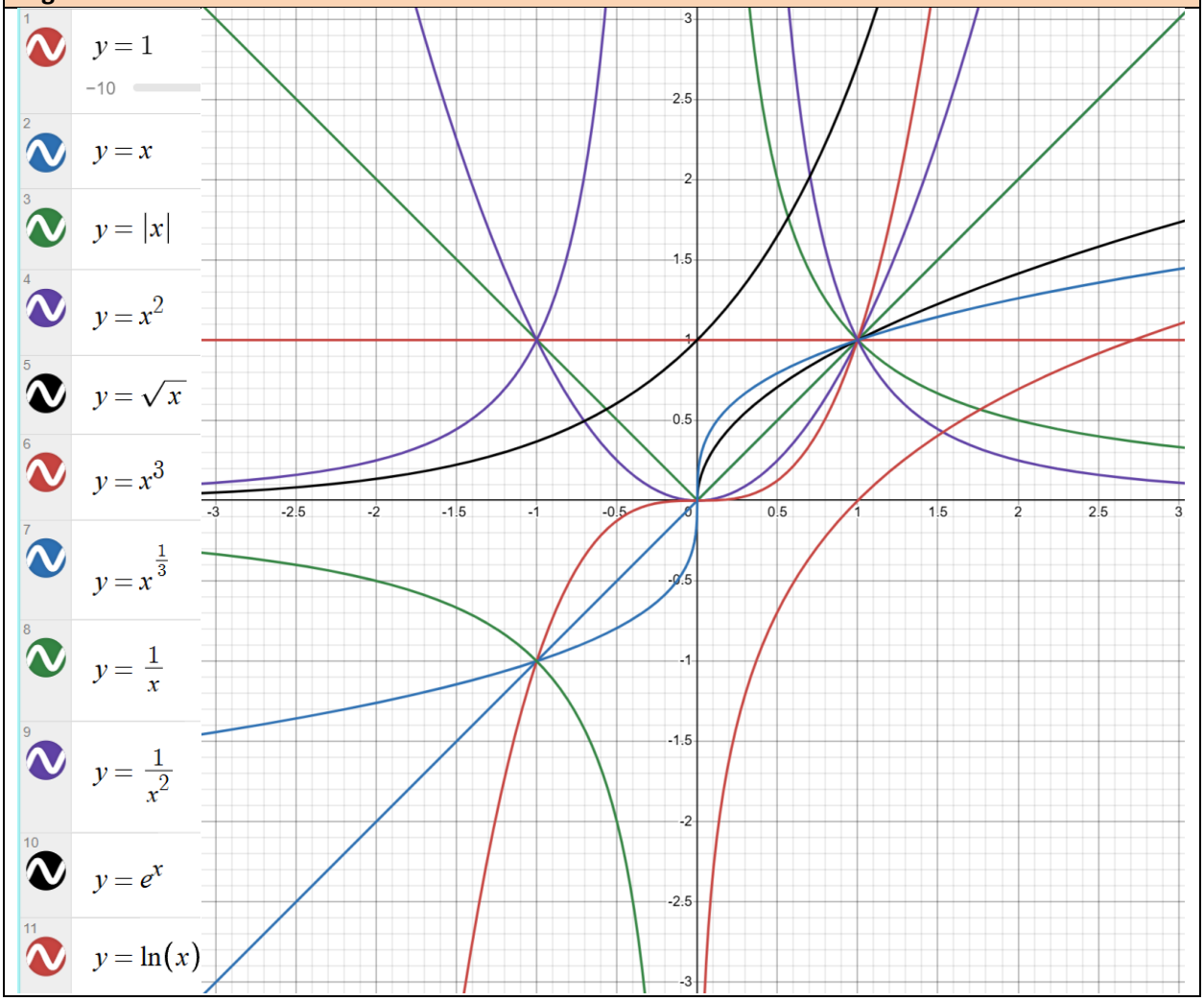
Harold's
Algebraic, Transcendental, and Conics Parent Functions
Cheat Sheet

AKA Library of Functions
10 October 2025

Parent Function Cheat Sheets:

