

$$5. \quad 3x + y = 4$$

$$y = -3x + 4$$

$$6. \quad 2x + 3y = 2$$

$$3y = -2x + 2$$

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

$$7. \quad x^2 + 3y = 4$$

$$3y = 4 - x^2$$

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

$$8. \quad x^2 + y - 4 = 0$$

$$y = -x^2 + 4$$

$$9. \quad 2\sqrt{x} - 3y = 15$$

$$-3y = -2\sqrt{x} + 15$$

$$y = \frac{2}{3}\sqrt{x} - 5$$

$$10. \quad 6|x| - 5y + 10 = 0$$

$$-5y = -6|x| - 10$$

$$y = \frac{6}{5}|x| + 2$$

11. *Verbal Model:*

Rate person 1

 +

Rate person 2

 =

Rate together

Labels: Your time = 4 hours
 Friend's time = 6 hours
 Time together = x hours

Equation:
$$\frac{1}{4} + \frac{1}{6} = \frac{1}{x}$$

$$12x\left(\frac{1}{4} + \frac{1}{6}\right) = \left(\frac{1}{x}\right)12x$$

$$3x + 2x = 12$$

$$5x = 12$$

$$x = \frac{12}{5} \text{ hours}$$

12. *Verbal Model:*

Total time

 =

Time 1

 +

Time 2

$$\text{Rate} = \frac{\text{Distance}}{\text{Time}}$$

Labels: Time 1 = $\frac{90}{54}$

Time 2 = $\frac{90}{42}$

Equation: Rate = $\frac{180}{\frac{90}{54} + \frac{90}{42}}$

Rate = 47.25 mph

SECTION 5.2 Simplifying Radical Expressions

1. Graph $x - y = -3$ with a dotted line since the inequality is $>$. Test one point in each half-plane formed by the line. Shade the half-plane that satisfies the inequality.

2. $3x + 4y \leq 4$ and $3x + 4y < 4$

The first inequality includes the points on the line $3x + 4y = 4$ and the second does not.

3. $-x^3 + 3x^2 - x + 3 = -x^2(x - 3) - 1(x - 3)$

$$= (x - 3)(-x^2 - 1)$$

$$= -(x - 3)(x^2 + 1)$$

4. $4t^2 - 169 = (2t - 13)(2t + 13)$

5. $x^2 - 3x + 2 = (x - 2)(x - 1)$

6. $2x^2 + 5x - 7 = (2x + 7)(x - 1)$

7. $11x^2 + 6x - 5 = (11x - 5)(x + 1)$

8. $4x^2 - 28x + 49 = (2x - 7)(2x - 7)$

$$= (2x - 7)^2$$

9. Verbal Model: $\boxed{\text{Adult tickets}} + \boxed{\text{Student tickets}} = 1200$

$$\boxed{\text{Price adult tickets}} \cdot \boxed{\text{Adult tickets}} + \boxed{\text{Price student tickets}} \cdot \boxed{\text{Student tickets}} = 21,120$$

Labels: Adult tickets = x
Student tickets = y

System: $x + y = 1200$
 $20x + 12.50y = 21,120$

Solve by substitution:

$$y = 1200 - x$$

$$20x + 12.50(1200 - x) = 21,120$$

$$20x + 15,000 - 12.50x = 21,120$$

$$7.5x = 6120$$

$$x = 816 \text{ adults}$$

$$y = 1200 - 816 = 384 \text{ students}$$

10. Verbal Model: $\frac{\boxed{\text{Number defective units 1}}}{\boxed{\text{Total number units 1}}} = \frac{\boxed{\text{Number defective units 2}}}{\boxed{\text{Total number units 2}}}$

Labels: Number defective units (2) = x

Equation: $\frac{2}{75} = \frac{x}{10,000}$

$$x = \frac{2(10,000)}{75}$$

$$x \approx 267 \text{ units}$$

SECTION 5.3 Multiplying and Dividing Radical Expressions

1. $x^2 + bx + c = (x + m)(x + n)$

$$mn = c$$

2. $x^2 + bx + c = (x + m)(x + n)$

If $c > 0$, the signs of m and n must be the same.

