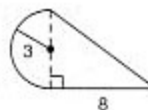
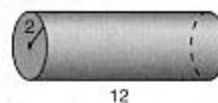


29. Find the area of this figure. Dimensions are in feet.



30. A right circular cylinder has a length of 12 centimeters and a radius of 2 centimeters, as shown. Find the surface area of the right circular cylinder.



LESSON 42 Solving Multivariable Equations

When we are asked to solve an equation in one unknown, such as

$$12 + 4x - 3 + 4 - 2x = 6x - 3 - 2 + 5x$$

we are asked to simplify both sides and to finally write the equation with x all by itself on one side and a number on the other side. When we do this, we say that we have **isolated x** on one side of the equation. When we have isolated x in this problem, we get

$$x = 2$$

If an equation contains more than one variable and we are asked to solve the equation for one of the variables, our task is the same as that described above. **We are asked to rearrange the equation so that the designated variable is the sole member of one side of the equation (either side).** In the following problems, however, the other side of the equation will contain variables as well as numbers.

example 42.1 Solve for y : $6y - x + z = 4$

solution We will begin the process of isolating y by eliminating $-x$ and z on the left-hand side of the equation.

$$\begin{array}{r} 6y - x + z = 4 \\ + x - z \quad + x - z \\ \hline 6y \qquad = 4 + x - z \end{array} \quad \begin{array}{l} \text{original equation} \\ \text{added } x - z \text{ to both sides} \end{array}$$

Now we complete the isolation of y by dividing every term by 6.

$$\begin{array}{r} \frac{6y}{6} = \frac{4}{6} + \frac{x}{6} - \frac{z}{6} \\ y = \frac{2}{3} + \frac{x}{6} - \frac{z}{6} \end{array} \quad \begin{array}{l} \text{divided both sides by 6} \\ \text{simplified} \end{array}$$

example 42.2 Solve for y : $4x - 2y + 2 = y - 4$

solution The first step is to eliminate the y term on one side or the other. We choose to eliminate the $-2y$ on the left-hand side of the equation, so we add $2y$ to both sides of the equation.

$$\begin{array}{r} 4x - 2y + 2 = y - 4 \\ + 2y \qquad + 2y \\ \hline 4x \qquad + 2 = 3y - 4 \end{array} \quad \begin{array}{l} \text{original equation} \\ \text{added } 2y \text{ to both sides} \end{array}$$

Now we have all the y 's on the right-hand side of the equation. To isolate y on the right-hand side of the equation, we must eliminate the -4 and the 3 that are on the right-hand side of the equation. To eliminate the -4 , we add 4 to both sides of the equation.

$$\begin{array}{r} 4x + 2 = 3y - 4 \\ \quad + 4 \quad \quad + 4 \\ \hline 4x + 6 = 3y \end{array} \quad \begin{array}{l} \text{equation} \\ \text{added 4 to both sides} \end{array}$$

Now we complete the isolation of y by dividing every term by 3 .

$$\begin{array}{r} \frac{4x}{3} + \frac{6}{3} = \frac{3y}{3} \\ \hline y = \frac{4}{3}x + 2 \end{array} \quad \begin{array}{l} \text{divided both sides by 3} \\ \text{simplified} \end{array}$$

example 42.3 Solve for p : $4p + 2a - 5 = 6a + p$

solution We begin by eliminating the p on the right-hand side of the equation.

$$\begin{array}{r} 4p + 2a - 5 = 6a + p \\ \quad - p \quad \quad \quad - p \\ \hline 3p + 2a - 5 = 6a \end{array} \quad \begin{array}{l} \text{original equation} \\ \text{added } -p \text{ to both sides} \end{array}$$

Now we eliminate the $2a$ and -5 on the left-hand side of the equation.

$$\begin{array}{r} 3p + 2a - 5 = 6a \\ \quad - 2a + 5 \quad -2a + 5 \\ \hline 3p = 4a + 5 \end{array} \quad \begin{array}{l} \text{equation} \\ \text{added } -2a + 5 \text{ to both sides} \end{array}$$

Now we complete the isolation of p by dividing every term by 3 .

$$\begin{array}{r} \frac{3p}{3} = \frac{4a}{3} + \frac{5}{3} \\ \hline p = \frac{4}{3}a + \frac{5}{3} \end{array} \quad \begin{array}{l} \text{divided both sides by 3} \\ \text{simplified} \end{array}$$

example 42.4 Solve for x : $5y + x - 2y - 4 + 3x = 0$

solution We will begin by adding like terms. Then we will eliminate the $3y$ and the -4 on the left-hand side of the equation by adding $-3y + 4$ to both sides of the equation.

