Solving Equations

Emphasis on Quadratic Equations by Quadratic Formula

Solve each of the following.

1. $x^2 + 15 = 16x$

$-16x \quad -16x$

$x^2 - 16x + 15 = 0$

$a = 1$

$b = -16$

$c = 15$

$x = \frac{16 \pm \sqrt{(-16)^2 - 4(1)(15)}}{2(1)}$

$x = \frac{16 \pm \sqrt{196}}{2}$

$x = \frac{16 \pm 14}{2}$

$\frac{16-14}{2} = \frac{2}{2} = \boxed{1} \qquad \frac{16+14}{2} = \frac{30}{2} = \boxed{15}$

2. $48 - 26x = -x^2$

$+x^2 \quad +x^2$

$x^2 - 26x + 48 = 0$

$a = 1$

$b = -26$

$c = 48$

$x = \frac{26 \pm \sqrt{(-26)^2 - 4(1)(48)}}{2(1)}$

$x = \frac{26 \pm \sqrt{484}}{2}$

$x = \frac{26 \pm 22}{2}$

$\frac{26+22}{2} = \frac{48}{2} = \boxed{24} \qquad \frac{26-22}{2} = \frac{4}{2} = \boxed{2}$

3. $-x^2 - 7x = -30$

$+30 \quad +30$

$-x^2 - 7x + 30 = 0$

$a = -1$

$b = -7$

$c = 30$

$x = \frac{7 \pm \sqrt{(-7)^2 - 4(-1)(30)}}{2(-1)}$

$x = \frac{7 \pm \sqrt{169}}{-2}$

$x = \frac{7 \pm 13}{-2}$

$\frac{7+13}{-2} = \frac{20}{-2} = \boxed{-10} \qquad \frac{7-13}{-2} = \frac{-6}{-2} = \boxed{3}$

4. $-22x - 48 + x^2 = 0$

$x^2 - 22x - 48 = 0$

$a = 1$

$b = -22$

$c = -48$

$x = \frac{22 \pm \sqrt{(-22)^2 - 4(1)(-48)}}{2(1)}$

$x = \frac{22 \pm \sqrt{676}}{2}$

$x = \frac{22 \pm 26}{2}$

$\frac{22+26}{2} = \frac{48}{2} = \boxed{24} \qquad \frac{22-26}{2} = \frac{-4}{2} = \boxed{-2}$

5. $x^2 - 51 - 7x = 5 + 3x$

$-5 \quad -3x \quad -5 - 3x$

$x^2 - 56 - 10x = 0$

$x^2 - 10x - 56 = 0$

$a = 1$

$b = -10$

$c = -56$

$x = \frac{10 \pm \sqrt{(-10)^2 - 4(1)(-56)}}{2(1)}$

$x = \frac{10 \pm \sqrt{324}}{2}$

$x = \frac{10 \pm 18}{2}$

$\frac{10+18}{2} = \frac{28}{2} = \boxed{14} \qquad \frac{10-18}{2} = \frac{-8}{2} = \boxed{-4}$

6. $3x^2 + 3 = -10x$

$3x^2 + 10x + 3 = 0$

$a = 3$

$b = 10$

$c = 3$

$x = \frac{-10 \pm \sqrt{(10)^2 - 4(3)(3)}}{2(3)}$

$x = \frac{-10 \pm \sqrt{64}}{6}$

$x = \frac{-10 \pm 8}{6}$

$\frac{-10+8}{6} = \frac{-2}{6} = \boxed{\frac{-1}{3}} \qquad \frac{-10-8}{6} = \frac{-18}{6} = \boxed{-3}$

7. $3x + 1 = -2x^2$

$+2x^2 \quad +2x^2$

$2x^2 + 3x + 1 = 0$

$a = 2$

$b = 3$

$c = 1$

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

$x = \frac{-3 \pm \sqrt{1}}{4}$

$x = \frac{-3 \pm 1}{4}$

$\frac{-3+1}{4} = \frac{-2}{4} = \boxed{\frac{-1}{2}} \qquad \frac{-3-1}{4} = \frac{-4}{4} = \boxed{-1}$

8. $12x^2 - 3x = 9$

$12x^2 - 3x - 9 = 0$

$a = 12$

$b = -3$

$c = -9$

$x = \frac{3 \pm \sqrt{(-3)^2 - 4(12)(-9)}}{2(12)}$

$x = \frac{3 \pm \sqrt{441}}{24}$

$x = \frac{3 \pm 21}{24}$

$\frac{3+21}{24} = \frac{24}{24} = \boxed{1} \qquad \frac{3-21}{24} = \frac{-18}{24} = \boxed{\frac{-3}{4}}$