3. If $c < 0$, the signs of m and n must be different.

4. If m and n have like signs, then $m + n = b$.

5. $(-1, -2), (3, 6)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - (-2)}{3 - (-1)} = \frac{6 + 2}{3 + 1} = \frac{8}{4} = 2$$

$$y - y_1 = m(x - x_1)$$

$$y - 6 = 2(x - 3)$$

$$y - 6 = 2x - 6$$

$$y = 2x$$

$$0 = 2x - y$$

6. $(1, 5), (6, 0)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 5}{6 - 1} = \frac{-5}{5} = -1$$

$$y - y_1 = m(x - x_1)$$

$$y - 0 = -1(x - 6)$$

$$y = -x + 6$$

$$x + y - 6 = 0$$

7. $(6, 3), (10, 3)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 3}{10 - 6} = \frac{0}{4} = 0$$

$$y - y_1 = m(x - x_1)$$

$$y - 3 = 0(x - 10)$$

$$y - 3 = 0$$

9. $(\frac{4}{3}, 8), (5, 6)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - 8}{5 - \frac{4}{3}} = \frac{-2}{\frac{11}{3}} = -\frac{6}{11}$$

$$y - y_1 = m(x - x_1)$$

$$y - 6 = -\frac{6}{11}(x - 5)$$

$$11y - 66 = -6x + 30$$

$$0 = 6x + 11y - 96$$

8. $(4, -2), (4, 5)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - (-2)}{4 - 4} = \frac{7}{0} = \text{undefined}$$

$$x = 4$$

$$x - 4 = 0$$

10. $(7, 4), (10, 1)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 4}{10 - 7} = \frac{-3}{3} = -1$$

$$y - y_1 = m(x - x_1)$$

$$y - 1 = -1(x - 10)$$

$$y - 1 = -x + 10$$

$$x + y - 11 = 0$$

11. Verbal Model: $\boxed{\text{Distance}} = \boxed{\text{Rate}} \cdot \boxed{\text{Time}}$

$$\frac{\boxed{\text{Distance}}}{\boxed{\text{Rate}}} = \boxed{\text{Time}}$$

Labels: Time = t

Distance = 360

Rate = r

Equation: $\frac{360}{r} = t$

12. Verbal Model: $\boxed{\text{Perimeter}} = 2 \cdot \boxed{\text{Length}} + 2 \cdot \boxed{\text{Width}}$

Labels: Perimeter = P

Length = L

Width = $\frac{L}{3}$

Equation: $P = 2L + 2\left(\frac{L}{3}\right)$

$$P = \frac{8}{3}L$$

SECTION 5.4 Solving Radical Equations

1. $f(x) = \frac{4}{(x+2)(x-3)}$

The function is undefined when the denominator is zero.
Set the denominator equal to zero and solve for x .

$$(x+2)(x-3) = 0$$

$$x+2 = 0 \quad x-3 = 0$$

$$x = -2 \quad x = 3$$

The domain is all real numbers x such that $x \neq -2$ and $x \neq 3$.

2. $\frac{2x^2 + 5x - 3}{x^2 - 9} = \frac{2x - 1}{x - 3}, \quad x \neq -3$

$$\frac{2(-3)^2 + 5(-3) - 3}{(-3)^2 - 9} = \frac{2(-3) - 1}{-3 - 3}$$

$$\frac{18 - 15 - 3}{9 - 9} = \frac{-7}{-6}$$

$$\frac{0}{0} = \frac{7}{6}$$

Undefined

3. $(-3x^2y^3)^2 \cdot (4xy^2) = 9x^4y^6 \cdot 4xy^2 = 36x^5y^8$

5. $\frac{64r^2s^4}{16rs^2} = 4r^{2-1}s^{4-2} = 4rs^2$

7. $\frac{x+13}{x^3(3-x)} \cdot \frac{x(x-3)}{5} = \frac{x+13}{x^3(3-x)} \cdot \frac{-x(3-x)}{5}$
 $= \frac{-(x+13)}{5x^2}$

9. $\frac{2x}{x-5} - \frac{5}{5-x} = \frac{2x}{x-5} + \frac{5}{x-5} = \frac{2x+5}{x-5}$

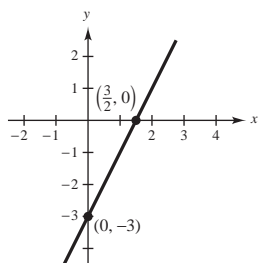
4. $(x^2 - 3xy)^0 = 1$

6. $\left(\frac{3x}{4y^3}\right)^2 = \left(\frac{3x}{4y^3}\right)\left(\frac{3x}{4y^3}\right) = \frac{9x^2}{16y^6}$

8. $\frac{x+2}{5x+15} \cdot \frac{x-2}{5(x-3)} = \frac{(x+2)(x-2)}{5(x+3)5(x-3)}$
 $= \frac{x^2-4}{25(x^2-9)}$

10. $\frac{3}{x-1} - 5 = \frac{3}{x-1} - 5\left(\frac{x-1}{x-1}\right)$
 $= \frac{3}{x-1} - \frac{5(x-1)}{x-1}$
 $= \frac{3-5x+5}{x-1}$
 $= \frac{8-5x}{x-1}$
 $= -\frac{5x-8}{x-1}$

11. $y = 2x - 3$



y-intercept:

$y = 2(0) - 3$

$y = -3$

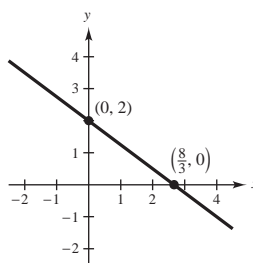
x-intercept:

