

Section 7.4 Adding and Subtracting Polynomials

factored form A polynomial is in factored form when it is written as a product of factors

roots the solutions of an equation

repeated roots 2 or more roots of an equation that are the same number

Core Concepts

* Zero-Product Property *

Words If the product of two real numbers is 0, then at least one of the numbers is 0.

Algebra

If a and b are real numbers and $ab = 0$, then $a = 0$ or $b = 0$.

Extra Practice

In Exercises 1-6, solve the equation.

<p>1. $x(x + 5) = 0$</p> <p style="margin-left: 20px;"> \downarrow \downarrow $x = 0$ $x + 5 = 0$ $-5 \quad -5$ \hline $x = -5$ </p> <p style="text-align: center; margin-top: 10px;">$\{ -5, 0 \}$</p>	<p>2. $5p(p - 2) = 0$</p> <p style="margin-left: 20px;"> \downarrow \downarrow $\frac{5p}{5} = 0$ $\frac{p-2}{+2} = 0$ $\frac{5}{5} \quad \frac{3}{3}$ $\frac{+2}{+2} \quad \frac{+2}{+2}$ $p = 0$ $p = 2$ </p> <p style="text-align: center; margin-top: 10px;">$\{ 0, 2 \}$</p>	<p>3. $(c - 2)(c + 1) = 0$</p>
<p>4. $(2b - 6)(3b + 18) = 0$</p>	<p>5. $(w + 4)^2(w + 1) = 0$</p> <p style="margin-left: 20px;"> $(w+4)(w+4)(w+1) = 0$ \downarrow \downarrow \downarrow $w+4=0$ $w+4=0$ $w+1=0$ $w=-4$ $w=-4$ $w=-1$ </p> <p style="text-align: center; margin-top: 10px;">$\{ -4 \text{ d.r.}, -1 \}$</p>	<p>6. $g(6 - 3g)(6 + 3g) = 0$</p> <p style="margin-left: 20px;"> \downarrow \downarrow \downarrow $g=0$ $6-3g=0$ $6+3g=0$ $-3g=-6$ $3g=-6$ $g=2$ $g=-2$ </p> <p style="text-align: center; margin-top: 10px;">$\{ -2, 0, 2 \}$</p>

↑
double root

In Exercises 7-12, factor the polynomial.

7. $6x^2 + 3x$ GCF: $3x$ $3x(2x+1)$	8. $4y^4 - 20y^3$ GCF: $4y^3$ $4y^3(y-5)$	9. $18u^4 - 6u$ GCF: $6u$ $6u(3u^3 - 1)$
10. $7z^7 + 2z^6$ GCF: z^6 $z^6(7z+2)$	11. $24h^3 + 8h$ GCF: $8h$ $8h(3h^2+1)$	12. $15f^4 - 45f$ GCF: $15f$ $15f(f^3-3)$

In Exercises 13-18, solve the equation.

- ① Let equation = 0
- ② Factor
- ③ Solve by using Zero-Product Property

13. $6k^2 + k = 0$ GCF: k $k(6k+1) = 0$ $k=0$ $6k+1=0$ $6k=-1$ $k=-\frac{1}{6}$ $\{-\frac{1}{6}, 0\}$	14. $35n - 49n^2 = 0$	15. $4z^2 + 52z = 0$
16. $6x^2 = -72x$ $6x^2 + 72x = 0$ GCF: $6x$ $6x(x+12) = 0$ $6x=0$ $x+12=0$ $x=0$ $x=-12$ $\{-12, 0\}$	17. $22s = 11s^2$	18. $7p^2 = 21p$ $7p^2 - 21p = 0$ GCF: $7p$ $7p(p-3) = 0$ $7p=0$ $p-3=0$ $p=0$ $p=3$ $\{0, 3\}$

19. A boy kicks a ball in the air. The height y (in feet) above the ground of the ball is modeled by the equation $y = -16x^2 + 80x$, where x is the time (in seconds) since the ball was kicked. Find the roots of the equation when $y = 0$. Explain what the roots mean in this situation.

$$0 = -16x^2 + 80x \quad \text{GCF: } -16x$$

$$0 = -16x(x-5)$$

$$\begin{array}{ccc} \downarrow & & \downarrow \\ -16x=0 & & x-5=0 \\ x=0 & & x=5 \end{array} \quad \{0, 5\}$$

The ball is on the ground at 0 seconds and 5 seconds.