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① $x^2+5x+6=0$

$a=1$, $b=5$, $c=6$

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

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

$=\frac{-5\pm\sqrt{25-24}}{2}$

$=\frac{-5\pm\sqrt{1}}{2}$

$=\frac{-5\pm1}{2}$

$=-\frac{6}{2}$ or $\frac{-4}{2}$

$\{-3,-2\}$

② $x^2+7x+10=0$

$a=1$, $b=7$, $c=10$

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

$=\frac{-7\pm\sqrt{7^2-4(1)(10)}}{2(1)}$

$=\frac{-7\pm\sqrt{49-40}}{2}$

$=\frac{-7\pm\sqrt{9}}{2}$

$=\frac{-7\pm3}{2}$

$=\frac{-10}{2}$ or $\frac{-4}{2}$

$\{-5,-2\}$

③ $x^2+5x+3=0$

$a=1$, $b=5$, $c=3$

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

$=\frac{-5\pm\sqrt{5^2-4(1)(3)}}{2(1)}$

$=\frac{-5\pm\sqrt{25-12}}{2}$

$=\frac{-5\pm\sqrt{13}}{2}$

$=\left\{\frac{-5\pm\sqrt{13}}{2}\right\}$

④ $x^2+5x+2=0$

$a=1$, $b=5$, $c=2$

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

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

$=\frac{-5\pm\sqrt{25-8}}{2}$

$=\frac{-5\pm\sqrt{17}}{2}$

$\left\{\frac{-5\pm\sqrt{17}}{2}\right\}$

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

$a=1$, $b=4$, $c=-6$

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

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

$=\frac{-4\pm\sqrt{16+24}}{2}$

$=\frac{-4\pm\sqrt{40}}{2}$

$=\frac{-4\pm\sqrt{4\cdot10}}{2}$

$=\frac{-4\pm2\sqrt{10}}{2}$

$=-2\pm\sqrt{10}\Rightarrow\{-2\pm\sqrt{10}\}$

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

$a=1$, $b=2$, $c=-4$

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

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

$=\frac{-2\pm\sqrt{4+16}}{2}$

$=\frac{-2\pm\sqrt{4\cdot5}}{2}$

$=\frac{-2\pm2\sqrt{5}}{2}$

$=-1\pm\sqrt{5}$

$\{-1\pm\sqrt{5}\}$

(7) $x^2+4x-7=0$

$a=1$, $b=4$, $c=-7$

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

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

$=\frac{-4\pm\sqrt{16+28}}{2}$

$=\frac{-4\pm\sqrt{4\cdot11}}{2}$

$=\frac{-4\pm2\sqrt{11}}{2}$

$=-2\pm\sqrt{11}$

$\{-2\pm\sqrt{11}\}$

(8) $x^2+4x+1=0$

$a=1$, $b=4$, $c=1$

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

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

$=\frac{-4\pm\sqrt{16-4}}{2}$

$=\frac{-4\pm\sqrt{4\cdot3}}{2}$

$=\frac{-4\pm2\sqrt{3}}{2}$

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

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

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(9) $x^2 - 3x - 18 = 0$

$a=1$, $b=-3$, $c=-18$

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

$= \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-18)}}{2(1)}$

$= \frac{3 \pm \sqrt{9+72}}{2}$

$= \frac{3 \pm \sqrt{81}}{2}$

$= \frac{3 \pm 9}{2}$

$= -\frac{6}{2}$ or $\frac{12}{2}$

$\{-3, 6\}$

(10) $x^2 - 3x - 10 = 0$ $a=1$, $b=-3$, $c=-10$

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

$= \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-10)}}{2(1)}$

$= \frac{3 \pm \sqrt{9+40}}{2}$

$= \frac{3 \pm \sqrt{49}}{2}$

$= \frac{3 \pm 7}{2}$

$= -\frac{4}{2}$ or $\frac{10}{2}$

$\{-2, 5\}$

(11) $6x^2 - 5x - 6 = 0$ $a=6$, $b=-5$, $c=-6$

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

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

$= \frac{5 \pm \sqrt{25+144}}{12}$

$= \frac{5 \pm \sqrt{169}}{12}$

$= \frac{5 \pm 13}{12}$

$= -\frac{8}{12}$ or $\frac{18}{12}$

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

(12) $9x^2 - 12x - 5 = 0$ $a=9$, $b=-12$, $c=-5$

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

$= \frac{-(-12) \pm \sqrt{(-12)^2 - 4(9)(-5)}}{2(9)}$

$= \frac{12 \pm \sqrt{144+180}}{18}$

$= \frac{12 \pm \sqrt{324}}{18}$

$= \frac{12 \pm 18}{18}$ (now divide each term by 6)

