IB Math AA HL Chapter 2 Quadratic Equations, Functions and Inequalities Notes

Remember with quadratics the graph is a parabola. Parabolas are symmetric and the axis of symmetry is down the middle of the graph. A parabola can cross the x-axis once, twice or not at all. The point(s) where the graph crosses the x-axis are called the zeros of the function or the roots of the equation.

$y=(x-a)^2$ horizontal translation

$y=x^2+a$ vertical translation

$y=ax^2$ vertical reflection and vertical dilation

Different forms of quadratic functions/equations

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

Factored form $y=a(x-r_1)(x-r_2)$

Intercept form $y=(ax+b)(cx+d)$ intercepts $\left(\frac{-b}{a}\right)$ or $\left(\frac{-d}{c}\right)$

Turning point form (Vertex form) $y=a(x-p)^2+q$ turning point/vertex (p, q)

Quadratic formula: If $y=ax^2+bx+c$, then $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$.

Discriminant b^2-4ac Use the discriminant to determine the nature of the roots.

if $b^2-4ac>0$ 2 real roots

if $b^2-4ac=0$ 1 real root

if $b^2-4ac<0$ 2 complex roots

Sum and product of roots for quadratic equations: Sum: $-\frac{b}{a}$ Product: $\frac{c}{a}$

Completing the square: ax^2+bx+c

You Try: Complete the square.
$4x^2+40x+125$

1. Take out a, leaving the constant alone: $a\left(x^2+\frac{b}{a}x\right)+c$
2. Complete the square and factor: $a\left[\left(x+\frac{b}{2a}\right)^2-\left(\frac{b}{2a}\right)^2\right]+c$
3. Multiply out the outer bracket: $a\left(x+\frac{b}{2a}\right)^2-\frac{b^2}{2a}+c$
4. Tidy up the constants: $a\left(x+\frac{b}{2a}\right)^2-\left(\frac{b^2-4ac}{4a}\right)$

Graphing inequalities (linear or quadratic):

1. Graph as if the inequality was an equal sign.
2. Shade the solution area. (pick a point, use end behavior or read the inequality sign)