Calculus

Derivatives: varying rate of change of a func with respect to an independent variable. Primarily used when there is some varying quantity and rate of change is not constant. Slope of the tan at a point

Differentiation: Finding the derivative

Integration: Finding area under a curve of a func

*Differentiation enable us to split complex funcs, integration sums them in one unit.

$\mathbb{R}$
Real numbers: Numbers that can be expressed as decimals. which we denote

$\mathbb{Q}$
Rational Numbers: Numbers that can be expressed as a ratio

$\mathbb{N}$
Natural Numbers: All positive

$\mathbb{I}$ or $\mathbb{Q}^c$
Irrational Numbers: Real numbers which can't be expr as fraction

Imaginary Numbers: i, $\sqrt{-5}$ non real numbers

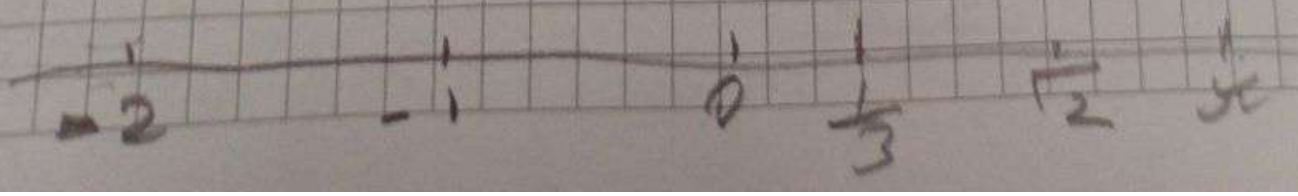
$\mathbb{Z}$
Integers:

$\mathbb{C}$
Complex Numbers: Real & imaginary num $a+bi$

Real numbers have obvious patterns. $-0,250$ 5.000

Imaginary Number don't have $\sqrt{2} = 1,4142\ldots$

Real num can be represented as points number line which we call Real Line



Supremum

for set $S = \{1, 2, 3, 4\}$

$\sup(S) = 4$

for $A = \{x : 0 < x < 1\}$

$\sup(A) = 1$

} sets of $\mathbb{R}$ subset

Infimum — least minimum

Cyclic number to fraction

$0,\overline{abc} = \frac{abc}{999}$

$0,b\overline{c} = \frac{abc - a}{990}$

Inequalities

if even piece not sign doesn't change

$(x-3)\cdot(x-3) > 0$

3

$+ \;|\; + \quad ax^2+bx+c$

if $b^2 - 4ac < 0$ at all $\mathbb{R}$ same sign with a.

for x^2 multiplying by $a \to 1$ shrinks the graph, $0 < a < 1$ expands

x^2 $\quad \frac{1}{5}x^2$

$ax^2 + bx + c$

$b^2 - 4ac = 0$

$x_1 = x_2 = \frac{-b}{2a}$

$\Delta = b^2 - 4ac$

$x_1 = \frac{-b + \sqrt{\Delta}}{2a}$

$x_2 = \frac{-b - \sqrt{\Delta}}{2a}$

$-\frac{b}{a} = x_1 + x_2$

$\frac{c}{a} = x_1 \cdot x_2$

Equadratic inequality → 2 directions

Union ∪ is in at least one interval

Intersection ∩ is occurs both

$[1,3) \cap [2,4] = [2,3)$

$[1,3) \cup [2,4] = [1,4]$

Absolute value

$$|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$$

$\sqrt{a^2} = |a|$

$|a \pm b| \leq |a| + |b|$

$|x| < D$

$\Rightarrow D < x < D$

$|x| > D$ either $x < -D$ or $x > D$

$|x - a| < D \rightarrow a - D < x < a + D$

Cartesian Coordinates

quadrants

II	I
$(-,+)$	$(+,+)$
III	IV
$(-,-)$	$(+,-)$

Increment is the net change in the value of variable

distances of two points

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$