Diploma Programme

Mathematics mind map

Analysis and approaches SL

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Mathematics mind map

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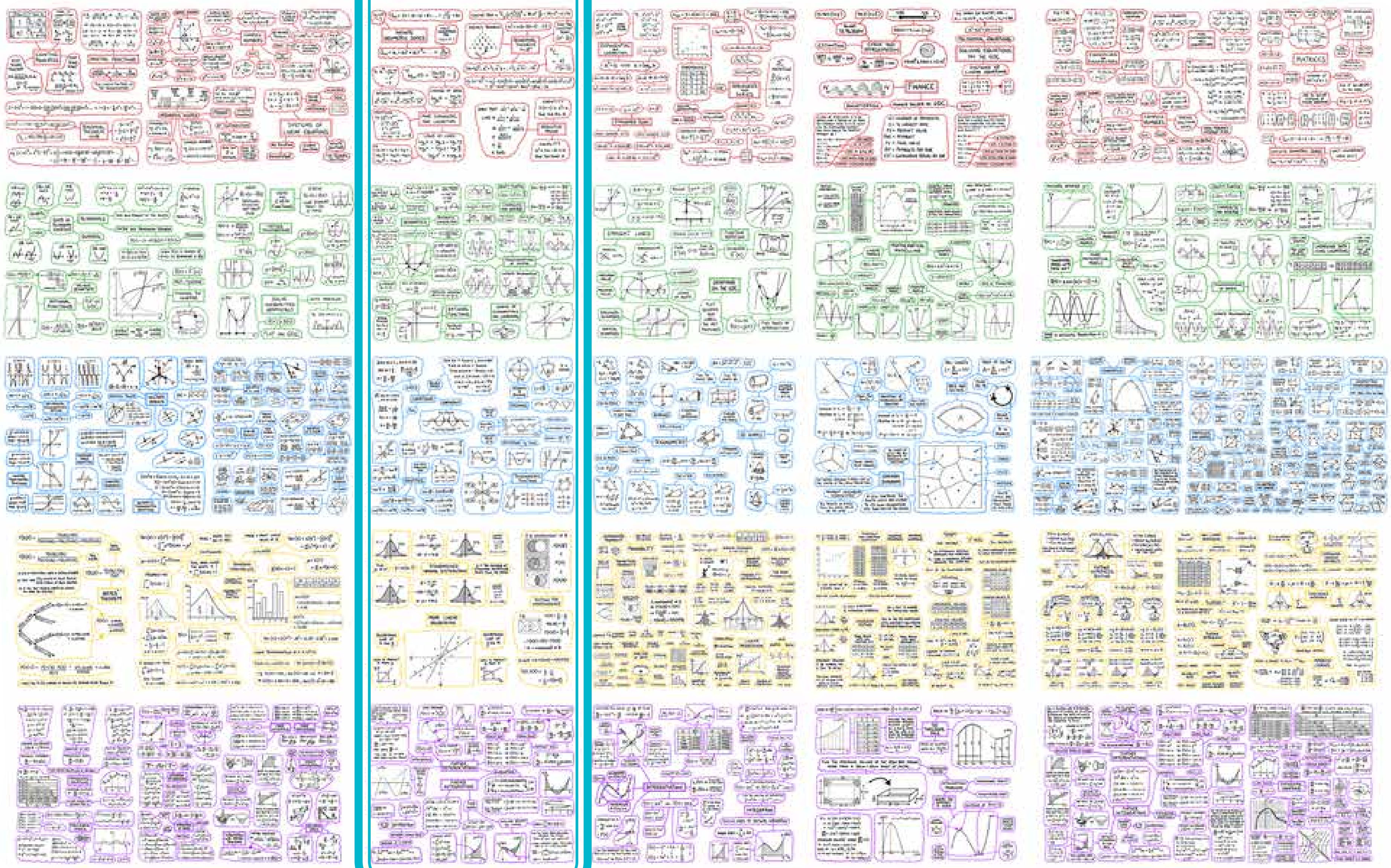
	Analysis and approaches AHL	Analysis and approaches SL	Common content	Applications and interpretation SL	Applications and interpretation AHL
Number and algebra					
Functions					
Geometry and trigonometry					
Statistics and probability					
Calculus					



Number and algebra

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Infinite geometric series

$u_1 = 27$, $r = \frac{2}{3}$

$S_\infty = 27 + 18 + 12 + 8 + \dots = \frac{27}{1-\frac{2}{3}} = 81$

Only converges for $-1 < r < 1$

$S_\infty = u_1 + u_1 r + u_1 r^2 + \dots = \frac{u_1}{1-r}$

Binomial theorem

$n \in \mathbb{Z}^+$

Constant term $= {}^9C_3 (x^2)^3 \left(\frac{-3}{x}\right)^6 = 84 x^6 \cdot \frac{3^6}{x^6} = 84 \times 3^6 = 61{,}236$

