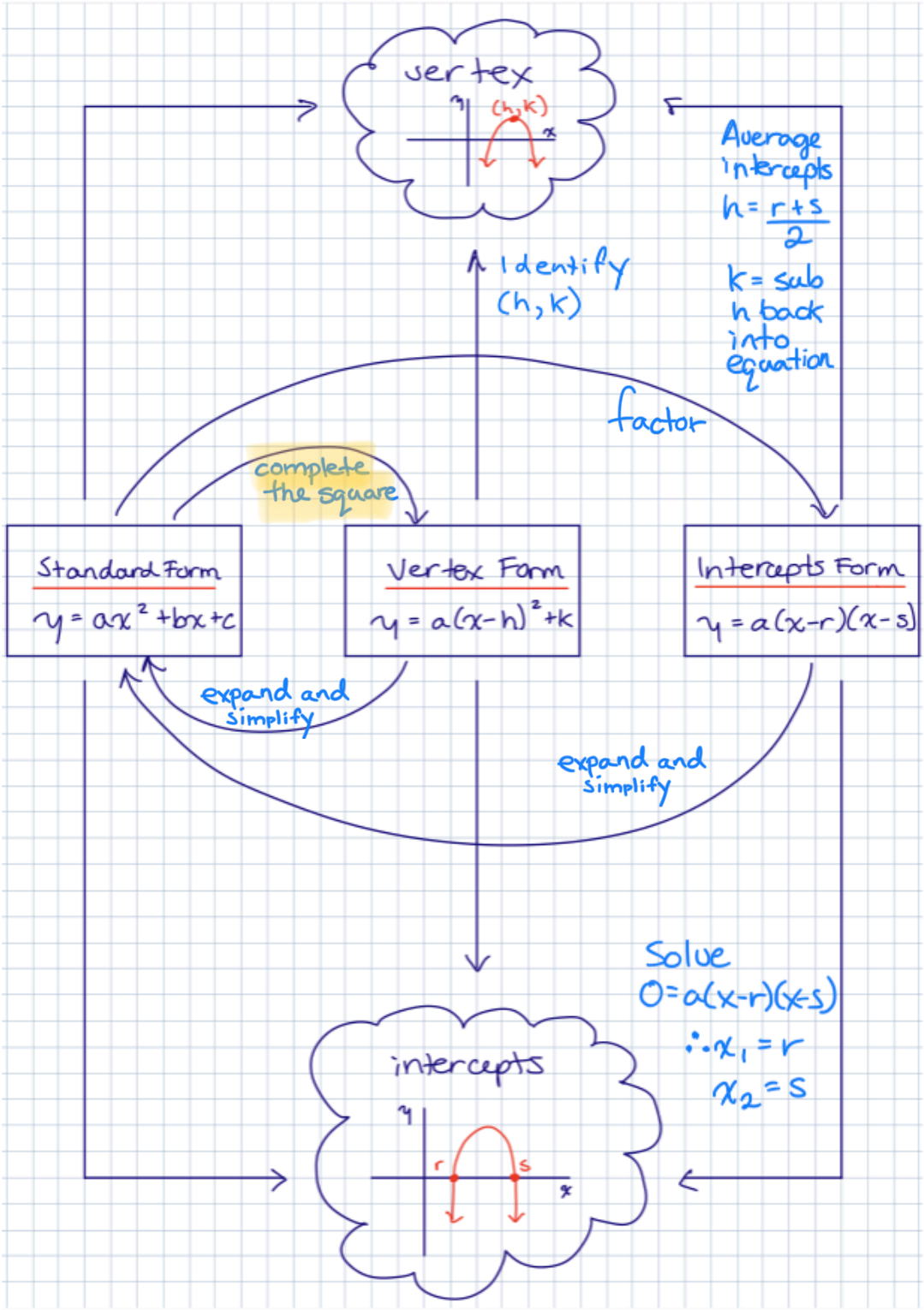
Standard Form to Vertex Form – Day 2

Quadratic Relations Concept Map



Recall When given a quadratic in the form $y = ax^2 + bx + c$ we complete the square to express it in the form $y = a(x-h)^2 + k$. This form is easier to graph and analyze .