$= \frac{2 \pm 3}{3}$

$= -\frac{1}{3}$ or $\frac{5}{3}$

$\{-\frac{1}{3}, \frac{5}{3}\}$

(13) $x^2 - 2x - 10 = 0$

$a=1$, $b=-2$, $c=-10$

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

$= \dfrac{-(-2) \pm \sqrt{(-2)^2-4(1)(-10)}}{2(1)}$

$= \dfrac{2 \pm \sqrt{4+40}}{2}$

$= \dfrac{2 \pm \sqrt{4 \cdot 11}}{2}$

$= \dfrac{2 \pm 2\sqrt{11}}{2}$

$= 1 \pm \sqrt{11}$

$\{1 \pm \sqrt{11}\}$

(14) $x^2 + 6x - 10 = 0$ $a=1$, $b=6$, $c=-10$

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

$= \dfrac{-6 \pm \sqrt{(6)^2-4(1)(-10)}}{2(1)}$

$= \dfrac{-6 \pm \sqrt{36+40}}{2}$

$= \dfrac{-6 \pm \sqrt{76}}{2}$

$= \dfrac{-6 \pm \sqrt{4 \cdot 19}}{2}$

$= \dfrac{-6 \pm 2\sqrt{19}}{2}$

$= -3 \pm \sqrt{19}$ → $\{-3 \pm \sqrt{19}\}$

(15) $x^2 - x = 14$

$x^2 - x - 14 = 0$ $a=1$, $b=-1$, $c=-14$

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

$= \dfrac{-(-1) \pm \sqrt{(-1)^2-4(1)(-14)}}{2(1)}$

$= \dfrac{1 \pm \sqrt{1+56}}{2}$

$\left\{\dfrac{1 \pm \sqrt{57}}{2}\right\}$

(16) $x^2 - 5x = 10$

$x^2 - 5x - 10 = 0$ $a=1$, $b=-5$, $c=-10$

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

$= \dfrac{-(-5) \pm \sqrt{(-5)^2-4(1)(-10)}}{2(1)}$

$= \dfrac{5 \pm \sqrt{25+40}}{2}$

$= \dfrac{5 \pm \sqrt{65}}{2}$ → $\left\{\dfrac{5 \pm \sqrt{65}}{2}\right\}$

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(17) $6x^2+6x+1=0$

$a=6$, $b=6$, $c=1$

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

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

$=\frac{-6\pm\sqrt{36-24}}{12}$

$=\frac{-6\pm\sqrt{4\cdot3}}{12}$

$=\frac{-6\pm2\sqrt{3}}{12}$

$\left\{\frac{-3\pm\sqrt{3}}{6}\right\}$

(18) $3x^2-5x+1=0$

$a=3$, $b=-5$, $c=1$

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

$=\frac{-(-5)\pm\sqrt{(-5)^2-4(3)(1)}}{2(3)}$

$=\frac{5\pm\sqrt{25-12}}{6}$

$=\frac{5\pm\sqrt{13}}{6}$

$\left\{\frac{5\pm\sqrt{13}}{6}\right\}$

(19) $9x^2-12x+4=0$

$a=9$, $b=-12$, $c=4$

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

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

$=\frac{12\pm\sqrt{144-144}}{18}$

$=\frac{12\pm\sqrt{0}}{18}$

$=\frac{12}{18}$

$\left\{\frac{2}{3}\right\}$

(20) $4x^2+12x+9=0$

$a=4$, $b=12$, $c=9$

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

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

$=\frac{-12\pm\sqrt{0}}{8}$

$=\frac{-12}{8}$

$\left\{-\frac{3}{2}\right\}$

(21) $4x^2 = 2x + 7$

$4x^2 - 2x - 7 = 0$

$a = 4$, $b = -2$, $c = -7$

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

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

$= \frac{2 \pm \sqrt{4 + 112}}{8}$

$= \frac{2 \pm \sqrt{116}}{8}$

$= \frac{2 \pm \sqrt{4 \cdot 29}}{8}$

$= \frac{2 \pm 2\sqrt{29}}{8}$

$\left\{\frac{1 \pm \sqrt{29}}{4}\right\}$

(22) $3x^2 = 6x - 1$

$3x^2 - 6x + 1 = 0$ $a = 3$, $b = -6$, $c = 1$

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