Find the constant term $\left(x^2 - \frac{3}{x}\right)^9$

$n! = n(n-1)(n-2)\dots 3.2.1$

Pascal's triangle

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1

${}^5C_3$ → 10

${}^nC_r = \frac{n!}{r!(n-r)!}$

$(a+b)^n = a^n + {}^nC_1 a^{n-1} b + \dots + {}^nC_r a^{n-r} b^r + \dots + b^n$

e.g. $(x-2)^5 = (x)^5 + 5(x)^4(-2)^1 + 10(x)^3(-2)^2 + 10(x)^2(-2)^3 + 5(x)^1(-2)^4 + (-2)^5$
$= x^5 - 10x^4 + 40x^3 - 80x^2 + 80x - 32$

More exponential and logarithm

Rational exponents

$a^{\frac{1}{m}} = \sqrt[m]{a} \Rightarrow a^{\frac{n}{m}} = (\sqrt[m]{a})^n = \sqrt[m]{a^n}$

e.g. $16^{3/4} = (\sqrt[4]{16})^3$
$= 2^3$
$= 8$

Change of base

$\log_b a = \frac{\log_c a}{\log_c b}$

e.g. $\log_{25} 125 = \frac{\log_5 125}{\log_5 25} = \frac{3}{2}$

Equations

e.g. $\left(\frac{1}{3}\right)^x = 9^{x+1}$
$(3^{-1})^x = (3^2)^{x+1}$
$3^{-x} = 3^{2x+2}$
$-x = 2x + 2$
$-2 = 3x \Rightarrow x = \frac{-2}{3}$

Laws of logs

$\log_a x + \log_a y = \log_a xy$

$\log_a x - \log_a y = \log_a \frac{x}{y}$

$\log_a x^n = n \log_a x$

e.g.
$\log 24 = \log 8 + \log 3$
$\log_3 \frac{10}{4} = \log_3 10 - \log_3 4$
$\log_4 3^5 = 5 \log_4 3$

Deductive proof

Identity

$x(x+1) \equiv x^2 + x$

True for all x

Equality

$x^2 + 3x - 10 = 0$

True for some x

Show that $\frac{1}{m+1} + \frac{1}{m^2+m} = \frac{1}{m}$

LHS $\equiv \frac{1}{m+1} + \frac{1}{m^2+m}$
$\equiv \frac{1}{m+1} + \frac{1}{m(m+1)}$
$\equiv \frac{m+1}{m(m+1)}$
$\equiv \frac{1}{m}$
$\equiv$ RHS

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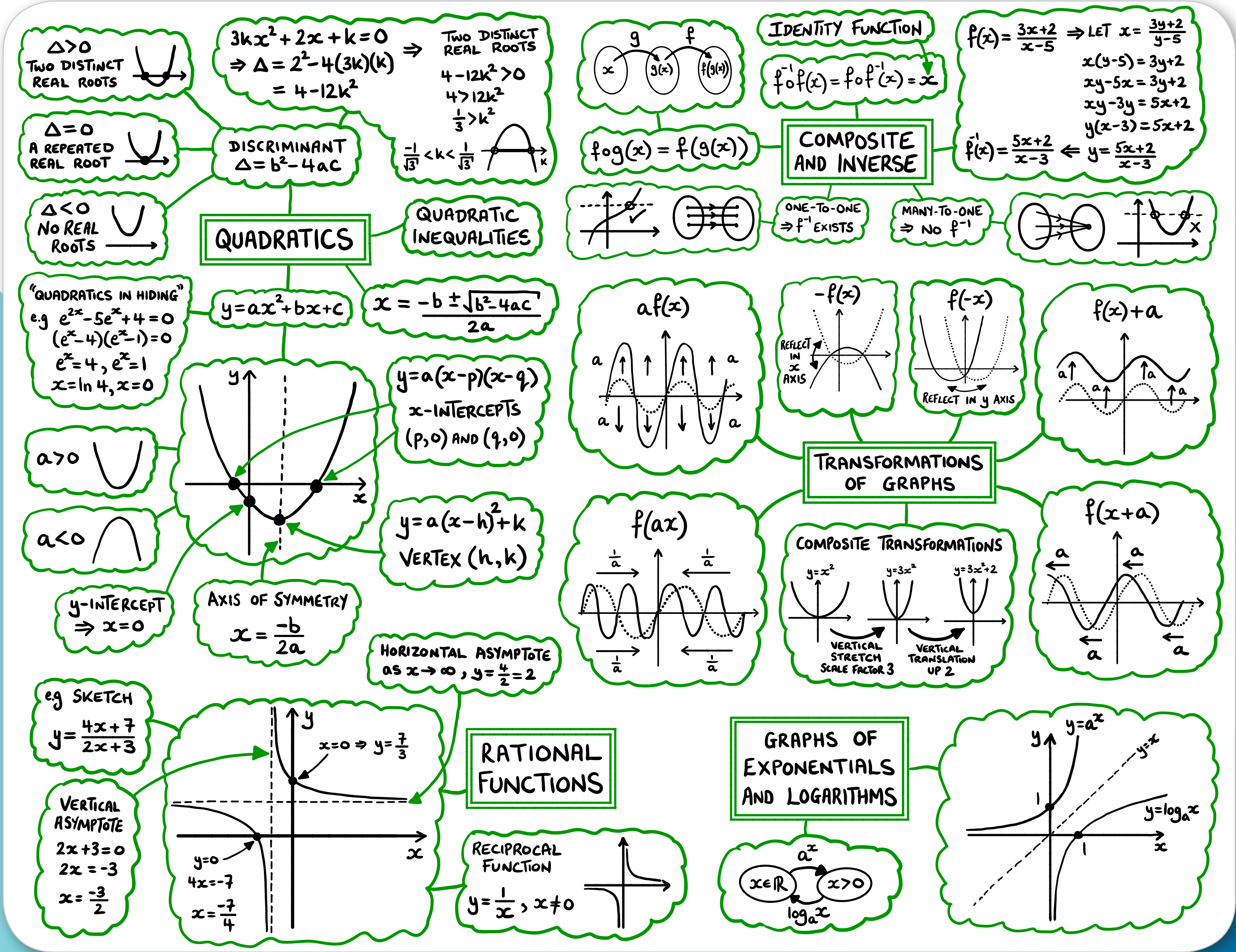
Functions



