Warm-Up Solve for x in as many different ways as you can

$f(x) = -2x^2 - x + 10 = 0$

① Factor

$\times$ -20	$(-5, 4)$
$+$ -1	-1

$(-2x^2 - 5x)(+4x + 10) = 0$

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

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

$-x+2 = 0$ $\quad$ $2x+5 = 0$

$x = 2$ $\quad$ $2x = -5$

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

Check? $x = 2$

$-2(2)^2 - 2 + 10 = 0$

$-8 - 2 + 10 = 0$

$0 = 0$ ✓

$x = -5/2$

$-2\left(-\frac{5}{2}\right)^2 - \left(-\frac{5}{2}\right) + 10 = 0$

$-2\left(\frac{25}{4}\right) + \frac{5}{2} + 10$

$-\frac{25}{2} + \frac{5}{2} + 10$

$-\frac{20}{2} + 10$

$0 = 0$ ✓

② Complete Square

$-2\left[\left(x^2 + \frac{1}{2}x + k\right) - k\right] + 10 = 0$

$\left(\frac{1}{2}\left(\frac{1}{2}\right)\right)^2 = \left(\frac{1}{4}\right)^2 = \frac{1}{16}$

$-2\left[\left(x^2 + \frac{1}{2}x + \frac{1}{16}\right) - \frac{1}{16}\right] + 10 = 0$

$-2\left[\left(x + \frac{1}{4}\right)^2 - \frac{1}{16}\right] + 10 = 0$

$-2\left(x + \frac{1}{4}\right)^2 + \frac{1}{8} + 10 = 0$

$-2\left(x + \frac{1}{4}\right)^2 + \frac{81}{8} = 0$

$\div -2$ $\quad -2\left(x + \frac{1}{4}\right)^2 = -\frac{81}{4}$ $\quad \div -2$

$\left(x + \frac{1}{4}\right)^2 = \frac{81}{16}$

$x + \frac{1}{4} = \pm\sqrt{\frac{81}{16}}$

$x = -\frac{1}{4} \pm \sqrt{\frac{81}{16}}$

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

$x = -\frac{1}{4} + \frac{9}{4} = 2$

$= -\frac{1}{4} - \frac{9}{4} = -\frac{10}{4} = -\frac{5}{2}$

3.1 & 3.2 Solving quadratic Equations

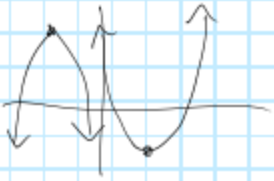
The answers to the equation:
$f(x) = -2x^2 - x + 10 = 0$ have different names.

$x = 2, -\frac{5}{2}$ are Called: Solutions to $f(x) = 0$
Zeros of $f(x)$
roots of $f(x)$

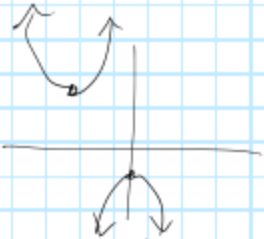
$(-x+2)$ and $(2x+5)$ are factors of $f(x)$

$(2, 0)$ and $(-\frac{5}{2}, 0)$ are x-intercepts of $f(x)$

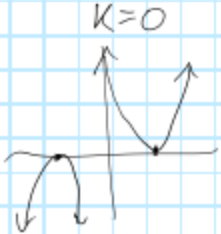
For quadratics we can have 0, 1 or 2 solutions.



2 Solutions



0 Solutions



1 Solution

Ex! Solve by factoring then check answers. (3.1)

a) $6x^2 + 10 = 7x + 8$

$6x^2 - 7x + 2 = 0$ ← you need to make one side equal zero

⊗ 12 | (-3, -4) | -7

⊕ -7

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

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

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

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

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

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

Check? $x = \frac{1}{2}$

$6\left(\frac{1}{2}\right)^2 + 10 = 7\left(\frac{1}{2}\right) + 8$

$\frac{6}{4} + 10 = \frac{7}{2} + 8$

$\frac{2}{2} + \frac{20}{2} = \frac{7}{2} + \frac{16}{2}$

$\frac{23}{2} = \frac{23}{2}$ ✓

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

$6\left(\frac{2}{3}\right)^2 + 10 = 7\left(\frac{2}{3}\right) + 8$

$\frac{24}{9} + 10 = \frac{14}{3} + 8$

$\frac{8}{3} + \frac{30}{3} = \frac{14}{3} + \frac{24}{3}$

$\frac{38}{3} = \frac{38}{3}$ ✓

b) $\frac{-11}{x} + \frac{4x}{x-3} = \frac{36}{x^2-3x}$

$x \neq 0, 3$

$x(x-3)\left(\frac{-11}{x} + \frac{4x}{x-3}\right) = \left(\frac{36}{x(x-3)}\right)x(x-3)$

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

$\frac{0}{0} \neq 1$

$-11(x-3) + 4x(x) = 36$

$-11x + 33 + 4x^2 = 36$

$4x^2 - 11x + 33 = 36$

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

⊗ -12 | $(-12, 1)$

⊕ -11 | -11

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

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

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

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

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

Check? $x=3$

Check? $x=3$

$$\frac{-11}{3}+\frac{4(3)}{3-3}=\frac{36}{3^2-3(3)}$$

$$\frac{-11}{3}+\frac{12}{0}=\frac{36}{0}$$

↳ undefined

$x=3$ is NOT a solution

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

$$\frac{-11}{-\frac{1}{4}}+\frac{4\left(-\frac{1}{4}\right)}{-\frac{1}{4}-3}=\frac{36}{\left(-\frac{1}{4}\right)^2-3\left(-\frac{1}{4}\right)}$$

$$44+\frac{-1}{\left(-\frac{13}{4}\right)}=\frac{36}{\frac{1}{16}+\frac{3}{4}}$$

$$44+\frac{4}{13}=\frac{36}{\frac{13}{16}}$$

$$44+\frac{4}{13}=\frac{576}{13}$$

$$\frac{576}{13}=\frac{576}{13}$$ ✓ (1) Nice!

Ex 2 Solve by Completing the Square, then check answers (3.2)

$$2x^2+14x+40=-2x+8$$ (−8 on both sides)

$$2x^2+14x+32=-2x$$ (+2x on both sides)

$$2x^2+16x+32=0$$

$$2\left[(x^2+8x+\_\_)-\_\_\right]+32=0$$

$\left(\frac{1}{2}(8)\right)^2=(4)^2=16$

$\left(\frac{1}{2}(8)\right)^2 = (4)^2 = 16$

$$2\left[(x^2+8x+16)-16\right]+32=0$$

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

$$\div 2 \quad 2(x+4)^2 = 0 \quad \div 2$$

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

$$x+4 = \pm 0$$

$$x = -4 \pm 0$$

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

Check

$$2(-4)^2 + 14(-4) + 40 = -2(-4) + 8$$

$$32 - 56 + 40 = 8 + 8$$

$$16 = 16 \checkmark$$

(1) ✓ woot!