$0 = 2x - 3$

$3 = 2x$

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

12. $y = -\frac{3}{4}x + 2$



y-intercept:

$y = -\frac{3}{4}(0) + 2 = 2$

x-intercept:

$0 = -\frac{3}{4}x + 2$

$\frac{3}{4}x = 2$

$x = 2 \cdot \frac{4}{3}$

$x = \frac{8}{3}$

SECTION 5.5 Complex Numbers

1. $\frac{3t}{5} \cdot \frac{8t^2}{15} = \frac{(3t)(8t^2)}{(5)(15)} = \frac{24t^3}{75}$

Multiply numerators. Multiply denominators.

2. $\frac{3t}{5} \div \frac{8t^2}{15} = \frac{3t}{5} \cdot \frac{15}{8t^2} = \frac{(3t)(15)}{(5)(8t^2)} = \frac{9}{8t}$

Multiply by the reciprocal of the divisor.

3. $\frac{3t}{5} + \frac{8t^2}{15} = \frac{9t}{15} + \frac{8t^2}{15} = \frac{9t + 8t^2}{15}$

Change each fraction into an equivalent fraction with the lowest common denominator as the denominator. Add the numerators and put over the lowest common denominator.

4. $\frac{t-5}{5-t} = \frac{t-5}{-1(t-5)} = -1$

$$\begin{aligned}
 5. \quad \frac{x^2}{2x+3} \div \frac{5x}{2x+3} &= \frac{x^2}{2x+3} \cdot \frac{2x+3}{5x} \\
 &= \frac{x^2(2x+3)}{(2x+3)5x} \\
 &= \frac{x}{5}
 \end{aligned}$$

$$\begin{aligned}
 6. \quad \frac{x-y}{5x} \div \frac{x^2-y^2}{x^2} &= \frac{x-y}{5x} \cdot \frac{x^2}{(x-y)(x+y)} \\
 &= \frac{(x-y)x^2}{5x(x-y)(x+y)} \\
 &= \frac{x}{5(x+y)}
 \end{aligned}$$

$$7. \quad \frac{\frac{9}{x}}{\left(\frac{6}{x}+2\right)} \cdot \frac{x}{x} = \frac{9}{6+2x}$$

$$8. \quad \frac{\left(1+\frac{2}{x}\right)}{\left(x-\frac{4}{x}\right)} \cdot \frac{x}{x} = \frac{x+2}{x^2-4} = \frac{x+2}{(x-2)(x+2)} = \frac{1}{x-2}$$

$$\begin{aligned}
 9. \quad \frac{\frac{4}{x^2-9} + \frac{2}{x-2}}{\frac{1}{x+3} + \frac{1}{x-3}} \cdot \frac{(x-3)(x+3)(x-2)}{(x-3)(x+3)(x-2)} &= \frac{4(x-2) + 2(x^2-9)}{(x-3)(x-2) + (x+3)(x-2)} \\
 &= \frac{4x-8+2x^2-18}{x^2-5x+6+x^2+x-6} \\
 &= \frac{2x^2+4x-26}{2x^2-4x} \\
 &= \frac{2(x^2+2x-13)}{2x(x-2)} \\
 &= \frac{x^2+2x-13}{x(x-2)}
 \end{aligned}$$

$$\begin{aligned}
 10. \quad \frac{\left(\frac{1}{x+1} + \frac{1}{2}\right)}{\left(\frac{3}{2x^2+4x+2}\right)} &= \frac{\left(\frac{1}{x+1} + \frac{1}{2}\right)}{\left(\frac{3}{2(x^2+2x+1)}\right)} \cdot \frac{2(x+1)^2}{2(x+1)^2} \\
 &= \frac{2(x+1) + (x+1)^2}{3} \\
 &= \frac{2x+2+x^2+2x+1}{3} \\
 &= \frac{x^2+4x+3}{3} \\
 &= \frac{(x+1)(x+3)}{3}
 \end{aligned}$$

$$11. \quad \frac{\frac{4x}{3} - \frac{x}{2}}{3} \cdot \frac{6}{6} = \frac{8x-3x}{18} = \frac{5x}{18}$$

$$\text{1st number: } \frac{x}{2} + \frac{5x}{18} = \frac{9x}{18} + \frac{5x}{18} = \frac{14x}{18} = \frac{7x}{9}$$

$$\text{2nd number: } \frac{14x}{18} + \frac{5x}{18} = \frac{19x}{18}$$

$$12. \quad \frac{1}{\left(\frac{1}{c_1} + \frac{1}{c_2}\right)} = \frac{1}{\frac{1}{c_1} + \frac{1}{c_2}} \cdot \frac{c_1c_2}{c_1c_2} = \frac{c_1c_2}{c_2+c_1}$$