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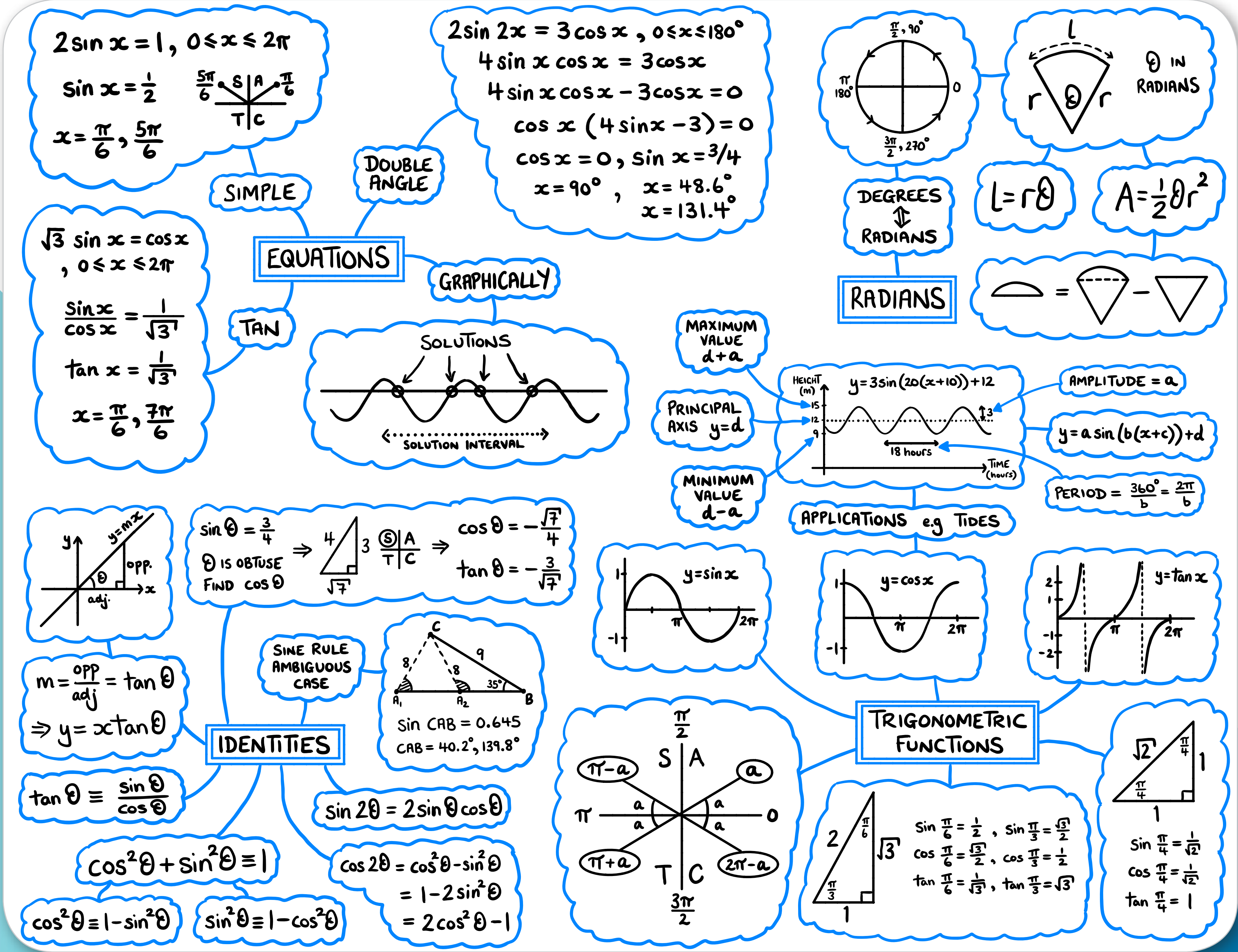
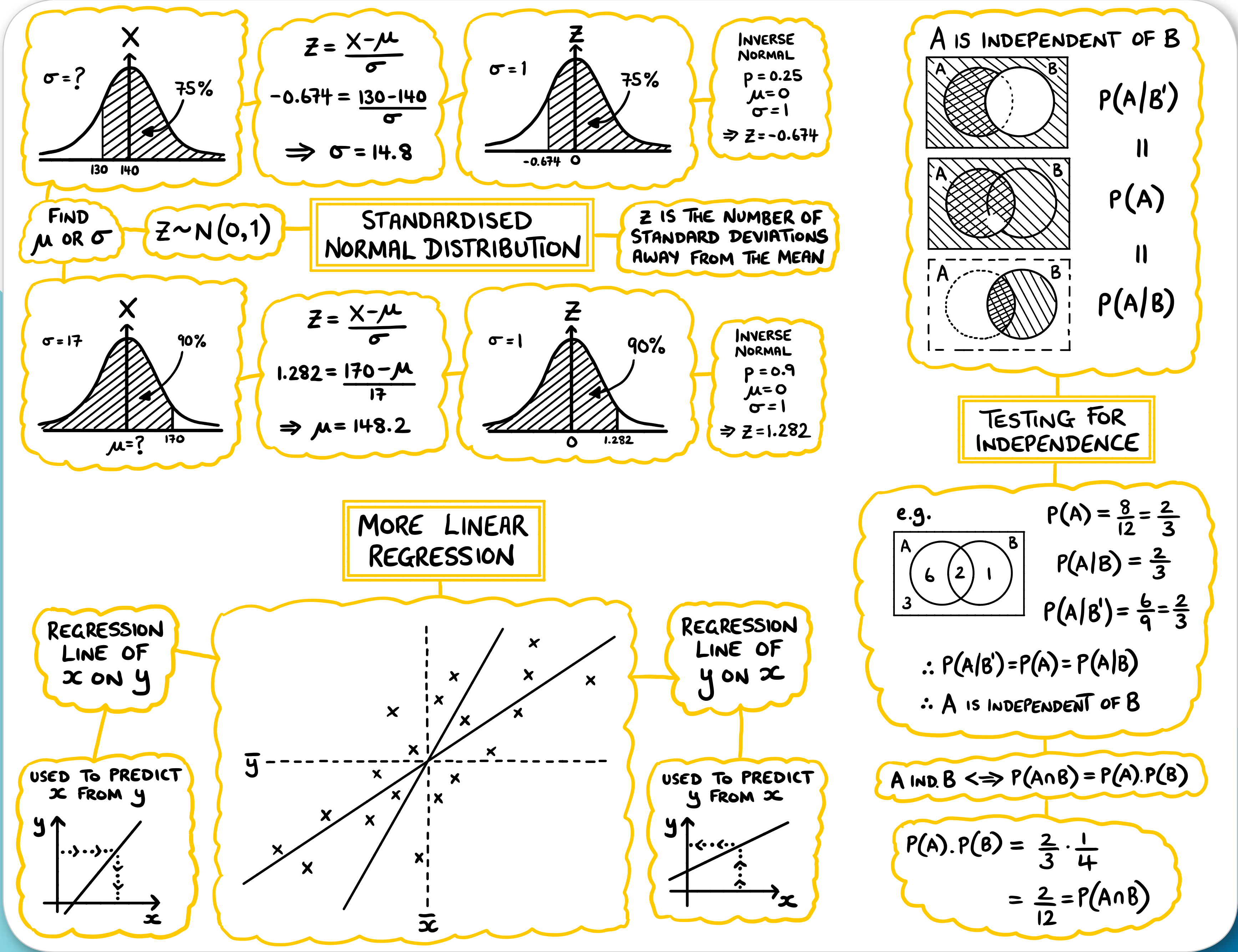
Geometry and trigonometry



Statistics and probability



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Calculus