the y-intercept, and \( x \) and \( y \) represent the horizontal and vertical coordinates of any point on the line. If \( x = 2, y = 5 \) and \( b = 1 \), what is slope \( m \)?

3. The perimeter of a rectangle is computed from the formula \( P = 2L + 2W \) where \( P \) is the perimeter, \( L \) is the length and \( W \) is the width. If the perimeter is 120 feet and the length is 45 feet, what is the width \( W \)?

4. The velocity of a rising or falling object can be modeled by the equation \( V = V_0 - 9.8T \), where \( V_0 \) is the original velocity in meters per second, \( V \) is the final velocity in meters per second after a period of time \( T \) measured in seconds. If the original velocity \( V_0 \) is 100 meters per second, what is the final velocity \( V \) when the time \( T = 10 \) seconds?

5. The simple interest on a loan is computed from the formula \( I = PRT \), where \( I \) is the interest in dollars, \( P \) is the principal in dollars, \( R \) is the interest rate and \( T \) is the time of the loan. If the interest \( I \) is $1200, the interest rate \( R \) is 6\% and the time \( T \) is 2 years, what is the principle \( P \) in dollars?
Linear Systems

If $y = 3x - 2$, $z = 3y - 2$ and $w = 3z - 2$, what is the value of $w$ when $x = 2$?

If $x = 4t + 1$, $y = 2x - 4$ and $z = y + 1$, what is the value of $z$ when $t = 1$?

If $f = -x + 2$, $g = 3f + 5$ and $h = 2g - 10$, what is the value of $h$ when $x = 0$?

Suppose $b = a + 5$, $c = b - 2$ and $d = 3c + 3$. What is the value of $d$ when $a = 2$?

Suppose $s = -2t - 3$, $u = -s - 1$, and $v = u + 5$. What is $v$ when $t = -3$?

Given: $p = 5x + 1$, $q = p + 8$, $r = q + 12$. What is $r$ when $x = -1$?
In each of the following problems express $r$ in terms of $t$.

1. $r = 3s - 1 \quad s = 4 - 2t$

2. $r = s + 4 \quad s = 2t + 1$

3. $r = 2s - 5 \quad s = 5t + 1$

4. $r = s - 6 \quad s = -t - 4$

5. $r = 3s + 7 \quad s = t + 2$

6. $r = -2s - 8 \quad s = -3t - 5$
Complex Numbers

\[ \sqrt{-1} = i \text{ or } i^2 = -1 \]

Simplify the following complex numbers.

1. \((3i + 5) - (2 + 8i)\)
2. \((-2i - 7) + (5 - 6i)\)

3. \(5(3 - i) + 4i\)
4. \((-3i + 7) - (8i + 3)\)

5. \((2i - 3)(4i + 5)\)
6. \((5i + 3)(5i - 3)\)

7. \((i + 9)(2i - 1)\)
8. \((i - 1)^2\)

9. \((4i - 2)^2\)
10. \((2 + i)^2\)

11. \(\frac{1}{2i - 1}\)
12. \(\frac{1}{3i + 4}\)

13. \(i^7\)
14. \(i^{10}\)

15. \(i^6\)
16. \(i^4\)
Radical Expressions

Simplify the following radical expressions.

1. $\sqrt{25}$
2. $\sqrt[3]{-8}$

3. $\frac{\sqrt{36}}{\sqrt{81}}$
4. $\frac{\sqrt[3]{-27}}{\sqrt{64}}$

5. $\frac{\sqrt{4}}{\sqrt{100}}$
6. $\frac{\sqrt[3]{1}}{\sqrt{8}}$

7. $\sqrt{81}$
8. $\sqrt[3]{64}$
Exponential and Logarithmic Equations

Solve the following equations for $x$.

1. $4^x = 64$
   a. 1
   b. 3
   c. -2
   d. 0

2. $4^x = 2$
   a. -1
   b. $\frac{1}{2}$
   c. $\frac{1}{3}$
   d. 2

3. $\log x = 3$
   a. 1000
   b. 100
   c. $\frac{1}{1000}$
   d. $\frac{1}{3}$

4. $\log x = -1$
   a. 0
   b. 10
   c. -10
   d. $\frac{1}{10}$

5. $2^{x+2} = \frac{1}{2}$
   a. -3
   b. -2
   c. 0
   d. 1

6. $3^{1-x} = \frac{1}{9}$
   a. 4
   b. -2
   c. 2
   d. 3
7. \(5^{3x+1} = \frac{1}{25}\)
   a. -2
   b. 2
   c. -1
   d. \(-\frac{1}{2}\)

8. \((\frac{1}{4})^x = 16\)
   a. 1
   b. \(\frac{1}{2}\)
   c. -2
   d. 4

9. \(5^x = 625\)
   a. 6
   b. -3
   c. 2
   d. 4

10. \(3^x = 81\)
    a. 2
    b. 4
    c. 3
    d. 0

11. \(2^x = 32\)
    a. 0
    b. -3
    c. 5
    d. 2

12. \(4^x = 256\)
    a. -1
    b. -3
    c. 2
    d. 4
Logarithm Rules

If M, N and P are real numbers and M > 0 and N > 0 then the following rules are true:

\[ \log MN = \log M + \log N \]

\[ \log \frac{M}{N} = \log M - \log N \]

\[ \log M^P = P \log M \]

Write the following as a sum or difference of logarithms without products, quotients or exponents in the argument.

