# Quadratics

Solving

Factor Completely:

$x^2 - 17x + 60$

$60$, $-12 \cdot -5$

$(x^2 - 12x) + (-5x + 60)$

$x(x-12) - 5(x-12)$

$(x-5)(x-12)$

$x^2 + 14x + 40$

$40$, $10 \cdot 4$

$(x^2 + 10x) + (4x + 40)$

$x(x+10) + 4(x+10)$

$(x+4)(x+10)$

$9x^2 - 100$

$(3x-10)(3x+10)$

$3x^2 - 4x - 7$

$3 \cdot -7 = -21$, $-7 \cdot 3$

$(3x^2 - 7x) + (3x - 7)$

$x(3x-7) + 1(3x-7)$

$(3x-7)(x+1)$

$2x^2 - 34x + 60$

$30$, $-15 \cdot -2$

$2(x^2 - 17x + 30)$

$(x^2 - 15x) + (2x + 30)$

$x(x-15) - 2(x-15)$

$2(x-2)(x-15)$

$6x^2 - 2x - 4$

$-6$, $-3 \cdot 2$

$2(3x^2 - x - 2)$

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

$3x(x-1) + 2(x-1)$

$2(3x+2)(x-1)$

## Solve by Factoring:

$60$ : $15 \cdot 4$

$x^2 + 19x + 60 = 0$

$(x^2+15x)+(4x+60)=0$

$x(x+15)+4(x+15)=0$

$(x+4)(x+15)=0$

$x+4=0 \quad x+15=0$

$x=-4 \quad x=-15$

$2x^2 + 19x = -24$ $\quad 2 \cdot 24 = 48$ : $16 \cdot 3$

$2x^2+19x+24=0$

$(2x^2+16x)+(3x+24)=0$

$2x(x+8)+3(x+8)=0$

$(2x+3)(x+8)=0$

$2x+3=0 \quad x+8=0$

$-3 \quad -3 \quad -8 \quad -8$

$2x=-3 \quad x=-8$

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

$-54$ : $-6 \cdot 9$

$x^2 + 3x = 54$

$x^2+3x-54=0$

$(x^2-6x)+(9x-54)=0$

$x(x-6)+9(x-6)=0$

$(x+9)(x-6)=0$

$x+9=0 \quad x-6=0$

$x=-9 \quad x=6$

$4x^2 + 3 = 8x$ $\quad 4 \cdot 3 = 12$ : $-2 \cdot -6$

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

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

$2x(2x-1)-3(2x-1)=0$

$(2x-3)(2x-1)=0$

$2x-3=0 \quad 2x-1=0$

$2x=3 \quad 2x=1$

$x=\frac{3}{2} \quad x=\frac{1}{2}$

Find the value of the discriminate. Find the number of real or imaginary solutions. If the solutions are real classify them as rational or irrational.

$D = b^2 - 4ac$ $D > 0$ 2 real $D < 0$ 2 imaginary $D = 0$ 1 Real

$3x^2 + 14x - 5 = 0$

$14^2 - 4(3)(-5)$

$196 - (-60)$

$256$

2 Real Solutions Rational

$9x^2 - 6x + 1 = 0$

$(-6)^2 - 4(9)(1)$

$36 - 36$

$0$

One Real Solution Rational

$x^2 + 6x + 10 = 0$

$6^2 - 4(1)(10)$

$36 - 40$

$-4$

2 imaginary (complex) solutions

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

$b^2 - 4ac$

$3^2 - 4(2)(-1)$

$9 - (-8)$

$17$

2 real solutions irrational

Solve using the quadratic formula. Classify each solution as rational, irrational, or complex. When possible make sure you simplify your radicals.

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

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

$2x^2 - 6x = 5$

$a=2 \quad b=-6 \quad c=-5$

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

$\frac{6}{4} \pm \frac{\sqrt{36-(-40)}}{4}$

$\frac{3}{2} \pm \frac{\sqrt{76}}{4} = \frac{3}{2} \pm \frac{2\sqrt{19}}{4} = \frac{3}{2} \pm \frac{\sqrt{19}}{2}$

