

Complete the square:

$$x^2 - 7x + \frac{49}{4} = \left(x - \frac{7}{2}\right)^2$$

Handwritten annotations:   
 - Above the fraction  $\frac{49}{4}$ :  $2^{nd} \left(\frac{b}{2}\right)^2$  with an arrow pointing to the fraction.   
 - Below the fraction  $\frac{49}{4}$ :  $1^{st} \frac{b}{2}$  with an arrow pointing to the fraction.   
 - The fraction  $\frac{49}{4}$  is written in blue.   
 - The term  $\frac{7}{2}$  inside the square is written in blue.

Solve by completing the square.

$$x^2 + 22x = 5$$

$$x^2 + 22x + 121 = 5 + 121$$

$$\frac{b}{2} \rightarrow (x + 11)^2 = 126$$

Handwritten annotations:   
 - Above the equation  $x^2 + 22x = 5$ , the term  $\left(\frac{b}{2}\right)^2$  is written in purple with an arrow pointing to the constant term 5.   
 - The numbers 121 and 121 in the second equation are enclosed in purple boxes.   
 - The fraction  $\frac{b}{2}$  is written in blue with an arrow pointing to the number 11 in the third equation.

Now solve using Square Roots

Solve by Completing the Square:

1. Get the equation into the following form:  $x^2 + bx = c$
2. Complete the square so the equation becomes:  $(x - h)^2 = k$
3. Solve for x using Square Roots.

$$ax^2 + bx = c$$

Solving by completing the square works best if:

1.  $a = 1$
2.  $b$  is even

Solve by Completing the Square.

$$x^2 - 8x - 11 = 0$$

$+11 \quad +11$

$$x^2 - 8x + 16 = 11 + 16$$

$$\sqrt{(x-4)^2} = \sqrt{27}$$

$$x-4 = \pm\sqrt{27} = \pm 3\sqrt{3}$$

$+4 \quad +4$

$$x = 4 \pm 3\sqrt{3}$$

Solve by Completing the Square.

$$x^2 - 6x - 29 = 11$$

$+29 \quad +29$

$$x^2 - 6x + 9 = 40 + 9$$

$$\sqrt{(x-3)^2} = \sqrt{49}$$

$$x-3 = \pm 7$$

$+3 \quad +3$

$$x = 10, -4$$

Solve by Completing the Square.

$$-x^2 - 4x + 1 = -13$$

$-1 \quad -1$

$$-x^2 - 4x = -14$$

$-1 \quad -1$

$$x^2 + 4x + 4 = 14 + 4$$

$$\sqrt{(x+2)^2} = \sqrt{18}$$

$$x+2 = \pm\sqrt{18} = \pm 3\sqrt{2}$$

$-2 \quad -2$

$$x = -2 \pm 3\sqrt{2}$$

Solve by Completing the Square.

$$x^2 + 10x = -21$$

$$x^2 + 10x + 25 = -21 + 25$$

$$\sqrt{(x+5)^2} = \sqrt{4}$$

$$x+5 = \pm 2$$

$-5 \quad -5$

$$x = -3, -7$$

Solve by Completing the Square.

$$x^2 - 6x + 23 = 0$$

- 2 3      - 2 3

$$x^2 - 6x + 9 = -23 + 9$$

$$\sqrt{(x-3)^2} = \sqrt{-14}$$

$$x-3 = \pm i\sqrt{14}$$

+3      +3

$$x = 3 \pm i\sqrt{14}$$

Solve by Completing the Square.

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

$$\frac{-x^2 + 3x}{-1} = \frac{11}{-1}$$

$$x^2 - 3x + \frac{9}{4} = -11 + \frac{9}{4} \rightarrow -\frac{11}{1} \cdot \frac{4}{4} + \frac{9}{4} = \frac{-44}{4} + \frac{9}{4} = \frac{-35}{4}$$

$$\sqrt{\left(x - \frac{3}{2}\right)^2} = \sqrt{\frac{-35}{4}}$$

$$x - \frac{3}{2} = \frac{\pm i\sqrt{35}}{2} + \frac{3}{2}$$

$$x = \frac{3}{2} \pm \frac{i\sqrt{35}}{2} \text{ or } \frac{3 \pm i\sqrt{35}}{2}$$

Solve by Completing the Square.

$$2x^2 - 36x + 10 = 0$$

-10      -10

$$\frac{2x^2 - 36x}{2} = \frac{-10}{2}$$

$$x^2 - 18x + 81 = -5 + 81$$

$$\sqrt{(x-9)^2} = \sqrt{76} \rightarrow 4 \cdot 19$$

$$x-9 = \pm 2\sqrt{19}$$

+9      +9

$$x = 9 \pm 2\sqrt{19}$$

Solve by Completing the Square.

$$2x^2 + 7x - 5 = 0$$

+5      +5

$$\frac{2x^2 + 7x}{2} = \frac{5}{2}$$

$$x^2 + \frac{7}{2}x + \frac{49}{16} = \frac{5}{2} + \frac{49}{16} \rightarrow \frac{5}{2} \cdot \frac{8}{8} + \frac{49}{16} = \frac{40}{16} + \frac{49}{16} = \frac{89}{16}$$

$$\sqrt{\left(x + \frac{7}{4}\right)^2} = \sqrt{\frac{89}{16}}$$

$$x + \frac{7}{4} = \frac{\pm \sqrt{89}}{4} - \frac{7}{4}$$

$$x = -\frac{7}{4} \pm \frac{\sqrt{89}}{4} \text{ or } \frac{-7 \pm \sqrt{89}}{4}$$

Find the coordinates of the Vertex then rewrite the equation into Vertex Form.

$y = x^2 + 10x - 7$   
 $a = 1$   
 $\text{LOS } x = \frac{-10}{2} = -5$   
 $\text{Vertex } (-5, -32)$   
 $(-5)^2 + 10(-5) - 7$   
 $y = 1(x+5)^2 - 32$

Rewrite the equation into Vertex Form by Completing the Square.

$y = x^2 + 10x - 7$   
 $+7$        $+7$       1st: Move the 7 to the left side of the equation  
 $y + 7 + 25 = x^2 + 10x + 25$       2nd: Complete the square by adding 25 to both sides of the equation  
 $y + 32 = (x + 5)^2$       3rd: Move the 32 back to the right side of the equation  
 $y = (x + 5)^2 - 32$

You can now finish Hwk #20

Sec 5-7

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