

Instructions: Factor the greatest common factor from the following polynomial.

#1 $9y^2 - 15y^3 + 33y^4$

Instructions: Factor each of the following polynomials completely.

#2 $x^2 + 6x + 5$

#3 $x^2 - 2x - 15$

#4 $x^2 - 8x + 16$

#5 $4x^3 + 36x^2 + 80$

#6 $98 - 2x^2$

Instructions: Factor the following polynomial by grouping.

#7 $36xz + 9x - 8z - 2$

Instructions: Solve the following equations.

#8 $x^2 - 7x + 10 = 0$

#9 $12 - 4x = x^2$

#10 Solve the quadratic equation $x^2 + 6x - 3 = 0$ using the quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

SOLUTIONS

Instructions: Factor the greatest common factor from the following polynomial.

#1 $9y^2 - 15y^3 + 33y^4$ $3y^2$ is the largest number that will go into all three terms.
 $3y^2(3 - 5y + 11y^2)$

Instructions: Factor each of the following polynomials completely.

#2 $x^2 + 6x + 5$ $x^2 + 6x + 5 \leftarrow$ constant
 $(x + 1)(x + 5)$ \uparrow
 linear term

Since the constant is positive, both binomials take the sign of the linear term. In this case, both binomials will be sums. Note also that the products of the outer terms and the inner terms of the binomial factors combine to the linear term of the trinomial ($6x$).

#3 $x^2 - 2x - 15$ $x^2 - 2x - 15 \leftarrow$ constant
 $(x + 3)(x - 5)$ \uparrow
 linear term

Since the constant is negative, the binomials will have opposite signs. Note also that the products of the outer terms and the inner terms of the binomial factors combine to the linear term of the trinomial ($-2x$).

#4 $x^2 - 8x + 16$ $x^2 - 8x + 16 \leftarrow$ constant
 $(x - 4)(x - 4)$ \uparrow
 linear term
 $(x - 4)^2$

Since the constant is positive, the binomials take the sign of the linear term. In this case, both binomials are differences. Note also that the products of the outer terms and the inner terms of the binomial factors combine to the linear term of the trinomial ($-8x$).

Since the factors are identical, $(x-4)(x-4)$, they can be written as a quantity squared, $(x-4)^2$.

#5 $4x^3 + 36x^2 + 80$ $4x^2 + 36x + 80$
 $4(x^2 + 9x + 20)$ The terms of the polynomial share a common factor, 4. Factor the common factor first.
 $4(x + 4)(x + 5)$
 $x^2 + 9x + 20 \leftarrow$ constant
 \uparrow
 linear term

Since the constant is positive, the binomials take the sign of the linear term. In this case, both binomials are sums. Note also that the products of the outer terms and the inner terms of the binomial factors combine to the linear term of the trinomial ($9x$).

- #6 $98 - 2x^2$
 $2(49 - x^2)$
 $2(7 - x)(7 + x)$
- The terms of the binomial share a common factor, 2. Factor the common factor first.
- The binomial factor is a difference of two squares and will factor according to the rule: $a^2 - b^2 = (a + b)(a - b)$.

Instructions: Factor the following polynomial by grouping.

- #7 $36xz + 9x - 8z - 2$
 $(36xz + 9x) + (-8z - 2)$
 $9x(4z + 1) - 2(4z + 1)$
 $(9x - 2)(4z + 1)$
- This polynomial has four terms, so factor by grouping. First, rewrite the polynomial as the sum of two binomials. Second, factor out the greatest common factor from each. The greatest common factor of the first binomial is $9x$, which yields $9x(4z + 1)$. The greatest common factor of the second binomial is 2, but factoring out a -2 will create the common binomial $(4z + 1)$. Finally, rewrite the expression as a product of two binomials.

Instructions: Solve the following equations.

- #8 $x^2 - 7x + 10 = 0$
 $(x - 2)(x - 5) = 0$
 $x - 2 = 0 \quad x - 5 = 0$
 $x = 2 \quad x = 5$
- Factor the polynomial.
- Set each factor equal to zero.
- Solve the two linear equations.
- #9 $12 - 4x = x^2$
 $x^2 + 4x - 12 = 0$
 $(x - 2)(x + 6) = 0$
 $x - 2 = 0 \quad x + 6 = 0$
 $x = 2 \quad x = -6$
- Transform the equation so that there is a polynomial equal to zero.
- Factor the polynomial.
- Set each factor equal to zero.
- Solve the two linear equations.

#10 Solve the quadratic equation $x^2 + 6x - 3 = 0$ using the quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Note that $a = 1$, $b = 6$, and $c = 3$.

$$x = \frac{-(6) \pm \sqrt{(6)^2 - 4(1)(-3)}}{2(1)}$$

Substitute these values into the quadratic formula.

$$x = \frac{-6 \pm \sqrt{36 + 4(1)(3)}}{2}$$

Note that the two negatives under the radical create a sum.

$$x = \frac{-6 \pm \sqrt{36 + 12}}{2}$$

The product of 4, 1, and 3 is 12.

$$x = \frac{-6 \pm \sqrt{48}}{2}$$

The radicand (number beneath the radical) is 48. Since 48 is divisible by a perfect square, it can be simplified. To simplify, factor the radicand to two factors including the largest perfect square that will go into it, in this case 16.

$$x = \frac{-6 \pm \sqrt{16 \cdot 3}}{2}$$

$$x = \frac{-6 \pm 4\sqrt{3}}{2}$$

The square root of 16 is 4, so rewrite the radical term as $4\sqrt{3}$.

$$x = \frac{2(-3 \pm 2\sqrt{3})}{2}$$

Factor the numerator if it has a common factor. Reduce the common factor with the denominator.

$$x = -3 \pm 2\sqrt{3}$$

These two solutions, $-3 + 2\sqrt{3}$ and $-3 - 2\sqrt{3}$, are irrational numbers and cannot be expressed exactly as a decimal. The numbers can, however, be approximated as decimals. $x \approx .464$ and $x \approx -6.464$.