Example 1 a) Write the following equation in the form $y = a(x-h)^2 + k$.

$y = x^2 - 8x + 19$ $\left(-\frac{8}{2}\right)^2 = (-4)^2 = 16$

$y = x^2 - 8x + 16 - 16 + 19$ Add and subtract the square of half the co-efficient of x

Group the perfect square trinomial.

$y = (x-4)^2 - 16 + 19$ Factor the perfect square trinomial (write as square of a binomial).

$y = (x-4)^2 + 3$ Simplify outside the brackets.

b) Analyze the relation.

opens: up

stretch/comp: none

vertex: (4, 3)

eq'n of axis of sym.: $x = 4$

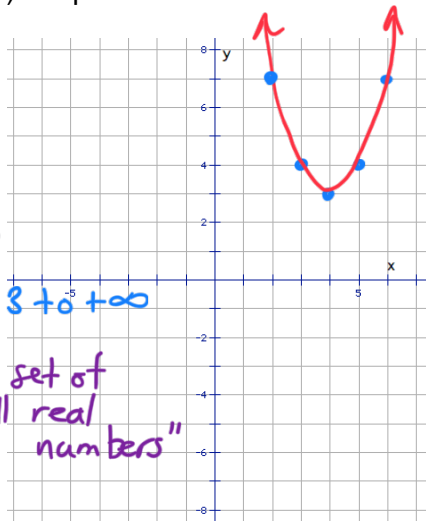
values x may take: $\mathbb{R}$ or $-\infty$ to $+\infty$

values y may take: $\{y \geq 3, y \in \mathbb{R}\}$ or 3 to $+\infty$

max/min val.:

minimum, 3 "greater than or equal to" "is an element of" "the set of all real numbers"

c) Graph the relation:



Example 2 a) Write the following equation in the form $y = a(x-h)^2 + k$.

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

$y = 2(x^2 + 2x) - 1$ Group the first two terms and factor out the co-efficient of x^2

$y = 2(x^2 + 2x + 1 - 1) - 1$ Inside the brackets, add and subtract the square of half the co-efficient of x

$y = 2((x+1)^2 - 1) - 1$ Factor the perfect square trinomial (first three terms inside brackets).

$y = 2(x+1)^2 - 2 - 1$ Distribute the number outside the large brackets to terms inside large brackets.

$y = 2(x+1)^2 - 3$ Simplify outside the brackets.

b) Analyze the relation.

opens: up

stretch/comp: stretch, factor of 2

vertex: $(-1, -3)$

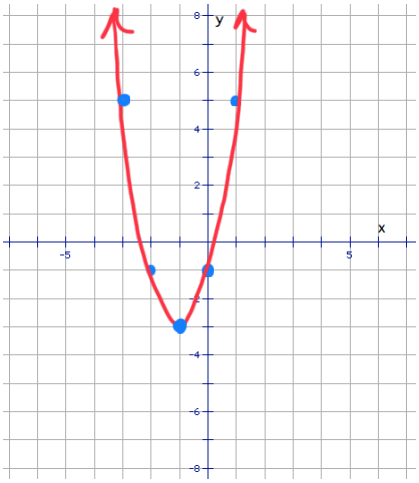
eq'n of axis of sym.: $x = -1$

values x may take: $\mathbb{R}$ or

values y may take: $\{y \geq -3, y \in \mathbb{R}\}$

max/min val.: minimum, -3

c) Graph the relation:



Example 3 a) Write the following equation in the form $y = a(x-h)^2 + k$.

$y = -3x^2 - 12x - 7$

$y = -3(x^2 + 4x) - 7$

$y = -3(x^2 + 4x + 4 - 4) - 7$

$y = -3((x+2)^2 - 4) - 7$

$y = -3(x+2)^2 + 12 - 7$

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

b) Analyze the relation.

opens: down

stretch/comp: stretch, factor of 3

vertex: $(-2, 5)$

eq'n of axis of sym.: $x = -2$

values x may take: $\mathbb{R}$

values y may take: $\{y \leq 5, y \in \mathbb{R}\}$ "less than or equal to"

max/min val.: maximum, 5

c) Graph the relation: