9.4 – 9.5 Factoring Quadratic Equations
Study Guide Questions

9.4: Factor Using the GCF –

You should be able to:

1. Identify the GCF of a quadratic expression and factor using this method.

   Ex: \(2x^2 - 4x\) becomes \(2(x - 2)\) when factored. The circled portion would be your answer.

   Factor using the GCF:
   
   Ex: \(-4y + 16y^2\)  
   Ex: \(3xy + 8xy^2\)

   \(-4y(1 - 4y)\)  
   \(xy(3 + 8y)\)

2. Solve a quadratic equation in factored form.

   Ex: \((3x - 1)(x + 2) = 0\), since you are multiplying two quantities and the answer is 0, then one of the two quantities being multiplied must be equal to zero. This means either \(3x - 1 = 0\) or \(x + 2 = 0\)

   If: \(3x - 1 = 0\) you would:
   
   First add 1 to both sides
   
   \(\frac{3x}{3} = \frac{1}{3}\)
   
   Then divide by three so:
   
   \(x = \frac{1}{3}\)

   Solve:

   Ex: \(x(2x - 5) = 0\)  
   Ex: \((3x - 7)(4x - 1) = 0\)

   \(x = 0\) or \(x = \frac{5}{2}\)  
   \(x = 0, x = \frac{7}{3}\) or \(x = \frac{1}{4}\)

3. Solve a quadratic equation by factoring using the GCF first!

   Ex: \(7x^2 + 21x = 0\)
   
   \(7x(x + 3) = 0\) Factor using GCF of 7x
   
   So either \(7x = 0\) or \(x + 3 = 0\)
   
   \(x = 0\) or \(x = -3\)
Solve:

Ex: \(8x^2 - 16x = 0\)
\[8x(x - 2) = 0\]
\[8x = 0 \text{ or } x - 2 = 0\]
\[x = 0 \text{ or } x = 2\]

Ex: \(2x^2 = -7x\)
\[2x^2 + 7x = 0\]
\[x(2x + 7) = 0\]
\[x = 0 \text{ or } x = \frac{-7}{2}\]

4. Use the vertical motion model to solve problems involving a problem’s height and time. (\(h = -16t^2 + vt + s\))

Ex: An object is launched from the ground with an initial vertical velocity of 32 feet per second. How long before the object reaches the ground?

\[
\begin{align*}
    h &= -16t^2 + vt + s \quad \text{Set up equation.} \\
    h &= -16t^2 + 32t \
    0 &= -16t^2 + 32t \quad \text{Substitute. (Initial height (s) is zero, and initial velocity (v) is 32 feet per second.)} \\
    0 &= -16t(t - 2) \quad \text{Replace } h \text{ with 0 since that will be the object’s height when it reaches the ground.} \\
    t &= 0 \quad \text{or} \quad t = 2 \quad \text{Factor using the GCF.} \\
\end{align*}
\]

\[t = 2\]

9.5: Factor Quadratics in the Form \(x^2 + bx + c\):

You should be able to:

1. Factor trinomials in the form \(x^2 + bx + c\) by factoring into two binomials in the form:
   \[(x + p)(x + q)\]
   *To find \(p\) and \(q\) you find the factors of \(c\) that add up to \(b\).

Ex: \(x^2 - 7x + 12\) becomes \([x - 3](x - 4)\) when factored because \(-4\) and \(-3\) first multiply to get +12, but also add up to \(-7\).

Factor:

Ex. \(x^2 - 2x - 24\)
\[(x - 6)(x + 4)\]

Ex: \(-x^2 - 9x - 18\)
\[-1(x + 6)(x + 3)\]

Ex: \(3x^2 + 9x + 6\)
\[3(x + 2)(x + 1)\]
2. Solve quadratic equations by factoring first.

**Ex:** \( x^2 - 7x + 12 = 0 \)  
Factor first  
\((x - 3)(x - 4) = 0\)  
Solve  
\[ x = 3 \text{ or } x = 4 \]

**Ex:** \( x^2 - 17x + 60 = 0 \)  
\((x - 5)(x - 12) = 0\)  
\[ x = 5 \text{ or } x = 12 \]

**Ex:** \( x^2 + 8x = -12 \)  
\( x^2 + 8x + 12 = 10 \)  
\((x + 6)(x + 2) = 0\)  
\[ x = -6 \text{ or } x = -2 \]

3. Use the vertical motion model to solve problems involving a problem’s height and time. \( h = -16t^2 + vt + s \)

**Ex:** An object is launched from a height of 48 feet with an initial vertical velocity of 32 feet per second. How long before the object reaches the ground?

\[
\begin{align*}
h &= -16t^2 + vt + s \\
h &= -16t^2 + 32t + 48 \\
0 &= -16t^2 + 32t + 48 \\
0 &= -16(t^2 - 2t - 3) \\
0 &= -16(t - 3)(t + 1) \\
t &= 3 \text{ or } t = -1 \\
\underline{t = 3 \text{ sec}} 
\end{align*}
\]
Set up equation.  
Substitute. (Initial height is 48 feet, and initial velocity is 32 feet per second.)  
Replace \( h \) with 0 since that will be the object’s height when it reaches the ground.  
Factor out GCF so coefficient of \( t^2 \) is 1.  
Factor.  
Solve.  
Choose the answer that makes sense.

4. Find the missing dimension of a rectangle given the area by factoring.

**Ex:**  
Area: 100 square inches  
\[
A = bh \\
100 = x(x - 15) \\
100 = x^2 - 15x \\
0 = x^2 - 15x - 100 \\
0 = (x - 20)(x + 5) \\
x = 5
\]