$\sqrt{76}$

$\sqrt{4} \cdot \sqrt{19}$

$2\sqrt{19}$

irrational

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

$+3 \qquad +3$

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

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

$1 \pm \frac{\sqrt{4+4}}{2}$

$1 \pm \frac{\sqrt{8}}{2}$

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

$\sqrt{8} = \sqrt{4} \cdot \sqrt{2}$

$2\sqrt{2}$

irrational

$a=1 \quad b=-2 \quad c=35$

$x^2-2x+35=0$

$x^2 + 35 = 2x$

$\frac{2}{2(1)} \pm \frac{\sqrt{(-2)^2-4(1)(35)}}{2(1)}$

$1 \pm \frac{\sqrt{4-140}}{2}$

$1 \pm \frac{\sqrt{-136}}{2} = 1 \pm \frac{2\sqrt{34}i}{2} = 1 \pm \sqrt{34}i$

$\sqrt{-136} = \sqrt{136}\,i$

$\sqrt{136}$

$\sqrt{4} \cdot \sqrt{34}$

$2\sqrt{34}\,i$

complex

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

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

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

$\frac{1}{4} \pm \frac{\sqrt{1-(-80)}}{-4}$

$\frac{1}{4} \pm \frac{\sqrt{81}}{-4}$

$\frac{1}{4} \pm \frac{9}{-4}$

$\frac{1}{4} + \frac{9}{4}$ $\qquad$ $\frac{1}{4} - \frac{9}{4}$

$\frac{10}{4}$ $\qquad$ $\frac{-8}{4}$

$\frac{5}{2}$ $\qquad$ $-2$

Rational

$-1$

Solve each quadratic by which ever method you chose. Make sure to simplify all radicals.

$\sqrt{40}$

$\sqrt{4}\cdot\sqrt{10}$

$2\sqrt{10}$

$-12$

$-1\cdot 12$

**$3x^2 + 11x = 4$**

$3x^2+11x-4=0$

$(3x^2-x)+(12x-4)=0$

$x(3x-1)+4(3x-1)=0$

$(3x-1)(x+4)=0$

$3x-1=0$ $\quad x+4=0$

$3x=1$ $\quad x=-4$

$x=\frac{1}{3}$

Rational

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

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

$\frac{4}{4} \pm \frac{\sqrt{(16)-24}}{4}$

$1 \pm \frac{\sqrt{-8}}{4}$

$1 \pm \frac{2\sqrt{2}i}{4}$

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

Complex

$\sqrt{-8} = \sqrt{8}\,i$

$\sqrt{8}$

$\sqrt{4}\cdot\sqrt{2}$

$2\sqrt{2}i$

**$3x^2 + 8x + 2 = 0$**

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

$-\frac{8}{6} \pm \frac{\sqrt{64-24}}{6}$

$-\frac{4}{3} \pm \frac{\sqrt{40}}{6} = -\frac{4}{3} \pm \frac{2\sqrt{10}}{6}$ irrational

$-\frac{4}{3} \pm \frac{\sqrt{10}}{3}$

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

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

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

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

$x-1=0$ $\quad x-2=0$

$x=1$ $\quad x=2$

Rational

Preform the indicated operation:

$-1-8i-4-i$

$-5-9i$

$-3+6i \ominus (-5-3i)-8i$

$-3+6i+5+3i-8i$

$2+i$

$i^2=-1$

$4i(-2-8i)$

$-8i-32i^2$

$-8i-32(-1)$

$32-8i$

$(4-5i)(4+i)$

$16+4i-20i-5i^2$

$16-16i-5(-1)$

$21-16i$

$(-2-i)(4+i)+(2-4i)(-6+i)$

FOIL FOIL

$-8-2i-4i-i^2$ $-12+2i+24i-4i^2$

$-8-6i-(-1)$ $-12+26i-4(-1)$

$-7+6i$ $8+26i$

$1+32i$

During a chemistry experiment, the cork in a 0.5 feet tall beaker with an effervescent solution pops off with an initial velocity of 20 feet per second. How many seconds does it take for the cork to hit the table.

$h(t) = h_0 + V_0 t - 16t^2$

$= .5 + 20t - 16t^2$

$0 = .5 + 20t - 16t^2$ $\quad a = -16 \quad b = 20 \quad c = .5$

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

$$\frac{-20}{2(-16)} \pm \frac{\sqrt{(20)^2 - 4(-16)(.5)}}{2(-16)}$$

$$\frac{20}{32} \pm \frac{\sqrt{400 - (-32)}}{-32}$$

$$\frac{20}{32} \pm \frac{\sqrt{432}}{-32}$$

$.625 \pm (-.65)$

$.625 - .65$

$-.025$

$.625 + .65$

$1.275$

$1.275$ sec