

1. Simplify:

$$\left(\frac{12x^3y^{-1}}{4xy^{-3}}\right)^{-1}$$

2. Perform the indicated operation and simplify. Leave your answer in factored form.

$$\frac{5}{x+3} - \frac{2}{x-5}$$

3. Reduce the rational expression to lowest terms.

$$\frac{x^2 - 4}{x^2 + 2x - 8}$$

4. Simplify. Assume that the variables are positive.

$$(36x^4y^6)^{\frac{1}{2}}(3xy^5)$$

5. Simplify the expression. Assume that the variable is positive.

$$\sqrt{x} \quad \sqrt[3]{x}$$

6. Solve the equation.

$$\frac{5}{x-1} = \frac{4}{x+1}$$

7. A shopkeeper has two types of coffee beans.

The first type sells for \$5.20 per pound, and the second type sells for \$5.80 per pound. How many pounds of each type should be mixed to obtain 20 pounds of a blend that sells for \$5.35 per pound?

8. Find all the real number solutions.

$$|1 - 2x| = 17$$

9. Find all solutions.

$$(2x - 1)^2 = 9$$

10. Solve the equation in the complex number system.

$$4x^2 + x + 1 = 0$$

11. Solve the equation.

$$\sqrt{x + 3} - x = 1$$

12. Solve the inequality.

$$2 \leq \frac{1 - x}{2} \leq 5$$

13. Solve the inequality.

$$\frac{x + 2}{x - 3} < 0$$

14. Find the length of the line segment having the endpoints (4, -1) and (2, 3).
15. Find the slope of the line passing through the points (-3, 1) and (0, -1).
16. Find an equation of the line perpendicular to  $y = -2x + 7$  and passing through the point (-8, 2).
17. Find the center and radius of the circle described by the equation:  
$$x^2 + y^2 + 2x - 4y - 4 = 0$$
18. Suppose  $y$  varies directly with  $x^2$  and inversely with  $z$ . If  $y = 2$  when  $x = 2$  and  $z = 12$ , what is  $y$  when  $x = 1$  and  $z = 3$ .
19. Find the domain of the function  $f$ .  
$$f(x) = \frac{x + 3}{x - 5}$$
20. Let  $f(x) = 4x - 1$ .  
Find the point on the graph of the function  $f$  when the  $x$ -coordinate is 3.
21. Let  $f(x) = \sqrt[3]{x + 4}$  and  $g(x) = 2x + 3$ .  
Find  $(f \circ g)(x)$ .

22. Let  $f(x) = \frac{2}{x+6}$

Find  $f^{-1}$ , the inverse function of  $f$ .

23. Sketch the graph of  $y = x^2 + 4x - 5$   
Label the vertex.

24. Find the quotient when  
 $f(x) = 3x^3 - 4x^2 - 12x - 9$   
is divided by  $g(x) = x - 3$ .

25. Find the amount that results from investing \$5000 at 8% compounded continuously after a period of 10 years. Use the correct formula.

$$A = P \left( 1 + \frac{r}{n} \right)^{nt}$$

**OR**

$$A = Pe^{rt}$$

26. Solve for  $x$ .  
 $\log_3 x + \log_3 (x - 2) = 1$

27. Solve for  $x$ . Express your answer using the exact value, or a three decimal place approximation.

$$e^{2x} = 11$$

28. Solve the system of equations.

$$\begin{cases} 4x + 5y = 10 \\ 3x + 2y = 11 \end{cases}$$

29. Solve the system of equations.

$$\begin{cases} x + 2y - z = 1 \\ 2x + y + z = 2 \\ x + 3y + 2z = -3 \end{cases}$$

30. Maximize the function  $z = 3x + 2y$   
subject to the following constraints:

$$\begin{cases} x \geq 0 \\ y \geq 0 \\ y \leq 2 \\ x + y \leq 3 \end{cases}$$