1. Solve by factoring.

   (a) $3x^2 - x - 2 = 0$
       Solution: $(3x + 2)(x - 1)$, $x = \{1, -\frac{2}{3}\}$

   (b) $3x^2 + 7x + 4 = 0$
       Solution: $(x + 1)(3x + 4)$, $x = \{-1, -\frac{4}{3}\}$

   (c) $x^2 - 3x - 18 = 0$
       Solution: $(x - 6)(x + 3)$, $x = \{-3, 6\}$

   (d) $2x^2 - 15x + 7 = 0$
       Solution: $(x - 7)(2x - 1)$, $x = \{\frac{1}{2}, 7\}$

   (e) $6x^2 - 5x + 1 = 0$
       Solution: $(2x - 1)(3x - 1)$, $x = \{\frac{1}{2}, \frac{1}{3}\}$

   (f) $16x^2 - 9 = 0$
       Solution: $(4x - 3)(4x + 3)$, $x = \{\frac{3}{4}, -\frac{3}{4}\}$

   (g) $4x^2 + 15x - 4 = 0$
       Solution: $(4x - 1)(x + 4)$, $x = \{\frac{1}{4}, -4\}$

   (h) $x^2 - 4x - 21 = 0$
       Solution: $(x - 7)(x + 3)$, $x = \{-3, 7\}$

2. Solve the following rational expressions.

   (a) $\dfrac{x - 4}{2} = 0$
       Solution: $x = 4$

   (b) $\dfrac{x + 6}{4} = 1$
       Solution: $x = -2$

   (c) $\dfrac{x + 4}{2} + \dfrac{x - 1}{2} = \dfrac{x + 4}{2x}$
       Solution: $x = \{-2, 1\}$

   (d) $\dfrac{x - 3}{10} = \dfrac{4}{x}$
       Solution: $x = \{-5, 8\}$

   (e) $\dfrac{3x^2 + 8x + 25}{7} = 4$
       Solution: $x = \{-3, \frac{1}{3}\}$

3. Solve using key number method.

   (a) $\dfrac{(x + 2)(x - 2)}{x(x + 1)(x - 1)} \leq 0$
       Solution: $(-\infty, -2] \cup (-1, 0) \cup (1, 2]$

(b) $\dfrac{(x+3)(x-1)}{(x+1)(x-3)} > 0$

Solution: $(-\infty, -3) \cup (-1, 1) \cup (3, \infty)$

(c) $\dfrac{-x^2 - 5x + 2}{x+3} + (2x-1) < 0$

Solution: $(-\infty, 3) \cup (-1, 1)$

4. Simplify.

(a) $\left(\dfrac{x^4 y^2}{x^{-3} y}\right)^{-1}$

     Solution: $\dfrac{1}{x^7 y}$

(b) $\dfrac{(x^3 y)^2}{x^5}$

     Solution: xy^2

(c) $\left(\left(x^{1/2} y\right)^{1/2}\right)^{-1} \cdot xy$

     Solution: $x^{\frac{3}{4}} y^{\frac{1}{2}}$

(d) $81^{1/4} \cdot 8^{2/3}$

     Solution: 12

(e) $\left(27^{-1}\right)^{1/3} \cdot 4^{1/2}$

     Solution: $2/3$

(f) $125^{2/3} \cdot 8^{-2/3}$

     Solution: $25/4$

5. Rationalize the denominator and simplify.

(a) $\dfrac{x-2}{x - \sqrt{2}}$

     Solution: $\dfrac{(x-2)(x+\sqrt{2})}{x^2 - 2}$

(b) $\dfrac{x}{1 - \sqrt{3}}$

     Solution: $-\dfrac{x(1+\sqrt{3})}{2}$

(c) $\dfrac{\sqrt{3}}{\sqrt{5}}$

     Solution: $\dfrac{\sqrt{15}}{5}$

(d) $\dfrac{7}{\sqrt{7}}$

     Solution: $\sqrt{7}$

(e) $\dfrac{1}{\sqrt[4]{a}}$

Solution: $\dfrac{a^{\frac{3}{4}}}{a}$

(f) $\dfrac{1}{\sqrt[5]{23^2}}$

Solution: $\dfrac{\sqrt[5]{23^3}}{23}$

(g) $\dfrac{4}{\sqrt{x+4}-4}$

Solution: $\dfrac{4\sqrt{x+4}+16}{x-12}$

(h) $\dfrac{x^2-3}{x+\sqrt{3}}$

Solution: $x-\sqrt{3}$