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

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

$= \frac{6 \pm \sqrt{24}}{6}$

$= \frac{6 \pm \sqrt{4 \cdot 6}}{6}$

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

$\left\{\frac{3 \pm \sqrt{6}}{3}\right\}$

(23) $2x^2 - x = 1$

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

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

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

$2x = -1$ or $x = 1$

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

$\left\{-\frac{1}{2}, 1\right\}$

(24) $3x^2 - 4x = 4$

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

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

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

$3x = -2$

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

$\left\{-\frac{2}{3}, 2\right\}$

(25) $5x^2 + 2 = 11x$

$5x^2 - 11x + 2 = 0$

$(5x - 1)(x - 2) = 0$

$5x - 1 = 0$ or $x - 2 = 0$

$5x = 1$ or $x = 2$

$x = \frac{1}{5}$

$\left\{\frac{1}{5}, 2\right\}$

(26) $5x^2 = 6 - 13x$

$5x^2 + 13x - 6 = 0$

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

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

$5x = 3$

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

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

(27) $3x^2 = 60$

$x^2 = 20$

$\sqrt{x^2} = \pm\sqrt{20}$

$x = \pm\sqrt{4 \cdot 5}$

$x = \pm 2\sqrt{5}$

$\{\pm 2\sqrt{5}\}$

(28) $2x^2 = 250$

$x^2 = 125$

$\sqrt{x^2} = \pm\sqrt{125}$

$x = \pm\sqrt{25 \cdot 5}$

$x = \pm 5\sqrt{5}$

$\{\pm 5\sqrt{5}\}$

(29) $x^2 - 2x = 1$ $\quad a = 1,\ b = -2,\ c = -1$

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

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

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

$= \frac{2 \pm \sqrt{4 + 4}}{2}$

$= \frac{2 \pm \sqrt{8}}{2}$

$= \frac{2 \pm \sqrt{4 \cdot 2}}{2}$

$= \frac{2 \pm 2\sqrt{2}}{2}$

$\{1 \pm \sqrt{2}\}$

(30) $2x^2 + 3x = 1$

$2x^2 + 3x - 1 = 0$ $\quad a = 2,\ b = 3,\ c = -1$

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

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

$= \frac{-3 \pm \sqrt{9 + 8}}{4}$

$\left\{\frac{-3 \pm \sqrt{17}}{4}\right\}$

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(31) $(2x+3)(x+4)=1$

$2x^2+8x+3x+12=1$

$2x^2+11x+12=1$ subtract 1 from each side

$2x^2+11x+11=0$

$a=2$, $b=11$, $c=11$

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

$=\frac{-11\pm\sqrt{11^2-4(2)(11)}}{2(2)}$

$=\frac{-11\pm\sqrt{121-88}}{4}$

$\left\{\frac{-11\pm\sqrt{33}}{4}\right\}$

(32) $(2x-5)(x+1)=2$

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

$2x^2-3x-5=2$ subtract 2 from each side

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

$a=2$, $b=-3$, $c=-7$

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

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

$=\frac{3\pm\sqrt{9+56}}{4}$

