

Warm-UpSolve for  $x$  in as many different ways as you can

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

① Factor

$$\otimes \begin{array}{c|c} -20 & (4, -5) \\ \hline \oplus & -1 \quad -1 \end{array}$$

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

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

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

$$\begin{array}{l} \uparrow \quad \quad \quad \uparrow \\ x-2=0 \quad -2x-5=0 \\ \underline{x=2} \quad \quad \underline{-2x=-5} \\ \quad \quad \quad \underline{x=-\frac{5}{2}} \end{array}$$

Check!  $x=2$ 

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

$$-8 - 2 + 10 = 0$$

$$0 = 0 \quad \checkmark$$

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

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

$$-2\left(\frac{25}{4}\right) + \frac{5}{2} + 10 = 0$$

$$-\frac{25}{2} + \frac{5}{2} + 10 = 0$$

$$-\frac{20}{2} + 10 = 0$$

$$-10 + 10 = 0$$

$$0 = 0 \quad \checkmark \quad \textcircled{11} \quad \text{woot!}$$

② Completing the Square

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

$$\textcircled{ii} \sqrt{1x} = \sqrt{x^2} = x \quad \textcircled{i} \left(\frac{1}{2}\left(\frac{1}{2}\right)\right)^2 = \frac{1}{16}$$

$$\sqrt{\text{last}} = \sqrt{k}$$

$$\frac{1}{2}x = \oplus 2(\sqrt{k})$$

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

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

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

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

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

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

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

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

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

$$x = -\frac{1}{4} + \frac{9}{4} = \frac{8}{4} = \boxed{2}$$

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

### 3.1/3.2 Solving Quadratic Equations

The answers to the equation:

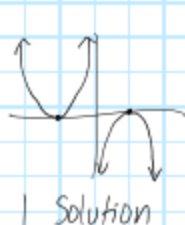
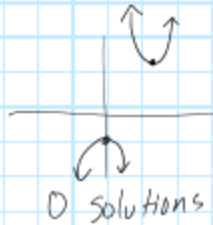
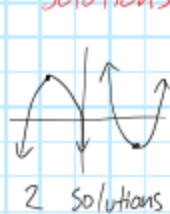
$$f(x) = -2x^2 - x + 10 \quad \text{have different names.}$$

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

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

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

For quadratics, we can have 2, 1 or 0  
Solutions



Ex 1 Solve by factoring, then check  
your answers

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

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

$$\textcircled{2} \begin{array}{r} 12 \phantom{0} \\ -(-3, -4) \end{array}$$

$$\textcircled{1} \begin{array}{r} -7 \phantom{0} \\ -(-7) \end{array}$$

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

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

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

$$\begin{aligned} \uparrow \\ 2x-1=0 \\ x=1/2 \end{aligned}$$

$$\begin{aligned} \uparrow \\ 3x-2=0 \\ x=2/3 \end{aligned}$$

Check  $x=1/2$

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

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

$$\frac{3}{2} + \frac{20}{2} = \frac{7}{2} + \frac{16}{2}$$

$$\frac{23}{2} = \frac{23}{2} \quad \checkmark$$

$x=2/3$

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

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

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

$$\frac{38}{3} = \frac{38}{3} \quad \checkmark$$

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

$$x \neq 0 \text{ or } 3$$

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

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

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

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

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

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

$$\textcircled{\otimes} \begin{array}{r|l} -12 & (-12, 1) \end{array}$$

$$\textcircled{\oplus} \begin{array}{r|l} -11 & -11 \end{array}$$

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

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

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

$$\begin{array}{l} \uparrow \quad \quad \quad \uparrow \\ 0 \quad \quad \quad 0 \\ x-3=0 \quad 4x+1=0 \\ \underline{x=3} \quad \quad \underline{x=-\frac{1}{4}} \end{array}$$

Check  $x=3$

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

$$\frac{-11}{3} + \frac{12}{0} = \frac{36}{0} \quad \leftarrow \text{undefined}$$

$x=3$  is NOT  
a solution!

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

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

$$44 + \frac{-1}{-\frac{13}{4}} = \frac{36}{\frac{1}{16} + \frac{3}{4}}$$

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

$$\frac{572}{13} + \frac{4}{13} = \frac{576}{13}$$

$$\frac{576}{13} = \frac{576}{13} \quad \checkmark$$

Ex 2 Solve by Completing the Square then  
Check answers

$$2x^2 + 14x + 40 = -2x + 8$$

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

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

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

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

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

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

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

$$x+4 = \pm 0$$

$$x = -4 \pm 0$$

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

Check

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

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

$$\underline{16 = 16} \quad \checkmark$$