1. Solve the following:  
\[
\begin{align*}
2y + 1 &= x, \\
\sqrt{x} + y &= 5
\end{align*}
\]

2. Solve the following:  
\[
\begin{align*}
a) \quad \frac{1}{x^2 - x} - \frac{1}{x - 1} &= 0 \\
b) \quad x - \sqrt{3x - 5} &= 3 \\
c) \quad 2x^3 + 5x^2 + x - 2 &= 0 \\
d) \quad \frac{2}{x^2 - 9} = \frac{x^2 - 16}{72}
\end{align*}
\]

3. Mr. B. has $20,000 to invest. He invests part at 6%, the rest at 7%, and he earns $1,280 interest. How much did he invest at each rate?  

4. The Lakers scored a total of 80 points in a basketball game against the Bulls. The Lakers made a total of 37 two-points and three-points baskets. How many three-points shots did the Lakers make? How many two-points shots did the Lakers make?  

5. The length of a rectangle is 7 metres less than twice the width. Find the dimensions if the area is 60 square metres.
SOLUTION

1.  \[ y^2 - 2y + 1 = \sqrt{x + y} \]
   \[ y = 5 - \sqrt{x} \rightarrow (5 - \sqrt{x})^2 - 2(5 - \sqrt{x}) + 1 = x \]

   25 - 2 \cdot 5 \sqrt{x} + x - 10 + 2 \sqrt{x} + 1 = x \rightarrow 25 - 10 \sqrt{x} + 2 \sqrt{x} - 10 + 1 = 0

   16 = 8 \sqrt{x} \rightarrow 2 = \sqrt{x} \rightarrow x = 4 \Rightarrow y = 5 - \sqrt{x} = 5 - 2 = 3 \text{ Solution: } x = 4, y = 3

2. Solve the following:
   a) \[ \frac{1}{x^2 - x} - \frac{1}{x - 1} = 0 \]
      \[ \frac{1}{x(x - 1)} - \frac{x}{x(x - 1)} = 0 \rightarrow 1 - x = 0 \Rightarrow x = 1 \]

      But \ x = 1 \text{ is not a solution. Denominator cancels } \frac{1}{0} - \frac{1}{-1} = 0

      So, it doesn't have any solution

   b) \[ x - \sqrt{3x - 5} = 3 \rightarrow x - 3 = \sqrt{3x - 5} \rightarrow (x - 3)^2 = (\sqrt{3x - 5})^2 \]
      \[ x^2 - 6x + 9 = 3x - 5 \Rightarrow x^2 - 9x + 14 = 0 \rightarrow x = \frac{9 \pm \sqrt{81 - 56}}{2} = \frac{7}{2} \]

      Checking:
      \[ \frac{7 - \sqrt{21 - 5}}{3} \rightarrow 7 - 4 = 3 \text{ YES} \]
      \[ \frac{2 - \sqrt{6 - 5}}{3} \rightarrow 2 - 2 \neq 3 \text{ NO} \]

      Solution \ x = 7

   c) \[ 2x^3 + 5x^2 + x - 2 = 0 \text{ Factors(2) = 1, -1, 2, -2} \]
      \[ P(1) = 2 + 5x^2 + 1 - 2 
eq 0 \text{ P(1) = -2 + 5x^2 - 1 - 2 = 0} \]

      Ruffini
      \[
      \begin{array}{c|cccc}
        & 2 & +5 & +1 & -2 \\
        \hline
        -1 & -2 & -3 & +2 \\
        & 2 & +3 & -2 & 0
      \end{array}
      \]

      \[ x = \frac{-3 \pm \sqrt{9 + 16}}{4} = \frac{1}{2} \]

      \[ 2x^2 + 3x - 2 = 0 \rightarrow 2(x + 1)(x + 2) \left( x - \frac{1}{2} \right) = 0 \Rightarrow \text{ Solution }:
      \begin{align*}
        x_1 &= -1 \\
        x_2 &= -2 \\
        x_3 &= \frac{1}{2}
      \end{align*} \]

   d) \[ \frac{2}{x^2 - 9} = \frac{x^2 - 16}{72} \rightarrow 144 = (x^2 - 16)(x^2 - 9) \rightarrow 144 = x^4 - 16x^2 - 9x^2 + 144 \]

      \[ x^4 - 25x^2 = 0 \Rightarrow x^2(x^2 - 25) = 0 \Rightarrow \begin{cases} x^2 = 0 \rightarrow x = 0 \\ x^2 - 25 = 0 \rightarrow x = \pm 5 \end{cases} \]
3. Mr. B. has $20,000 to invest. He invests part at 6%, the rest at 7%, and he earns $1,280 interest. How much did he invest at each rate?

Investment at 6% - \( x \)

\[ x + y = 20000 \]

Investment at 7% - \( y \)

\[ \frac{6}{100}x + \frac{7}{100}y = 1280 \]

\[ x + y = 20000 \]

\[ 0.06x + 0.07y = 1280 \]

\[ \begin{cases} x + y = 20000 \\ 0.06x + 0.07y = 1280 \end{cases} \]

\[ \Rightarrow y = 20000 - x \Rightarrow 0.06x + 0.07(20000 - x) = 1280 \]

\[ 0.06x + 1400 - 0.07x = 1280 \Rightarrow -0.01x = -120 \Rightarrow x = 12000 \]

He invested $12000 at 6% and $8000 at 7%.

4. The Lakers scored a total of 80 points in a basketball game against the Bulls. The Lakers made a total of 37 two-points and three-points baskets. How many three-points shots did the Lakers make? How many two-points shots did the Lakers make?

Two-points shots - \( x \)

\[ x + y = 37 \]

Three-points shots - \( y \)

\[ 2x + 3y = 80 \]

\[ \begin{cases} x + y = 37 \\ 2x + 3y = 80 \end{cases} \]

\[ \Rightarrow y = 6 \Rightarrow x = 37 - 6 = 31 \]

Answer: They made 6 three-points shots and 31 two-points shots.

5. The length of a rectangle is 7 metres less than twice the width. Find the dimensions if the area is 60 square metres.

Width \( x \)  Length \( y \)

\[ y = 2x - 7 \]

\[ x \cdot y = 60 \]

\[ \Rightarrow x \cdot (2x - 7) = 60 \Rightarrow 2x^2 - 7x - 60 = 0 \Rightarrow x = \frac{7 \pm \sqrt{49 + 480}}{4} = \frac{15}{2} \]

So \( x = \frac{15}{2} \Rightarrow y = 2 \cdot \frac{15}{2} - 7 = 8 \)

Answer: length 8 metres and width 7.5 metres.