$\boxed{\left\{\frac{3\pm\sqrt{65}}{4}\right\}}$

(33) $(3x-4)^2=16$

$\sqrt{(3x-4)^2}=\pm\sqrt{16}$

$3x-4=\pm4$

$3x-4=-4$ or $3x-4=4$

$3x=0$ or $3x=8$

$x=0$ or $x=\frac{8}{3}$

$\left\{0,\frac{8}{3}\right\}$

(34) $(2x+7)^2=25$

$\sqrt{(2x+7)^2}=\pm\sqrt{25}$

$2x+7=\pm5$

$2x+7=-5$ or $2x+7=5$

$2x=-12$ or $2x=-2$

$x=-6$ or $x=-1$

$\{-6,-1\}$

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(35) $3x^2-12x+12=0$

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

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

$x-2=0$

$x=2$

$\{2\}$

(36) $9-6x+x^2=0$

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

$(x-3)^2=0$

$x-3=0$

$x=3$

$\{3\}$

(37) $4x^2-16=0$

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

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

$x-2=0$ or $x+2=0$

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

$\{-2,2\}$

(38) $3x^2-27=0$

$3x^2=27$

$x^2=9$

$x=\pm\sqrt{9}$

$\{\pm 3\}$

(39) $x^2+9x=0$

$x(x+9)=0$

$x=0$ or

$x+9=0$

$x=-9$

$\{-9,0\}$

(40) $x^2-6x=0$

$x(x-6)=0$

$x=0$ or $x-6=0$

$x=6$

$\{0,6\}$

(41) $\frac{3}{4}x^2-\frac{5}{2}x-2=0$

$4\left(\frac{3}{4}x^2-\frac{5}{2}x-2\right)=4(0)$

$3x^2-10x-8=0$

$a=3$

$b=-10$

$c=-8$

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

$=\frac{-(-10)\pm\sqrt{(-10)^2-4(3)(-8)}}{2(3)}$

$=\frac{10\pm\sqrt{100+96}}{6}$

$=\frac{10\pm\sqrt{196}}{6}$

$=\frac{10\pm 14}{6}$

$=\frac{5\pm 7}{3}$

$\{-\frac{2}{3},4\}$

(19)

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(42) $\frac{1}{3}x^2 - \frac{1}{2}x - \frac{3}{2} = 0$

$6\left(\frac{1}{3}x^2 - \frac{1}{2}x - \frac{3}{2}\right) = 6(0)$

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

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

$2x-3=0$ or $x-3=0$

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

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

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

(43) $(3x-2)^2 = 10$

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

$3x-2 = \pm\sqrt{10}$

$+2 \quad +2$

$\frac{3x}{3} = \frac{2\pm\sqrt{10}}{3}$

$x = \frac{2\pm\sqrt{10}}{3}$

$\left\{\frac{2\pm\sqrt{10}}{3}\right\}$

(44) $(4x-1)^2 = 15$

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

$4x-1 = \pm\sqrt{15}$

$4x = -1\pm\sqrt{15}$

$x = \frac{-1\pm\sqrt{15}}{4}$

$\left\{\frac{-1\pm\sqrt{15}}{4}\right\}$

(45) $\frac{x^2}{x+7} - \frac{3}{x+7} = 0$

$(x+7)\left(\frac{x^2}{(x+7)} - \frac{3}{(x+7)}\right) = 0(x+7)$

$x^2 - 3 = 0$

$x^2 = 3$

$x = \pm\sqrt{3}$

$\{\pm\sqrt{3}\}$

(53) $-\frac{16}{4}t^2 + \frac{60}{4}t + \frac{4}{4} = \frac{0}{4}$

$-4t^2 + 15t + 1 = 0$

$a=-4$, $b=15$, $c=1$

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

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

$= \frac{-15\pm\sqrt{225+16}}{-8}$

$= \frac{-15\pm\sqrt{241}}{-8}$

use $\frac{-15-\sqrt{241}}{-8}$

≈ 3.8 seconds