Day6-MCR3U

Solving Quadratic Equations

If necessary, rearrange the equation into the form $ax^2 + bx + c = 0$

Option #1: Factoring

If pq=0, then either p=0 or q=0. So if we can factor the trinomial into 2 factors, we just set each factor equal to zero and solve the linear equation.

Example 1:

a. $x^2 - x = 6$

ST

$x^2 - x - 6 = 0$

$(x-3)(x+2) = 0$

$x = 3$ or $x = -2$

$\{3, -2\}$

b. $2x^2 - 6x = x + 15$

CT $\quad m = -30 \quad A = -7 \quad N = -10, 3$

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

$2x^2 - 10x + 3x - 15 = 0$

$2x(x-5) + 3(x-5) = 0$

$(2x+3)(x-5) = 0$

$x = -\frac{3}{2}$ or $x = 5$

$\{-\frac{3}{2}, 5\}$

c. $5a^2 = 7a$

$5a^2 - 7a = 0$ (gcf)

$a(5a-7) = 0$

$a = 0$ or $a = \frac{7}{5}$

$\{0, \frac{7}{5}\}$

Option #2: Quadratic Formula : If $ax^2 + bx + c = 0$ *then* $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Example 2:

a. $x^2 = 6x - 7$

$x^2 - 6x + 7 = 0$

does not factor use QF

$a = 1, \quad b = -6, \quad c = 7$

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

$= \dfrac{6 \pm \sqrt{36 - 4(1)(7)}}{2}$

$= \dfrac{6 \pm \sqrt{8}}{2}$

$= \dfrac{6 \pm \sqrt{4}\sqrt{2}}{2}$

$= \dfrac{6 \pm 2\sqrt{2}}{2} = \dfrac{2(3 \pm \sqrt{2})}{2}$

$= 3 \pm \sqrt{2}$

b. $2x^2 + 18x + 26 = 0$ $\Rightarrow$ divide by 2 $\Rightarrow$ $x^2 + 9x + 13 = 0$

$a = 1 \quad b = 9 \quad c = 13$

$x = \dfrac{-9 \pm \sqrt{81 - 4(1)(13)}}{2}$

$= \dfrac{-9 \pm \sqrt{81 - 52}}{2}$

$= \dfrac{-9 \pm \sqrt{29}}{2}$

Keep the exact roots unless specified.

Practice: Solving Quadratic Equations

a. $3x^2 + 9x - 30 = 0$

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

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

$x=-5$ or 2

$\{-5, 2\}$

b. $x^2 = 12 - 6x$

$x^2+6x-12=0$

$x=\frac{-6\pm\sqrt{36-4(1)(-12}}{2}$

$=\frac{-6\pm\sqrt{84}}{2}$

$=\frac{-6\pm\sqrt{4}\sqrt{21}}{2}$

$=\frac{-6\pm 2\sqrt{21}}{2}=-3\pm\sqrt{21}$

c. $4x^2 - 23 = -12x$

$4x^2+12x-23=0$

$x=\frac{-12\pm\sqrt{144-4(4)(-23)}}{8}$

$=\frac{-12\pm\sqrt{512}}{8}=\frac{-12\pm\sqrt{256}\sqrt{2}}{8}$

$=\frac{-12\pm 16\sqrt{2}}{8}=\frac{+4(-3\pm 4\sqrt{2})}{8}$

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

d. $4x^2 + 5x = -1 + 5x$

$4x^2+1=0$

NO solution since

$4x^2+1>0$ for any x.

alternatively: $4x^2\neq -1$

e. $4x^2 = 1$

$4x^2-1=0$

$(2x-1)(2x+1)=0$

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

$\{\pm\frac{1}{2}\}$

f. $10x^2 - 20x - 8 = 0$

$5x^2-10x-4=0$

$x=\frac{10\pm\sqrt{100-4(5)(-4)}}{10}$

$=\frac{10\pm\sqrt{180}}{10}$

$=\frac{10\pm\sqrt{36}\sqrt{5}}{10}$

$=\frac{10\pm 6\sqrt{5}}{10}=\frac{2(5\pm 3\sqrt{5})}{10}$

$=\frac{5\pm 3\sqrt{5}}{5}$

g. $3x^2 - 8x + 4 = 0$

M	A	N
12	-8	-6, -2

$3x^2-6x-2x+4=0$

$(3x^2-6x)+(-2x+4)=0$

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

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

$x=\frac{2}{3}$ or 2

$\{\frac{2}{3}, 2\}$

h. $9x^2 + 5x = 0$

$x(9x+5)=0$

$x=0$ or $-\frac{5}{9}$

$\{0, -\frac{5}{9}\}$

Homework: p. 177 #1b, 2b, 4bf, 5b, 9, 10