9. $x - x^2 = -30$

$+30 \quad +30$

$x - x^2 + 30 = 0$

$-x^2 + x + 30 = 0$

$a = -1$

$b = 1$

$c = 30$

$x = \frac{-1 \pm \sqrt{(1)^2 - 4(-1)(30)}}{2(-1)}$

$x = \frac{-1 \pm \sqrt{121}}{-2}$

$x = \frac{-1 \pm 11}{-2}$

$\frac{-1+11}{-2} = \frac{10}{-2} = \boxed{-5} \qquad \frac{-1-11}{-2} = \frac{-12}{-2} = \boxed{6}$

10. $15x^2 = 7x + 2$

$15x^2 - 7x - 2 = 0$

$a = 15$

$b = -7$

$c = -2$

$x = \frac{7 \pm \sqrt{(-7)^2 - 4(15)(-2)}}{2(15)}$

$x = \frac{7 \pm \sqrt{169}}{30}$

$x = \frac{7 \pm 13}{30}$

$\frac{7+13}{30} = \frac{20}{30} = \boxed{\frac{2}{3}} \qquad \frac{7-13}{30} = \frac{-6}{30} = \boxed{\frac{-1}{5}}$

11. $x^2 + 7x + 9 = 0$

$a = 1$

$b = 7$

$c = 9$

$x = \frac{-7 \pm \sqrt{(7)^2 - 4(1)(9)}}{2(1)}$

$x = \frac{-7 \pm \sqrt{13}}{2}$

12. $x^2 - 9x + 5 = 0$

$a = 1$

$b = -9$

$c = 5$

$x = \frac{9 \pm \sqrt{(-9)^2 - 4(1)(5)}}{2(1)}$

$x = \frac{9 \pm \sqrt{61}}{2}$

13. $x^2 + 9x - 2 = -16$

$+16 \quad +16$

$x^2 + 9x + 14 = 0$

$a = 1$

$b = 9$

$c = 14$

$x = \frac{-9 \pm \sqrt{(9)^2 - 4(1)(14)}}{2(1)}$

$x = \frac{-9 \pm \sqrt{25}}{2}$

$x = \frac{-9 \pm 5}{2}$

$\frac{-9+5}{2} = \frac{-4}{2} = -2$ $\quad \frac{-9-5}{2} = \frac{-14}{2} = -7$

14. $5x^2 + 16x - 6 = 3$

$-3 \quad -3$

$5x^2 + 16x - 9 = 0$

$a = 5$

$b = 16$

$c = -9$

$x = \frac{-16 \pm \sqrt{(16)^2 - 4(5)(-9)}}{2(5)}$

$x = \frac{-16 \pm \sqrt{436}}{10}$

15. $3x^2 - 3 = -5x - 1$

$+5x+1 \quad +5x+1$

$3x^2 + 5x - 2 = 0$

$a = 3$

$b = 5$

$c = -2$

$x = \frac{-5 \pm \sqrt{(5)^2 - 4(3)(-2)}}{2(3)}$

$x = \frac{-5 \pm \sqrt{49}}{6}$

$x = \frac{-5 \pm 7}{6}$

$\frac{-5+7}{6} = \frac{2}{6} = \frac{1}{3}$ $\quad \frac{-5-7}{6} = \frac{-12}{6} = -2$

16. $x^2 + 6x + 5 = 0$

$a = 1$

$b = 6$

$c = 5$

$x = \frac{-6 \pm \sqrt{(6)^2 - 4(1)(5)}}{2(1)}$

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

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

$\frac{-6+4}{2} = \frac{-2}{2} = -1$ $\quad \frac{-6-4}{2} = \frac{-10}{2} = -5$

17. $-2x^2 + 4x = -2$

$+2 \quad +2$

$-2x^2 + 4x + 2 = 0$

$a = -2$

$b = 4$

$c = 2$

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

$x = \frac{-4 \pm \sqrt{32}}{-4}$

18. $-6x^2 + 3x + 19 = 0$

$a = -6$

$b = 3$

$c = 19$

$x = \frac{-3 \pm \sqrt{(3)^2 - 4(-6)(19)}}{2(-6)}$

$x = \frac{-3 \pm \sqrt{465}}{-12}$

19. $0 = 7x^2 + 6x - 5$

$a = 7$

$b = 6$

$c = -5$

$x = \frac{-6 \pm \sqrt{(6)^2 - 4(7)(-5)}}{2(7)}$

$x = \frac{-6 \pm \sqrt{176}}{14}$

20. $-3 = 7x + 2x^2$

$+3 \quad +3$

$0 = 2x^2 + 7x + 3$

$a = 2$

$b = 7$

$c = 3$

$x = \frac{-7 \pm \sqrt{(7)^2 - 4(2)(3)}}{2(2)}$

$x = \frac{-7 \pm \sqrt{25}}{4}$

$x = \frac{-7 \pm 5}{4}$

$\frac{-7+5}{4} = \frac{-2}{4} = -\frac{1}{2}$ $\quad \frac{-7-5}{4} = \frac{-12}{4} = -3$