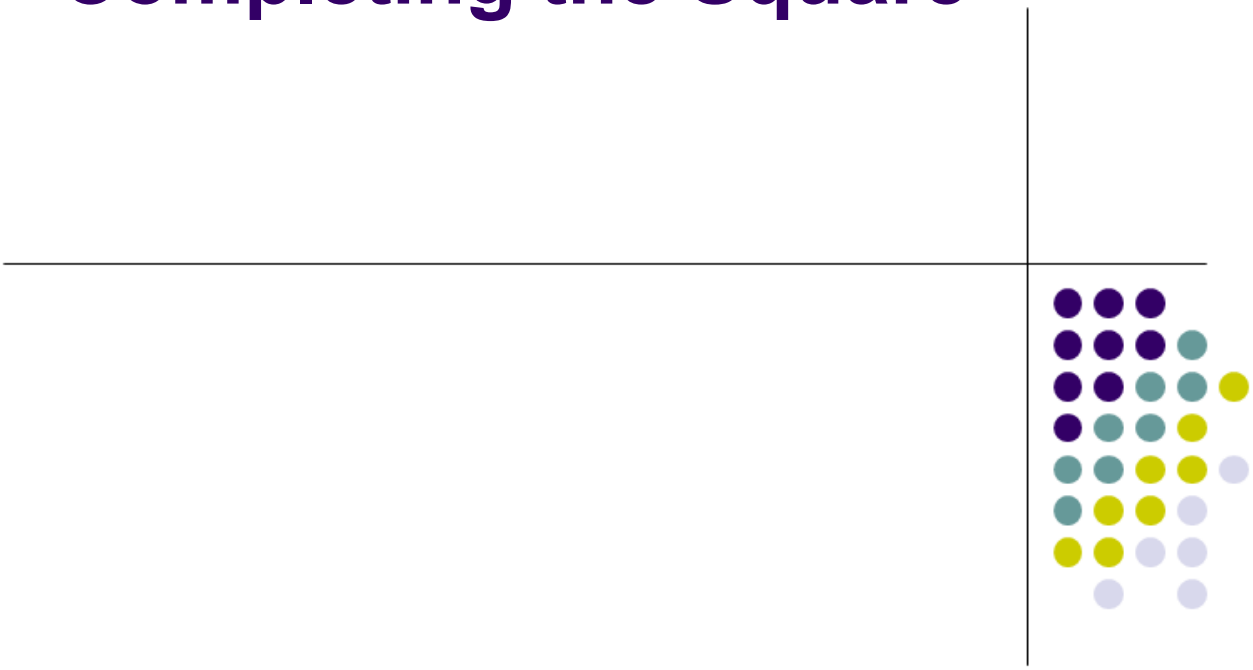
Completing the Square



Completing the square

- Process by which you force a quadratic expression to factor
- $(x-2)^2$ $(x+3)^2$ x^2+10x

Complete the square to find the vertex form.

$y = \overset{a}{x^2} + \overset{b}{10}x - \overset{c}{24}$

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

① Move "c" to the other side of the eq.

$x^2+10x \quad = y+24$

② factor out "a"

$\left(\frac{10}{2}\right)^2 = 25$

③ find the new "c" $\left(\frac{b}{2}\right)^2$

$x^2+10x+25 = y+24+25$

Add the new "c" to both sides

$(x+5)(x+5)$

$(x+5)^2 = y+49$

④ factor the trinomial

Vertex form

$(x+5)^2-49=y$

$(x--5)$

V: $(-5,-49)$

AOS: $x=-5$

Min $=-49$

Bring "c" back over

Solve

$(x+5)^2 = 0+49$

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

$x+5 = \pm 7$

-5

$x = -5 \pm 7$

$x = -5+7 = 2$

$x = -5-7 = -12$

Vertex form

$$f(x) = (x-h)^2+k$$

vertex = (,)

AOS x=

Max/Min =

Complete the square to find the vertex form.

$$f(x) = x^2 - 12x + 5$$

$x^2 - 12x + 5 = y$

$x^2 - 12x = y - 5$

$x^2 - 12x + 36 = y - 5 + 36$ $\left(\frac{-12}{2}\right)^2 = 36$

$(x-6)^2 = y + 31$

Vertex form

$(x-6)^2 - 31 = y$

V: $(6, -31)$

AOS $x = 6$

min: -31

Solve

$(x-6)^2 = 0 + 31$

$\sqrt{(x-6)^2} = \sqrt{31}$

$x - 6 = \pm\sqrt{31}$

$+6$

$x = 6 \pm \sqrt{31}$

Complete the square to find the vertex form.

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

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

$2x^2 + 6x = y + 16$

$2(x^2 + 3x + \frac{9}{4}) = y + 16 + \frac{18}{4}$

new "c" $(\frac{3}{2})^2$

$2(x + \frac{3}{2})^2 = y + \frac{82}{4}$

$\frac{2(x + \frac{3}{2})^2}{2} = \frac{0 + \frac{82}{4} \div 2}{2}$ Solve

$(x + \frac{3}{2})^2 = \frac{82}{8}$

$\sqrt{(x + \frac{3}{2})^2} = \sqrt{\frac{41}{4}}$

$x + \frac{3}{2} = \pm \frac{\sqrt{41}}{2}$

$-\frac{3}{2}$

$x = -\frac{3}{2} \pm \frac{\sqrt{41}}{2}$

Complete the square to find the vertex form.

$$f(x) = -2x^2 + 8x - 7$$

$-2x^2 + 8x = y + 7$

$-2(x^2 - 4x + 4) = y + 7 - 8$

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

$-2(x-2)^2 = y - 1$

$\frac{-2(x-2)^2}{-2} = \frac{-1}{-2}$

$\sqrt{(x-2)^2} = \sqrt{\frac{1}{2}}$

$x - 2 = \pm\sqrt{\frac{1}{2}}$

$\sqrt{\frac{1}{2}} = \frac{\sqrt{1}}{\sqrt{2}} = \frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \pm\frac{\sqrt{2}}{2}$

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

$+2 \quad +2$

$x = 2 \pm \frac{\sqrt{2}}{2}$

Complete the square to find the vertex form.

$$y = 3x^2 - 9x + 2$$

$3x^2 - 9x = y - 2$

$3(x^2 - 3x + \frac{9}{4}) = y - 2 + \frac{27}{4}$

$(x \quad)(x \quad) \quad (-\frac{3}{2})^2 = \frac{9}{4}$

-9, -3

$3(x - \frac{3}{2})^2 = y + \frac{19}{4}$

$\sqrt{(x - \frac{3}{2})^2} = \sqrt{\frac{19}{12}}$

$x - \frac{3}{2} = \pm\frac{\sqrt{19}}{\sqrt{12}}$

$\frac{\sqrt{19}}{2\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{57}}{6}$

$x = \frac{3}{2} \pm \frac{\sqrt{57}}{6}$