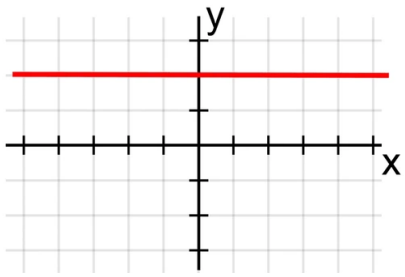
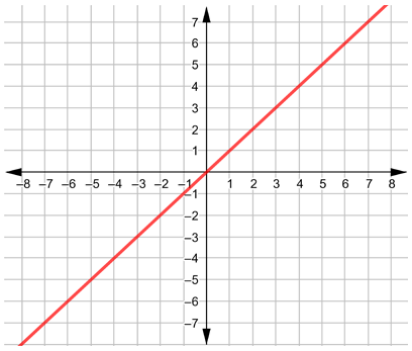
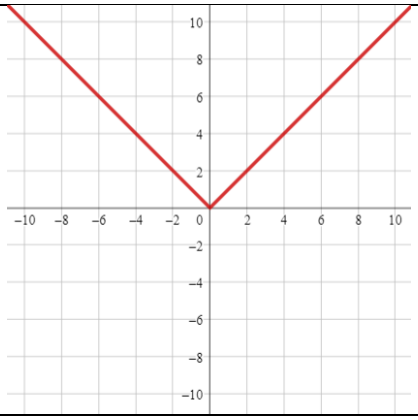
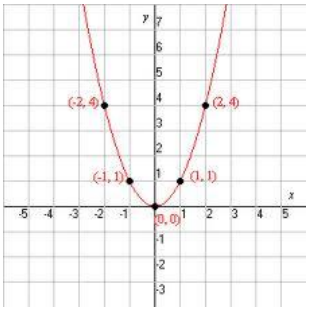
1. Harold's Algebraic, Transcendental, and Conic Parent Functions Cheat Sheet
   - Algebraic
   - Transcendental
   - Conic Sections
2. Harold's Trigonometry & Hyperbolic Parent Functions Cheat Sheet
   - Trigonometry / Inverse Trigonometry
   - Hyperbolic / Inverse Hyperbolic
3. Harold's Polar Parent Functions Cheat Sheet
   - Polar

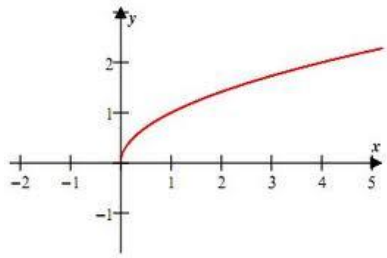
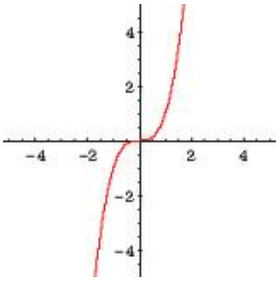
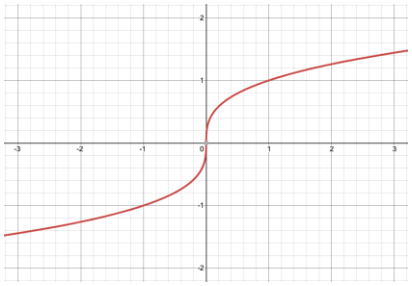
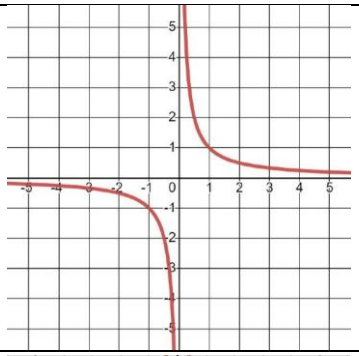
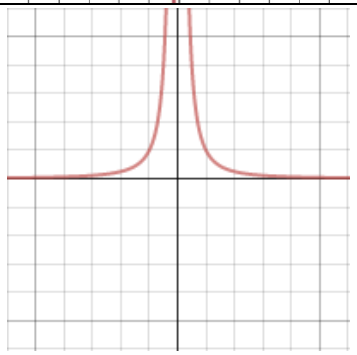
Algebraic & Transcendental Functions



