1. State the domain of each equation and solve the equation:

   a. \( \frac{20x - 3}{20} + \frac{2x}{x} = \frac{5}{4x} \)
      \[ \text{L.C.D.} = 20x \]
      
      \[-3x + 40 = 25 \]
      
      \[-3x = -15 \]
      
      \[ x = 5 \]
      
      \[ \{ 5 \} \]

   b. \( \frac{1}{x - 3} + \frac{1}{x + 3} = \frac{6}{x^2 - 9} \)
      \[ \text{L.C.D.} = (x + 3)(x - 3) \]
      
      \[ \frac{(x + 3)(x - 3)}{x - 3} + \frac{(x + 3)(x - 3)}{x + 3} = \frac{6(x + 3)(x - 3)}{(x + 3)(x - 3)} \]
      
      \[ x + 3 + x - 3 = 6 \]
      
      \[ 2x = 6 \]
      
      \[ x = 3 \]
      
      No Solution

   c. \( \frac{4}{x^2 + x - 6} - \frac{1}{x^2 - 4} = \frac{2}{x^2 + 5x + 6} \)
      \[ \frac{4(x + 3)(x - 2)}{(x + 3)(x - 2)(x + x^2 + 5x + 6)} - \frac{1}{(x + 3)(x - 2)} = \frac{2}{(x + 3)(x + 2)(x + 2)} \]
      
      \[ \frac{4(x + 3)(x - 2) - 1(x + 3)}{(x + 3)(x - 2)(x + 3)(x + 2)} = \frac{2}{(x + 3)(x + 2)(x + 2)} \]
      
      \[ 4x + 8 - x - 3 = 2x - 2 \]
      
      \[ 3x + 5 = 2x - 4 \]
      
      \[ x = -9 \]
      
      \[ \{ -9 \} \]

2. State the horizontal and vertical asymptotes. Graph the function:

   a. \( f(x) = \frac{2}{x + 3} \)

   Vertical Asymptote: \( x + 3 = 0 \) \( x = -3 \)

   Horizontal Asymptote: \( y = 0 \)

   As \( x \) values get large in the positive direction, the graph approaches \( y = 0 \)

   As \( x \) values get very small in the negative direction, the graph approaches \( y = 0 \)
3. Solve for the indicated variable:
   a. \( \frac{PV}{T} = \frac{pv}{t} \) for \( T \)  
      \[ \text{LCD: } \frac{Tt}{T} \]
      \[ PVt = pvt \]
      \[ T = \frac{PVt}{pv} \]
   b. \( y = \frac{x+z}{a-x} \) for \( x \)
      \[ \text{LCD: } a-x \]
      \[ y(a-x) = x+z \]
      \[ ya - yx = x + z \]
      \[ ya - z = x + yx \]
      \[ x(1+y) = ya - z \]
      \[ x = \frac{ya - z}{1+y} \]

4. At a winery in Napa Valley, California, one pipe can fill a tank with wine in 3 hours and another pipe can empty the tank in 5 hours. If the valves to both pipes are open, how long will it take to fill the empty tank?

   \[ 15x + \frac{15}{13} - 5 = \frac{1}{x} \]
   \[ 5x - 3x = 15 \]
   \[ 2x = 15 \]
   \[ x = 7.5 \]
   \[ 7 \frac{1}{2} \text{ hours} \]

5. Linda and John Franco own a house cleaning service. When Linda cleans Damon's house by herself, it takes 7 hours. When Linda and John work together, they can clean the house in 4 hours. How long will it take John to clean the house by himself?

   \[ \frac{28x}{7} + 2x = \frac{1}{4} \]
   \[ 4x + 78 = 7x \]
   \[ 78 = 3x \]
   \[ x = \frac{28}{3} \approx 9.3 \]
   \[ \text{It takes John 9.3 hrs} \]

6. Dave and Sandy are frequent flyers with American Airlines. They often fly from Philadelphia to Chicago, a distance of 780 miles. On one particular trip they fly into the wind and the flight takes 2 hours. The return trip, with the wind behind them only takes 1 \( \frac{1}{2} \) hours. Find the speed of the wind and find the speed of the plane in still air.

   Let \( x = \) speed of plane  
   \( y = \) windspeed
   \[ \begin{align*}
   x+y &= 780 \\
   x-y &= 2 \\
   ax - by &= 2340 \\
   bx + by &= 3120 \\
   bx + by &= 3120 \\
   ax - by &= 2340 \\
   15x + 15y &= 780 \\
   15x &= 5460 \\
   x &= 455 \\
   x &= 455 \\
   9x - 2y &= 780 \\
   9x - 2y &= 780 \\
   -2y &= -130 \\
   y &= 65
   \end{align*} \]