KEY CONCEPTS

- Factoring a polynomial is the opposite of expanding a polynomial.
- The greatest common factor (GCF) is the greatest number and/or variable that is a factor of each term in a polynomial expression.
- To factor a polynomial expression using the method of common factoring, remove the GCF as the first factor, and then divide each term by the GCF to obtain the second factor.

  $8x^2y^3 - 12x^4y = 4x^2y(2y^2 - 3x^2)$
- To factor a polynomial expression using the method of factoring by grouping, factor groups of two terms with a common factor to produce a binomial common factor.

  $$\begin{aligned} bx + 3x + by + 3y &= (bx + 3x) + (by + 3y) \\ &= x(b + 3) + y(b + 3) \\ &= (b + 3)(x + y) \end{aligned}$$

- Quadratic polynomial expressions of the form $ax^2 + bx + c$ can sometimes be factored by applying the method of decomposition. To find the terms to use when decomposing the linear term of an expression of the form $ax^2 + bx + c$, look for the pair of integers whose sum is b and whose product is ac. When $a = 1$, the middle steps of the method of decomposition can be omitted.

  For $6x^2 - 5x + 1$, $a = 6$, $b = -5$, and $c = 1$. Two integers whose product is 6 and whose sum is -5 are -2 and -3.

  $$\begin{aligned} 6x^2 - 5x + 1 &= 6x^2 - 2x - 3x + 1 \\ &= (6x^2 - 2x) + (-3x + 1) \\ &= 2x(3x - 1) - 1(3x - 1) \\ &= (3x - 1)(2x - 1) \end{aligned}$$

- When factoring a polynomial expression, there may be more than one type of factoring. If there is a greatest common factor for the terms in the polynomial expression, apply the method of common factoring, and then apply any other types of factoring as applicable to factor the polynomial expression completely.