Function Name	Parent Function	Graph	Characteristics

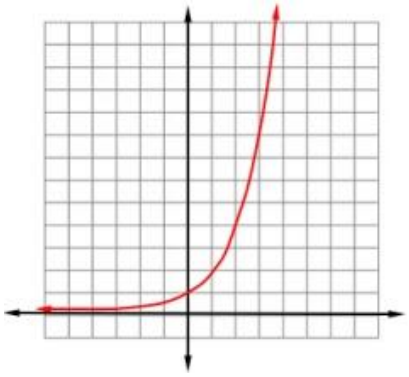
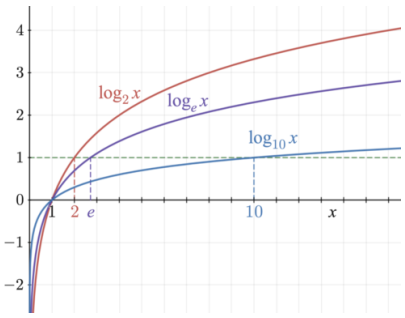
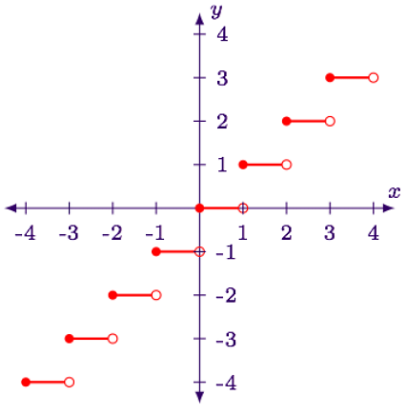
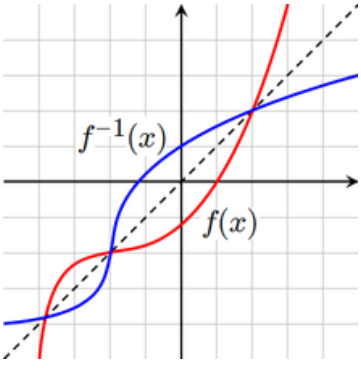
Algebra

Constant	$f(x) = c$		Domain: $(-\infty, \infty)$ Range: [c, c] Inverse Function: Undefined (asymptote) Restrictions: c is a real number Odd/Even: Even General Form: $Ay + B = 0$
Linear (Identity)	$f(x) = x$		Domain : $(-\infty, \infty)$ Range : $(-\infty, \infty)$ Inverse Function: Same as parent Restrictions: m ≠ 0 Odd/Even: Odd General Forms : $Ax + By + C = 0$ $y = mx + b$ $y - y_0 = m(x - x_0)$
Absolute Value	$f(x) = \lvert x \rvert$		Domain: $(-\infty, \infty)$ Range: [0, ∞) Inverse Function: $f^{-1}(x) = x \; for \; x \geq 0$ Restrictions: $f(x) = \begin{cases} x, & if \; x \geq 0 \\ -x, & if \; x < 0 \end{cases}$ Odd/Even: Even General Form: $f(x) = a\lvert b(x - h)\rvert + k$
Quadratic (Square)	$f(x) = x^2$		Domain: $(-\infty, \infty)$ Range: [0, ∞) Inverse Function: $f^{-1}(x) = \sqrt{x}$ Restrictions: None Odd/Even: Even General Form: $Ax^2 + By + Cx + D = 0$

Function Name	Parent Function	Graph	Characteristics
Square Root	$f(x) = \sqrt{x}$		Domain: [0, ∞) Range: [0, ∞) Inverse Function: $f^{-1}(x) = x^2$ Restrictions: $x \geq 0$, x can be complex Odd/Even: Neither General Form: $f(x) = a\sqrt{b(x-h)} + k$
Cubic	$f(x) = x^3$		Domain: $(-\infty, \infty)$ Range: $(-\infty, \infty)$ Inverse Function: $f^{-1}(x) = \sqrt[3]{x}$ Restrictions: None Odd/Even: Odd General Form: $f(x) = a(b(x-h))^3 + k$
Cube Root	$f(x) = \sqrt[3]{x}$		Domain: $(-\infty, \infty)$ Range: $(-\infty, \infty)$ Inverse Function: $f^{-1}(x) = x^3$ Restrictions: None Odd/Even: Odd General Form: $f(x) = a\sqrt[3]{b(x-h)} + k$
Reciprocal (Rational)	$f(x) = \frac{1}{x}$		Domain: $(-\infty, 0) \cup (0, \infty)$ Range: $(-\infty, 0) \cup (0, \infty)$ Inverse Function: Same as parent Restrictions: x ≠ 0 Odd/Even: Odd General Form: $f(x) = \frac{a}{b(x-h)} + k$
Reciprocal Squared (Rational)	$f(x) = \frac{1}{x^2}$		Domain: $(-\infty, 0) \cup (0, \infty)$ Range: $(0, \infty)$ Inverse Function: $f^{-1}(x) = \frac{1}{\sqrt{x}}$ Restrictions: x ≠ 0 Odd/Even: Even General Form: $f(x) = \frac{a}{b(x-h)^2} + k$

