Grade 11 Math Cheat Sheet

Choose the piecewise rule

For $x < 0$	$f(x) = -x$
For nonnegative x	$f(x) = x^2$
Evaluate both branches	$f(-2) = 2,\ f(3) = 9$

Check which interval contains the input. The second rule includes $x = 0$.

Polynomials and rational graphs

Remainder on division by $x - a$	$r = P(a)$
If $P(a) = 0$	$x - a$ is a factor
Rational graph	cancel common factors first
Equal degrees	horizontal asymptote $y = a/b$

a and b in the asymptote rule are leading coefficients. Keep original domain exclusions. Canceled denominator roots may be holes.

Cancel factors, keep the domain

Original expression	$f(x) = (x^2 - 9)/(x - 3)$
Simplify on the domain	$f(x) = x + 3,\ x \neq 3$
Hole in the graph	$(3, 6)$

Find excluded inputs using the original denominator before canceling.

Fractional powers & roots

Square root	$a^{1/2} = \sqrt{(a)}$
General positive base	$a^{m/n} = (a^{1/n})^m$
Example	$27^{2/3} = 3^2 = 9$
Square root of a square	$\sqrt{(x^2)} = \lvert x \rvert$

For the general rule use $a > 0$ and positive integer n. An even real root cannot have a negative radicand.

Exponential and logarithm laws

Inverse relationship	$\log_b(x) = y$ iff $b^y = x$
Product and quotient	$\log_b(MN) = \log_b(M) + \log_b(N)$
Power rule	$\log_b(x^p) = p \log_b(x)$
Change of base	$\log_b(x) = \ln(x)/\ln(b)$

Use positive inputs and $b > 0$, $b \neq 1$. For quotients, subtract the logs.

Arithmetic sequences and sums

Constant difference d	$a_n = a_1 + (n - 1)d$
Sum of first n terms	$S_n = n(a_1 + a_n)/2$
Example: 4, 7, 10, ...	$a_8 = 25,\ S_8 = 116$

Check the first differences before using the formula.

Geometric sequences and sums

Common ratio r	$a_n = a_1\, r^{n-1}$
Finite sum, $r \neq 1$	$S_n = a_1(1 - r^n)/(1 - r)$
Finite sum, $r = 1$	$S_n = n\, a_1$
Infinite sum, $\lvert r \rvert < 1$	$S = a_1/(1 - r)$

The nth-term formula uses a_1 for $n = 1$, including when $r = 0$.

Complex numbers

Imaginary unit	$i^2 = -1$
Conjugate pair	$a + bi$ and $a - bi$
Multiply the pair	$(a + bi)(a - bi) = a^2 + b^2$

Example: the conjugate of $3 + 2i$ is $3 - 2i$, and their product is 13.