## Completing the Square Notes

Some quadratic equations in the form of $\boldsymbol{a} \boldsymbol{x}^{2}+\boldsymbol{b} \boldsymbol{x}+\boldsymbol{c}=\mathbf{0}$ can be solved easily by factoring. For example, the equation $\boldsymbol{x}^{\mathbf{2}}+\mathbf{6 x}-\mathbf{1 6}=\mathbf{0}$ can be factored easily to $(\boldsymbol{x}+\mathbf{8})(\boldsymbol{x}-\mathbf{2})=\mathbf{0}$ to give solutions of $x=-\mathbf{8}$ and $\boldsymbol{x}=\mathbf{2}$

When a quadratic equation cannot be factored using integers, you have two options. You can use the quadratic formula of you can use a method called completing the square. When $\mathrm{a}=1$, completing the square is the way to go (when a $>1$, use the quadratic formula).

Example 1: Solve $\boldsymbol{x}^{\mathbf{2}}+\mathbf{8 x} \mathbf{x} \mathbf{1 0}=\mathbf{0}$ by completing the square.

| Since it cannot be factored using integers, Write the equation in the form $a x^{2}+b x=-c$ | $x^{2}+8 x-10=0$ $x^{2}+8 x=10$ |
| :---: | :---: |
| Find $\frac{\mathbf{1}}{\mathbf{2}}$ of $\boldsymbol{b}$ and add the square of that number $\left(\frac{\boldsymbol{b}}{\mathbf{2}}\right)^{\mathbf{2}}$ to both sides of the equation | $\begin{aligned} & \text { Think } b=8 \\ & \frac{1}{2} b=4 \text { and } 4^{2}=16 \\ & x^{2}+8 x=10 \\ & x^{2}+8 x+16=10+16 \end{aligned}$ |
| The left side is now a perfect square trinomial (PST), so factor it. | $(x+4)(x+4)=26$ $(x+4)^{2}=26$ |
| Find the square root of each side. | $\begin{aligned} & (x+4)^{2}=26 \\ & x+4= \pm \sqrt{26} \end{aligned}$ |
| Solve for x | $x=-4 \pm \sqrt{26}$ |
| Use a calculator to approximate the solutions, if necessary | $x \approx-4 \pm 5.099$ $x \approx 1.099 \text { or }-9.099$ |