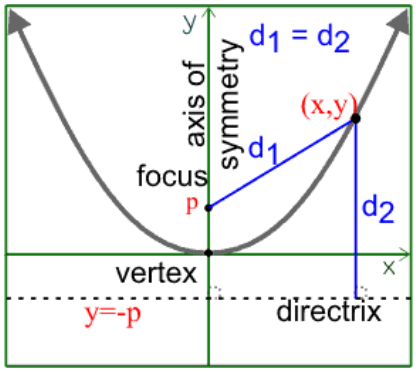
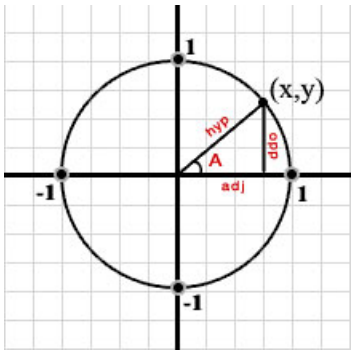
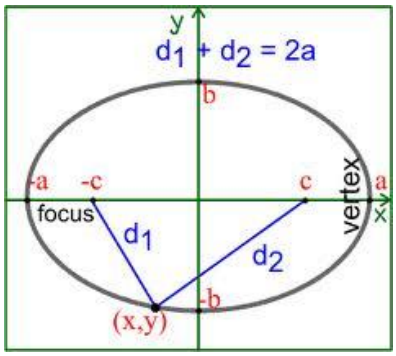
Function Name	Parent Function	Graph	Characteristics

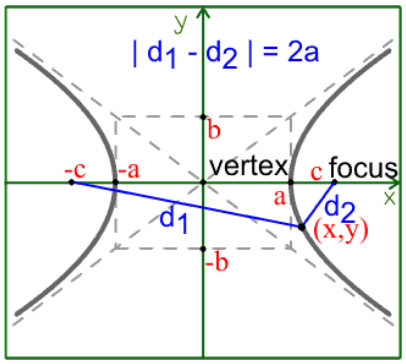
Transcendentals

Exponential	$f(x) = 10^x$ *or* $f(x) = e^x$		Domain: $(-\infty, \infty)$ Range: (0, ∞) Inverse Function: $f^{-1}(x) = \log x$ *or* $f^{-1}(x) = \ln x$ Restrictions: None, x can be complex Odd/Even: Neither General Form: $f(x) = a\ 10^{(b(x-h))} + k$
Logarithmic	$f(x) = \log x$ *or* $f(x) = \ln x$		Domain: (0, ∞) Range: $(-\infty, \infty)$ Inverse Function: $f^{-1}(x) = 10^x$ *or* $f^{-1}(x) = e^x$ Restrictions: x > 0 Odd/Even: Neither General Form: $f(x) = a \log(b(x-h)) + k$
Greatest Integer (Floor)	$f(x) = [x]$		Domain: $(-\infty, \infty)$ Range: $(-\infty, \infty)$ whole numbers only Inverse Function: Undefined (asymptotic) Restrictions: Real numbers only Odd/Even: Neither General Form: $f(x) = a[b(x-h)] + k$
Inverse Functions	$f(f^{-1}(x)) = x$ $f^{-1}(f(x)) = x$		Domain of x → Domain of y Range of y → Range of x Inverse Function: By definition Restrictions: None Odd/Even: Neither General Form: $f(x) = a\ f(b(x-h)) + k$ Algebraically: Swap $x \leftrightarrow y$, then solve for y Graphically: Rotate about 45° line $y = x$