1. \( \log(10x) = \)

2. \( \log \left( \frac{x}{100} \right) = \)

3. \( \log (x^3) = \)

4. \( \log \left( \frac{1000x^4}{y^2} \right) = \)

Write the following as a single logarithm.

1. \( \log(4) + \log(y) = \)

2. \( \log(y) - \log(7) = \)

3. \( 3 \log(y) = \)

4. \( 2 \log(x) - 8 \log(y) + 10 \log(z) = \)
Simplify the following logarithms.

1. \( \log \sqrt[2]{\frac{x^2 y}{100}} \)
2. \( \log \sqrt[100]{\frac{400}{a^4 b^2}} \)

3. \( \log \sqrt[10]{w^8 z} \)
4. \( \ln(e^{14}) \)

5. \( \ln(e^{6x^3 y^5 z^6}) \)
6. \( \ln\left(\frac{e^{4x^7 y^3}}{e^{10w^4 z}}\right) \)
Trigonometry

\[
\sin x = \frac{\text{opposite}}{\text{hypotenuse}} \quad \cos x = \frac{\text{adjacent}}{\text{hypotenuse}} \quad \tan x = \frac{\text{opposite}}{\text{adjacent}}
\]

Pythagorean Theorem: \(a^2 + b^2 = c^2\)

Given the following triangles find the trig value.

1. \(\sin x = \)

   \[
   \begin{array}{c}
   \text{5} \\
   \text{12} \\
   \text{13} \\
   \end{array}
   \]

2. \(\cos x = \)

   \[
   \begin{array}{c}
   \text{6} \\
   \text{8} \\
   \text{10} \\
   \end{array}
   \]

3. \(\tan x = \)

   \[
   \begin{array}{c}
   \text{3} \\
   \text{4} \\
   \text{5} \\
   \end{array}
   \]
Matrices and Determinants

Definition of a determinant: If \( C = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \) then \( \det(C) = ad - bc \).

Perform the following matrix operations.

1. \( A = \begin{bmatrix} 2 & -5 \\ 0 & 7 \end{bmatrix} \quad B = \begin{bmatrix} 4 & 6 \\ 1 & 3 \end{bmatrix} \)
   
a. \( A + B = \)

b. \( A - B = \)

c. \( \det(A) = \)

2. \( A = \begin{bmatrix} 2 & 5 \\ 3 & 7 \end{bmatrix} \quad B = \begin{bmatrix} -2 & -4 \\ -1 & 6 \end{bmatrix} \)
   
a. \( A + B = \)

b. \( A - B = \)

c. \( \det(A) = \)
3. \( A = \begin{bmatrix} \frac{1}{2} & -3 \\ 2 & \frac{1}{2} \\ 2 & -2 \end{bmatrix} \quad B = \begin{bmatrix} \frac{1}{2} & 5 \\ 2 & \frac{1}{2} \\ 2 & 4 \end{bmatrix} \)

a. \( A + B = \)

b. \( A - B = \)

c. \( \text{det}(B) = \)

4. \( A = \begin{bmatrix} 3 & 6 \\ -1 & -2 \end{bmatrix} \quad B = \begin{bmatrix} -1 & -2 \\ -3 & -4 \end{bmatrix} \)

a. \( A + B = \)

b. \( A - B = \)

c. \( \text{det}(B) = \)
Geometric Sequences

A geometric sequence is a sequence of the form \( a_0, a_0r, a_0r^2, a_0r^3, a_0r^4, \ldots \)

The \textbf{nth term} of a geometric sequence is given by \( a_n = a_0r^{n-1} \)

The first term = \( a_0 \)

second term: \( a_1 = a_0r \)

third term: \( a_2 = a_0r^2 \)

fourth term: \( a_3 = a_0r^3 \)

\[ r = \frac{a_1}{a_0} \quad a_{n+1} = r \cdot a_n \]

Determine the next term in each geometric sequence.

1. \( 1, 2, 4, 8, \ldots \)

2. \( 1, \frac{1}{3}, \frac{1}{9}, \frac{1}{27}, \ldots \)

3. \( 3, 6, 12, 24, \ldots \)

4. \( -1, 3, -9, 27, \ldots \)

5. \( 1, -\frac{1}{2}, \frac{1}{4}, -\frac{1}{8}, \ldots \)

6. \( 3, -\frac{3}{2}, \frac{3}{4}, -\frac{3}{8}, \ldots \)
Arithmetic Sequences

An arithmetic sequence is a sequence of the form \(a_0, a_1, a_2, a_3, a_n, \ldots\)

Where \(a_1 = a_0 + c\)

\[a_2 = a_1 + c\]

\[a_3 = a_2 + c\]

\[a_n = a_{n-1} + c\]  \(c\) is a constant.

Find the missing term in each arithmetic sequence.

1. \(1, 3, 5, \ldots\)

2. \(1, \frac{7}{2}, \ldots\)

3. \(2, \frac{3}{4}, \ldots\)

4. \(\frac{3}{2}, \ldots\)

5. \(\frac{16}{3}, 3, \ldots\)

6. \(-2, \ldots\)