

## 5.4 Completing the Square

- Obj:
1. Use completing the square to solve quadratic eqns.
  2. Use vertex form to locate the axis of symmetry.

Factor

$$\begin{aligned} & *x^2 + 2x + 1 \\ & \underline{\hspace{1.5cm}} \\ & \quad \quad \quad \uparrow \\ & (x+1)(x+1) \\ & * \underline{(x+1)^2} \end{aligned}$$

Nov 14-11:02 AM

## Complete the Square

$$x^2 + \frac{b}{8+8}x + \frac{(\frac{1}{2}b)^2}{8 \cdot 8}$$

$$\begin{aligned} & (x+8)(x+8) \\ & (x+8)^2 \end{aligned}$$

$$\begin{aligned} & \textcircled{x^2} + \underline{6}x + \textcircled{3^2} \\ & \quad \quad \quad (x+3)(x+3) \\ & \quad \quad \quad \underline{(x+3)^2} \end{aligned}$$

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$$\begin{aligned} & \textcircled{x}^2 - 7x + \frac{\left(\textcircled{-\frac{7}{2}}\right)^2}{\left(x - \frac{7}{2}\right)^2} \\ & x^2 + 15x + \frac{\left(\frac{15}{2}\right)^2}{\left(x + \frac{15}{2}\right)^2} \\ & x^2 - 3x + \frac{\left(-\frac{3}{2}\right)^2}{\left(x - \frac{3}{2}\right)^2} \end{aligned}$$

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Solve

$$x^2 + 6x - 16 = 0$$

1.  $x^2 + 6x = 16$

3.  $\textcircled{x^2} + 6x + \textcircled{3^2} = 16 + 9$

4.  $\sqrt{(x+3)^2} = \sqrt{25}$

5.  $x+3 = \pm 5$   
 $\quad -3 \quad -3$   
 $x = -3 \pm 5$   
 $x = -3 + 5 \quad x = -3 - 5$   
 $\boxed{x=2} \quad \boxed{x=-8}$

1. Everything w/ x on one side.
2. Coeff. of  $x^2$  is a 1
3. Add  $\left(\frac{1}{2}b\right)^2$  to both sides
4. Write as a perfect sq. (factor)
5. Solve

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Solve.

$$x^2 + 10x - 24 = 0$$

+24   +24

$$x^2 + 10x = 24$$

$$(x^2 + 10x + 5^2) = 24 + 25$$

$$\sqrt{(x+5)^2} = \sqrt{49}$$

$$x+5 = \pm 7$$

-5   -5

$$x = -5 \pm 7$$

$$x = -5 + 7 \quad x = -5 - 7$$

$$\boxed{x = 2 \quad x = -12}$$

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Solve:

$$x^2 + 18x - 40 = 0$$

+40   +40

$$x^2 + 18x = 40$$

$$(x^2 + 18x + 9^2) = 40 + 81$$

$$\sqrt{(x+9)^2} = \sqrt{121}$$

$$x+9 = \pm 11$$

-9   -9

$$x = -9 \pm 11$$

$$x = -9 + 11 \quad x = -9 - 11$$

$$\boxed{x = 2 \quad x = -20}$$

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Solve:

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

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

$$2(x^2 + 3x) = 7 \quad \frac{14}{2} \quad 1 \cdot 2 \left( \frac{9}{4} \right)$$

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

$$\frac{1}{2} \left( 2 \left( x + \frac{3}{2} \right)^2 \right) = \left( \frac{23}{2} \right) \frac{1}{2}$$

$$\sqrt{\left(x + \frac{3}{2}\right)^2} = \sqrt{\frac{23}{4}}$$

$$x + \frac{3}{2} = \pm \sqrt{\frac{23}{4}}$$

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

$$x = -\frac{3}{2} \pm \sqrt{\frac{23}{4}}$$

$$-\frac{3}{2} \pm \frac{\sqrt{23}}{2}$$

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Standard Form

$$y = ax^2 + bx + c$$

Vertex Form

$$y = a(x-h)^2 + k$$

vertex: (h, k)

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Write in vertex form:  $y = a(x-h)^2 + k$

$$g(x) = 2x^2 + 12x + 13 = 0$$

$$2x^2 + 12x = -13$$

$$2(x^2 + 6x) = -13$$

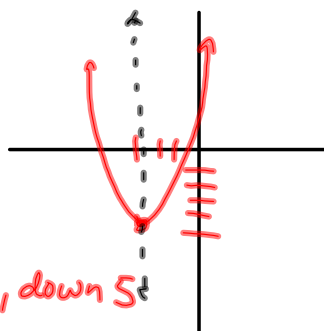
$$2(x^2 + 6x + 3^2) = -13 + 2(9)$$

$$g(x) = 2(x+3)^2 = 5$$

$$g(x) = 2(x+3)^2 - 5$$

$$V: (-3, -5)$$

v. str. by 2, left 3, down 5



$$\text{axis: } x = -3$$

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