Function Name	Parent Function	Graph	Characteristics

Conic Sections

Parabola	$y = ax^2$		Domain: $(-\infty, \infty)$ Range: $[k, \infty)$ or $(-\infty, k]$ Inverse Function: $f^{-1}(x) = \sqrt{x}$ Restrictions: None Odd/Even: Even Vertex : (h, k) Focus : $(h, k + p)$ General Forms: $(x - h)^2 = 4p(y - k)$ $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ *where* $B^2 - 4AC = 0$
Circle	$x^2 + y^2 = r^2$		Domain: $[-r + h,\ r + h]$ Range: $[-r + k,\ r + k]$ Inverse Function: Same as parent Restrictions: None Odd/Even: Both Focus : (h, k) General Forms: $(x - h)^2 + (y - k)^2 = r^2$ $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ *where* $A = C$ *and* $B = 0$
Ellipse	$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$		Domain: $[-a + h,\ a + h]$ Range: $[-b + k,\ b + k]$ Inverse Function: $\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$ Restrictions: None Odd/Even: Both Foci : $c^2 = a^2 - b^2$ General Forms: $\frac{(x - h)^2}{a^2} + \frac{(y - k)^2}{b^2} = 1$ $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ *where* $B^2 - 4AC < 0$

Function Name	Parent Function	Graph	Characteristics
Hyperbola	$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$		Domain: $(-\infty, -a+h] \cup [a+h, \infty)$ Range: $(-\infty, \infty)$ Inverse Function: $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$ Restrictions: Domain is restricted Odd/Even: Both Foci : $c^2 = a^2 + b^2$ General Forms: $\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$ $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ *where* $B^2 - 4AC > 0$

Graphing Tips

$$f(x) = af(b(x-h)) + k$$

The Seven Function "Levers"	*y = a f (b (x - h)) + k*	Graphing Tips
1) Move up/down ↕	k (Vertical translation)	"+" Moves it up
2) Move left/right ↔	h (Horizontal translation)	"+" Moves it right if $(x-h)$
3) Stretch up/down ↕	a (Vertical dilation)	Larger stretches it taller or makes it grow faster
4) Stretch left/right ↔	b (Horizontal dilation)	Larger stretches it out wider
5) Flip about x-axis ↻	a → −a	$f(x) \rightarrow -f(x)$ If $f(x) = -f(-x)$ then "odd" function
6) Flip about y-axis ↺	b → −b	$f(x) \rightarrow f(-x)$ If $f(x) = f(-x)$ then "even" function
7) Rotate CW/CCW ↺	$\theta = \frac{1}{2}\tan^{-1}\left(\frac{B}{A-C}\right)$	"+" θ rotates CCW For conic sections, where: $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$

See Also

- Harold's Algebraic, Transcendental, and Conic Parent Functions Cheat Sheet
- Harold's Trigonometry & Hyperbolic Parent Functions Cheat Sheet
- Harold's Polar Parent Functions Cheat Sheet

Function Name	Parent Function	Graph	Characteristics

Graphing Polynomials	(See Harold's Graphing Rationals Cheat Sheet)
1. Determine the end behavior	
Horizontal Asymptotes (HA)	$\lim_{x\to\infty^-} f(x) \to y$ and $\lim_{x\to\infty^+} f(x) \to y$
Infinite Limits at Infinity	$\lim_{x\to\infty^-} f(x) \to \infty$ and $\lim_{x\to\infty^+} f(x) \to \infty$
2. Find the x- and y-intercepts	
y-Intercept	$f(0) = y$
x-Intercepts (Zeros or Roots)	$f(x) = 0$
3. Determine the real zeros and their multiplicity	
Factoring, quadratic equation, synthetic division, long division, P/Q rational root candidates	
4. Determine the domain and range	
Domain	Valid x values Assume $(-\infty, \infty)$
Range	Valid y values Horizontal ruler test
5. Determine the max. number of turning points	
Minimum Exponent (ax^n)	The highest power of the exponent (n) must be ≥ number of direction changes + 1. Can increase by adding multiples of 2.
Local Minimum / Maximum (Relative Min. / Max.)	$f(x)$ has a local min/max at $x = a$ if $f(a)$ is less than or equal to (≤) / greater than or equal to (≥) the values of $f(x)$ in some interval around a. a is usually **near the origin**.
Absolute Minimum / Maximum (Global Min. / Max.)	$f(x)$ has an absolute min/max at $x = c$ if $f(c)$ is less than or equal to (≤) / greater than or equal to (≥) $f(x)$ for **all** x in the domain of f.
6. Note discontinuities	
Continuity	No division by 0, no negative square roots or logarithms
Vertical Asymptotes (VA)	x = division by 0 or undefined
7. Graph it