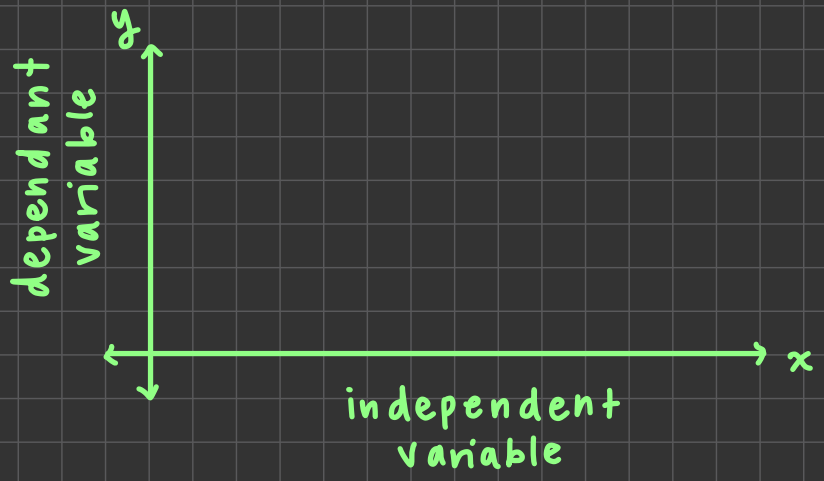
CHAPTERS 4, 5, 6

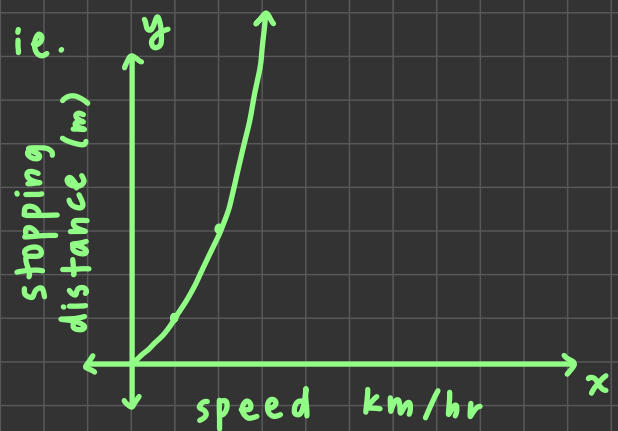
quadratic RELATIONS

quadratic

$x^0 = 1$, $x^{-y} = \frac{1}{x^y}$, $x^y = x^y$



ie.



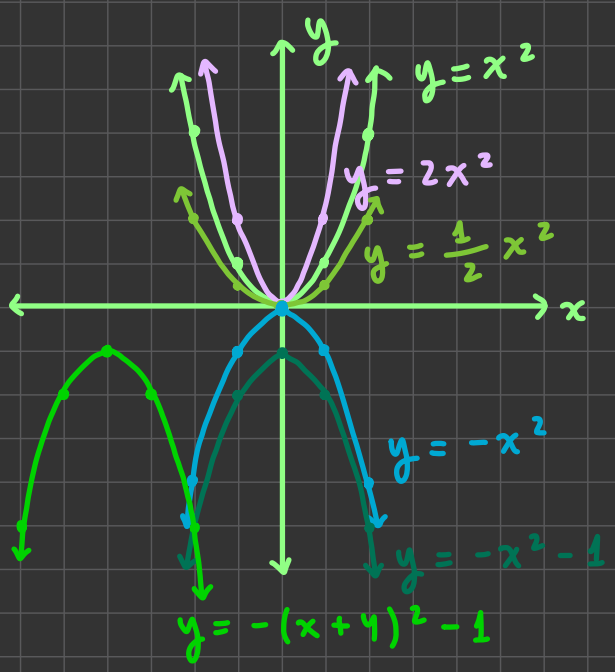
AXIS of SYMMETRY:

2 points: $(x_1, y), (x_2, y)$

midpoint = $\left(\frac{x_1 + x_2}{2}, y\right)$

axis of symmetry $\Rightarrow x = \frac{x_1 + x_2}{2}$

graphs of quadratic relations



$x = \frac{r+s}{2}$

↑ axis of symmetry

MAPPING NOTATION:

$4x^2 - 7$

$(x, y) \longrightarrow (x, 4y - 7)$

$3(x-1)^2 + 5$

$(x, y) \longrightarrow (x+1, 3y+5)$

$y = a(x-r)(x-s)$ form

$(r, 0)$ & $(s, 0)$ are x-intercepts

vertex $= \left(\frac{r+s}{2}, y\right)$

quadratic

quadratic

EXPRESSIONS

$(mx+n)(px+q)$
$= mpx^2 + mqx + npx + nq$
$= mpx^2 + (mq+np)x + nq$

$(4x-3)(2x+5)$
$= 8x^2 + 20x - 6x - 15$
$= 8x^2 + 14x - 15$

$x^2 + px + q$ to $(x-r)(x-s)$

$p = -r - s$ $\quad q = -r \cdot -s$
$p = -(r+s)$ $\quad q = rs$

$(mx+n)^2$
$= m^2x^2 + 2mnx + n^2$

$(m-n)(m+n)$
$= m^2 - n^2$

$(mx-n)^2$
$= m^2x^2 - 2mnx + n^2$

$m(x+p) + n(x+p)$
$= (x+p)(m+n)$

quadratic EQUATIONS

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

COMPLETING THE SQUARE examples

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

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

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

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

vertex $= (-2, -3)$

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

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

$y = 4(x^2 + 2x + 1 - 1) - 7$

$y = 4(x^2 + 2x + 1) - 4 - 7$

$y = 4(x+1)^2 - 11$

vertex $= (-1, -11)$

quadratic FORMULA

quadratic

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, \text{ where } ax^2 + bx + c = 0$$

axis of symmetry $\rightarrow$ $x = \dfrac{\dfrac{-b + \sqrt{b^2-4ac}}{2a} + \dfrac{-b - \sqrt{b^2-4ac}}{2a}}{2}$

$$x = \frac{-\frac{2b}{2a}}{2} = \frac{-\frac{b}{a}}{2} = -\frac{b}{2a} \rightarrow \text{axis of symmetry}$$

discriminant $\rightarrow$ $b^2 - 4ac$

- $b^2 - 4ac > 0$, 2 $\mathbb{R}$ solutions
- $b^2 - 4ac < 0$, no $\mathbb{R}$ solutions
- $b^2 - 4ac = 0$, 1 $\mathbb{R}$ solution / 2 equal $\mathbb{R}$ solutions