$$\begin{array}{r} 3y + 4x - 4 = 0 \\ \quad -3y \quad \quad + 4 = -3y + 4 \\ \hline 4x = -3y + 4 \end{array} \quad \begin{array}{l} \text{added like terms} \\ \text{added } -3y + 4 \text{ to both sides} \end{array}$$

Now we complete the isolation of x by dividing every term by 4 .

$$\begin{array}{r} \frac{4x}{4} = \frac{-3y}{4} + \frac{4}{4} \\ \hline x = -\frac{3}{4}y + 1 \end{array} \quad \begin{array}{l} \text{divided both sides by 4} \\ \text{simplified} \end{array}$$

example 42.5 Solve for y : $4y + 6x - 4 = 2$

solution Since only one term contains a y , we begin by moving all other terms to the right-hand side of the equation.

$$\begin{array}{r} 4y + 6x - 4 = 2 \\ \quad - 6x + 4 = +4 - 6x \\ \hline 4y = 6 - 6x \end{array} \quad \begin{array}{l} \text{original equation} \\ \text{added } 4 - 6x \text{ to both sides} \end{array}$$

Now we complete the isolation of y by dividing every term by 4.

$$\frac{4y}{4} = \frac{6}{4} - \frac{6x}{4} \quad \text{divided both sides by 4}$$

$$y = \frac{3}{2} - \frac{3}{2}x \quad \text{simplified}$$

practice

- a. Solve for y : $8y - 13x - 8 = 4$
 b. Solve for p : $8p + 3w = w - 15 - 2p$

problem set
42

1. War Eagle spied a total of 1428 antelope and wildebeests grazing on the savannah. If the ratio of antelope to wildebeests was 9 to 5, how many antelope were there?
 2. If the sum of twice a number and -3 is multiplied by 4, the answer is 28. Find the number.
 3. Is the product of 30 positive numbers and 33 negative numbers a positive number or a negative number?
 4. Use four unit multipliers to convert 58 square centimeters to square feet.
 5. The area of a square is 25 cm^2 . Find the perimeter of the square.
 6. Write both an inequality and a negated inequality that describe this graph.



7. $5\frac{7}{10}$ of what number is $9\frac{1}{2}$?

8. If $h(x) = -2x^2 + 3$, find $h(3)$.

Solve:

9. $2\frac{1}{3}x + 5 = 19$

10. $0.4k + 0.4k - 0.02 = 4.02$

11. $3p - 2(p - 4) = 7p + 6$

12. $4(x - 2) - 4x = -(3x + 2)$

13. If $x - 6 = 3$, what is the value of $x + 2$?

Solve for y :

14. $3x + 2y = 5 - y$

15. $-2y + 6y - x - 4 = 0$

Factor the greatest common factor:

16. $4x^2m^5y - 2x^4m^3y^3$

17. $4m^2x^5 - 2m^2x^2 + 6m^5x^2$

Simplify (factor if necessary):

18. $\frac{3xy - 9x^2y^2}{3xy}$

19. $\frac{x^2ym + xym}{xym}$

Simplify. Write the answers with all exponents positive.

20. $\frac{x^5y^5mm^{-2}}{xx^3y^{-3}m^4}$

21. $\frac{x^2xyp^{-5}}{p^{-3}p^{-4}y^{-4}}$

22. Expand by using the distributive property. Write the answer with all exponents positive.

$$x^2z^{-2} \left(\frac{x^4z^{-4}}{x} - \frac{3z^2}{x^2} \right)$$

23. Simplify by adding like terms: $5yx^0p^2 - p^2y^2y^{-1}x + 2p^2p^0yx - 3p^2y^2y^{-1}x$

24. Simplify by adding like terms. Write the answer with all variables in the denominator.

$$\frac{3x^{-2}x^3y}{y^{-4}} - 2xy^5$$

171

43.A least common multiple

Evaluate:

25. $x(x^0 - y) + |xy|$ if $x = -2$ and $y = 5$
(25)

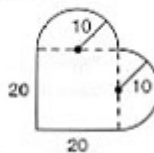
26. $k^3 - (k - c)$ if $k = -2$ and $c + 2 = 6$
(26)

Simplify:

27. $\frac{1}{-3^{-2}} - \sqrt[3]{8}$
(27)

28. $\frac{-3^2 - (-3)^3 - 3}{-3(-3)(+3)}$
(28)

29. Find the perimeter of this figure. Corners that look square are square. Dimensions are in meters.
(29)



30. A right circular cylinder has a radius of 10 inches and a height of 20 inches, as shown. Find the volume of the right circular cylinder.
(30)

