2.4 Solving Quadratic algebraically.

p196

(#5) $2x^2 = 3 - 5x$

write in general form.

$ax^2 + bx + c = 0$

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

(8) $x(x+2) = 3x^2 + 1$

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

$-x^2 \quad -2x \quad -x^2 - 2x$

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

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

Solving using Factorization

(9) $6x^2 + 3x = 0$

(GCF) $3x(2x+1) = 0$ Zero product property

$x = 0$ or $2x + 1 = 0$

$x = 0; \; x = -\frac{1}{2}$

If $ab = 0$ then $a = 0$ or $b = 0$ or Both zero.

(12) $x^2 + 10x + 9 = 0$

$(x-1)(x-9) = 0$

$\boxed{x = 1, 9}$

(17) $x^2 + 4x = 12$

$x^2 + 4x - 12 = 0$

$(x+6)(x-2) = 0$

$\boxed{x = -6, 2}$

(19) $(x+a)^2 - b^2 = 0$

$x^2 + 2ax + a^2 - b^2 = 0$

$x^2 + 2ax + (a^2 - b^2) = 0$

$x^2 + 2ax + (a-b)(a+b) = 0$

format: $A^2 - B^2 = (A-B)(A+B)$

$((x+a) - b)((x+a) + b) = 0$

$\boxed{x = -a+b}$ $\boxed{x = -a-b}$

$x + a - b = 0$

$-a + b \quad +b$

$-a$

$\boxed{x = -a+b}$

(20) $x^2 + 2ax + a^2 = 0$

perfect Square

$A^2 + 2AB + B^2 = (A+B)^2$

$(x+a)^2 = 0$

$\boxed{x = -a}$ double

Solve Using Square Root.

$x^2 = M$ $\boxed{M \geq 0}$

$x = \pm\sqrt{M}$

(21) $x^2 = 49$

$x = \pm\sqrt{49} = \boxed{\pm 7}$

(23) $(x-12)^2 = 16$

$x - 12 = \pm\sqrt{16} = \pm 4$

$x - 12 = 4$ → $\boxed{x = 16}$

$x - 12 = -4$ → $\boxed{x = 8}$

(26) $(2x+3)^2 + 25 = 0$

$(2x+3)^2 = -25$

$2x+3 = \pm\sqrt{-25} = \pm 5i$

$2x+3 = 5i$ or $2x+3 = -5i$

$x = a+bi$

$x = -\frac{3}{2} + \frac{5}{2}i$ $\quad$ $x = -\frac{3}{2} - \frac{5}{2}i$

Conjugate

(28) $\sqrt{(x+5)^2} = \sqrt{(x+4)^2}$

$|x+5| = |x+4|$ $\therefore$ $x+5 = x+4$ or $x+5 = -(x+4)$

$x+5 = \pm(x+4)$

$x+5 = x+4$ No solution

or $x+5 = -x-4$

$+x-5 \quad +x-5$

$2x = -9$

$x = -9/2$

$(x+5)^2 - (x+4)^2 = 0$

$(x+5-x-4)(x+5+x+4) =$

$1(2x+9) = 0$

$x = -9/2$

Solving by Completing the Square.

(29) $x^2 + 4x - 32 = 0$

Key $a^2 + 2ab + b^2 = (a+b)^2$

$a^2 - 2ab + b^2 = (a-b)^2$

$x^2 + 4x + \left(\frac{4}{2}\right)^2 = 32 + \left(\frac{4}{2}\right)^2$

$2^2 \qquad\qquad 2^2$

$x^2 = M$

$x = \pm\sqrt{M}$

$(x+2)^2 = 36$

$x+2 = \pm 6$

$x+2 = 6$ or $x+2 = -6$

$\boxed{x = 4}$ $\boxed{x = -8}$

(30) $x^2 - 2x - 3 = 0$

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

$(x-1)^2 = 4$

$x-1 = \pm 2$ < $x-1 = 2$ $\therefore \boxed{x = 3}$; $x-1 = -2$ $\boxed{x = -1}$

(39) $x^2 - 4x + 13 = 0$

$x^2 - 4x + 2^2 = -13 + 2^2$

$(x-2)^2 = -9$

$x - 2 = \pm 3i$

$\boxed{x = 2+3i}$ or $\boxed{x = 2-3i}$

$a^2 - 2ab$

$(2x)^2 - 2(2x)1$

(34) $4x^2 - 4x - 99 = 0$

$4x^2 - 4x = 99$

$(2x)^2 - 2(2x)1 + 1 = 99 + 1$

$a^2 - 2ab$

$x^2 - x + (\frac{1}{2})^2 = \frac{99}{4} + (\frac{1}{2})^2$

$(2x-1)^2 = 100$ $\quad (x - \frac{1}{2})^2 = \frac{100}{4} = 25$

$2x - 1 = \pm 10$ $\quad x - \frac{1}{2} = \pm 5$

$2x - 1 = 10$ $\quad x = 11/2$ $\quad x = 5\frac{1}{2}$ or $x = -4\frac{1}{2}$

$2x - 1 = -10$

$x = -9/2$

$\boxed{x = 11/2}$ or $\boxed{x = -9/2}$

Solving using Quadratic formula.

General form

$$ax^2+bx+c=0$$

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

Discriminant b^2-4ac

- $b^2-4ac>0$ | two Real Solutions
  2 x-intercepts.
  2 zeros
  2 Roots.
- $b^2-4ac=0$ one Solution
  one x-intercept (touch).
- $b^2-4ac<0$ | two Conjugate roots.
  no x-intercepts.

$a=9,\ b=-6,\ c=37$

$9x^2-6x+37=0$

$$x=\frac{-(-6)\pm\sqrt{(-36^2)}}{2(9)}$$

$b^2-4ac=(6)^2-4(9)(37)=36-36(37)=36[1-37)=-36^2$

$(36)(-36)=-36^2$

$$x = \frac{6 \pm 36i}{18} \begin{cases} \frac{6}{18} + \frac{36}{18}i = \boxed{\frac{1}{3} + 2i} \\ \frac{6}{18} - \frac{36}{18}i = \boxed{\frac{1}{3} - 2i} \end{cases}$$

(62) $11x^2 + 33x = 0$

factor $11x[x+3] = 0$

$\boxed{x = 0, -3}$ ✓

(65) $x^2 - 2x + 13/4 = 0$

$x^2 - 2x + 1 = -13/4 + 1$

$(x-1)^2 = -9/4$

$x - 1 = \pm i\frac{3}{2}$

$x = 1 \pm \frac{3}{2}i$ $\begin{cases} \boxed{1 + \frac{3}{2}i} \\ \boxed{1 - \frac{3}{2}i} \end{cases}$

HW p 196-197
#46, 50, 56, 58, 68, 84, 86

Quadratic famula

$$ax^2 + bx + c = 0$$

General fom.

$$a(x-h)^2 + k = 0$$

Standard form (functnis).

$$a\left(x^2 + \frac{b}{a}x + \frac{c}{a}\right) = 0$$

$$x^2 + \frac{b}{a}x + \frac{c}{a} = 0$$

$$x^2 + \frac{b}{a}x + \left(\frac{b}{2a}\right)^2 = -\frac{c}{a} + \left(\frac{b}{2a}\right)^2$$

$$\left(x + \frac{b}{2a}\right)^2 = -\frac{c}{a} + \frac{b^2}{4a^2}$$

$$= \frac{-4ac + b^2}{4a^2}$$

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$

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

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

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