

pomp's
Mathematics
cheat sheet

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made with Typst



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1. Algebra

1.1. Algebraic properties

Property	$\times$	$+$	$-$	$\div$
Commutative / $\boxtimes\boxtimes\boxtimes\boxtimes$	$\bullet$	$\bullet$		
Associative / $\boxtimes\boxtimes\boxtimes\boxtimes$	$\bullet$	$\bullet$		
Distributive / $\boxtimes\boxtimes\boxtimes\boxtimes$	$\bullet$			

1.1.1. Commutative / $\boxtimes\boxtimes\boxtimes\boxtimes$

$$a + b = b + a$$

$$a \cdot b = b \cdot a$$

1.1.2. Associative / $\boxtimes\boxtimes\boxtimes\boxtimes$

$$(a + b) + c = a + (b + c)$$

$$(a \cdot b) \cdot c = a \cdot (b \cdot c)$$

1.1.3. Distributive / $\boxtimes\boxtimes\boxtimes\boxtimes$

$$a \cdot (b + c) = ab + ac$$

1.2. Types of numbers

- $\mathbb{C}$ - Complex / $\boxed{\boxed{a + bi}}$
- $\mathbb{R}$ - Real / $\boxed{\boxed{a + bi}}$
 - $\mathbb{Q}$ - Rational / $\boxed{\boxed{\frac{p}{q}}}$ ($\frac{p}{q} | p, q \in \mathbb{Z}, q \neq 0$)
 - $\mathbb{Z}$ - Integer / $\boxed{\boxed{... , -1, 0, 1, ...}}$
 - $\mathbb{N}$ - Natural / $\boxed{\boxed{1, 2, 3, ...}}$
 - $\mathbb{W}$ - Whole ($0, 1, 2, ...$)
 - Irrational / $\boxed{\boxed{\pi, e, \sqrt{2}, ...}}$
- $\mathbb{I}$ - Imaginary / $\boxed{\boxed{a + bi}}$

Closed under

	$\mathbb{C}$	$\mathbb{R}$	$\mathbb{I}$	$\mathbb{Q}$	$\mathbb{Z}$	$\mathbb{N}$	$\mathbb{W}$
+	•	•	•	•	•	•	•
$\times$	•	•	•	•	•	•	•
-	•	•	•	•	•		
$\div$	•	•	•	•			

1.3. Tricks

1.3.1. Decimal termination test

Given simplified fraction of rational number $x = \frac{p}{q}$, if $q = 2^m \cdot 5^n \mid m, n \in \mathbb{Z}$, then decimal form of x is terminating.

1.3.2. Decimal-fraction conversion

To convert a repeating decimal number to fraction, use the following formula:

$$a.\overline{\text{bcd}} = \frac{abcd - ab}{990}$$

1.3.3. Multiplication

1.3.3.1. $x \times 11$

1.3.3.2. $x1 \times y1$

1.4. Simple Equations

1.4.1. Linear equation (slope-intercept form)

$$y = mx + b$$

1.4.2. Linear equation (point-slope form)

$$(y - y_1) = m(x - x_1)$$

1.4.3. Reciprocal functions

$$y = \frac{a}{x - h} + k$$

1.5. Notable numbers

1.5.1. π - Pi

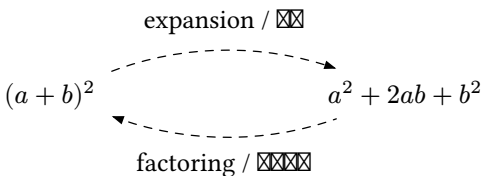
100 digits of pi:

$\pi = 3.1415\ 92\ 6535\ 8979\ 323\ 846\ 2643\ 3832\ 79\ 5028\ 841\ 971\ 693\ 993\ 7510\ 582\ 0974\ 944\ 592\ 3078\ 164\ 06\ 286\ 208\ 9986280348253421170679$

1.5.2. e - Euler's number

1.5.3. φ - Golden ratio

1.6. Factoring



1.6.1. Algebraic formulas

$$(ax + b)(cx + d) = acx^2 + (ad + bc)x + bd$$

$$(x + a)(x + b) = x^2 + (a + b)x + ab$$

$$(ax \pm b)^2 = a^2 \pm 2abx + b^2$$

$$\left(x \pm \frac{1}{x}\right)^2 = x^2 \pm 2 + \frac{1}{x^2}$$

$$a^2 \pm b^2 = (a \pm b)^2 \mp 2ab$$

$$a^2 - b^2 = (a + b)(a - b)$$

$$a^3 \pm b^3 = (a \pm b)(a^2 \mp ab + b^2)$$

$$\begin{aligned}(a \pm b)^3 &= a^3 \pm 3ab(a \pm b) \pm b^3 \\ &= a^3 \pm 3a^2b + 3ab^2 \pm b^3\end{aligned}$$

$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$$

1.6.2. Factoring quadratic equations

$$2x^2 - 7x + 3$$

$$\begin{array}{ccc} 2 & \nearrow & -1 = -1 \\ 1 & \searrow & -3 = -6 \end{array}$$

$$= (2x - 1)(x - 3)$$

$$= 2x^2 + (-6 - 1)x + 3$$

1.6.3. Quadratic formula

$$ax^2 + bx + c = 0$$

$$x^2 + \frac{b}{a}x + \frac{c}{a} = 0$$

$$x^2 + \frac{b}{a}x = -\frac{c}{a}$$

$$x^2 + 2\left(\frac{b}{2a}\right)x + \left(\frac{b}{2a}\right)^2 = -\frac{c}{a} + \left(\frac{b}{2a}\right)^2$$

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$

$$x + \frac{b}{2a} = \pm \frac{\sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

1.7. Logarithm

1.7.1. Exponential growth

1.7.2. Exponential decay

1.8. Conic sections

1.8.1. Point

1.8.2. Line

1.8.3. Parabola

1.8.4. Hyperbola

1.8.5. Ellipse

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1.9. Trigonometry

1.9.1. Trigonometric identities

1.10. Vector

1.11. Matrix

2. Calculus

2.1. Limit

2.2. Integral

2.3. Series

3. Geometry

4. Combinatorics

5. Statistics & Probability

5.1. Mean, median, and mode

5.2. Permutation & Combination

5.2.1. Permutation

$$\begin{aligned} & nPr \\ &= \frac{n!}{(n-r)!} \end{aligned}$$

5.2.2. Combination

- “n choose r”

$$\begin{aligned} & nCr \\ &= \frac{n!}{(n-r)!r!} \\ &= \frac{nPr}{r!} \\ &= \binom{n}{r} \end{aligned}$$

6. Set theory

7. Number theory

8. Miscellaneous

8.1. Dimension

8.2. Fourier transform