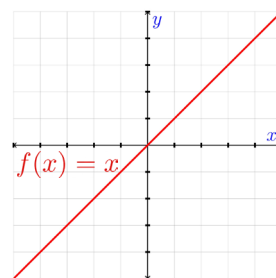


Functions

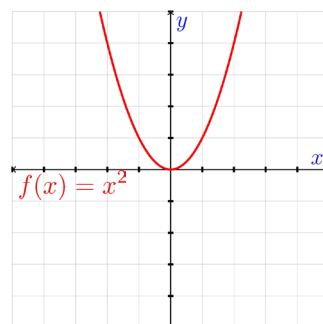
1. Linear Functions (e.g., $y = mx + b$)

- **Graph:** Straight line.
- **Slope (m):** Determines the steepness and direction of the line.
- **y -intercept (b):** The point where the line crosses the y -axis.
- **Key Feature:** Constant rate of change.



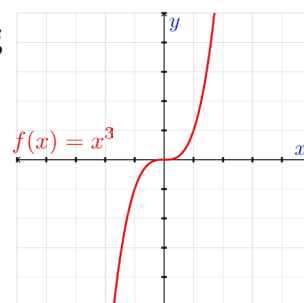
2. Quadratic Functions (e.g., $y = ax^2 + bx + c$)

- **Graph:** A Parabola, can open upwards or downwards depending on the sign of a .
- **Vertex:** The highest(max) or lowest(min) point of the parabola.
- **Axis of Symmetry:** A vertical line that passes through the vertex, dividing the parabola into two mirror images.
- **Roots/zeros:** Points where the graph intersects the x -axis. Can be real and distinct, real and equal (vertex), or complex.



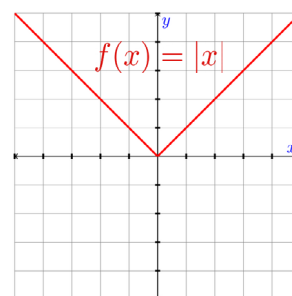
3. Polynomial Functions (e.g., $y = a_nx^n + \dots + a_1x + a_0$)

- **Graph:** Can take various shapes including hills and valleys, depending on the degree n and the leading coefficient a_n .
- **Degree:** Determines the number of roots, the end behavior of the function, and the maximum number of turns.
- **End Behavior:** Describes how the graph behaves as x approaches positive or negative infinity.
- **Roots/zeros:** Points where the function intersects the x -axis.



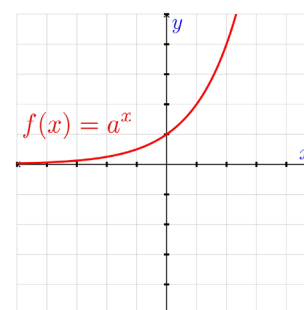
4. Absolute Value Functions (e.g., $y = |x|$)

- **Graph:** Forms a V-shape with a vertex at the origin (0,0); the graph is symmetric about the y -axis. The absolute value function reflects all negative inputs to positive outputs, creating two linear pieces joined.
- **End Behavior:** As x approaches infinity, y also approaches infinity; as x approaches negative infinity, y again approaches infinity.
- **Roots/zeros:** The point where the function meets the x -axis is at $x = 0$.



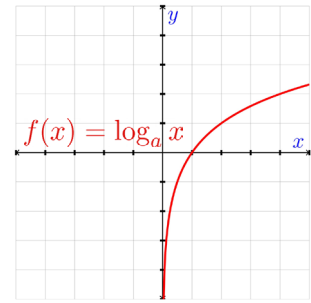
5. Exponential Functions (e.g., $y = ab^x$)

- **Graph:** Curves that rise or fall rapidly, depending on the base b (if $b > 1$, it grows; if $0 < b < 1$, it decays).
- **y -intercept:** Always at $(0, a)$, since $b^0 = 1$.
- **Asymptote:** Horizontal line $y = 0$ for growth functions; the graph never touches or crosses this line.
- **Key Feature:** The rate of change increases or decreases exponentially.



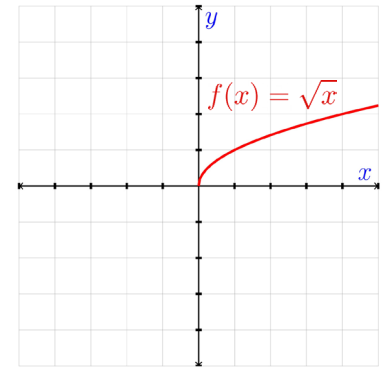
6. Logarithmic Functions (e.g., $y = \log_b x$)

- **Graph:** The inverse of exponential functions, passing through the point $(1, 0)$ and approaching the y -axis as an asymptote.
- **x -intercept:** At $(1, 0)$, since $\log_b 1 = 0$.
- **Vertical Asymptote:** Line $x = 0$, which the graph approaches but never touches or crosses.
- **Key Feature:** Increases slowly for $x > 1$ and decreases towards the asymptote as x approaches 0.



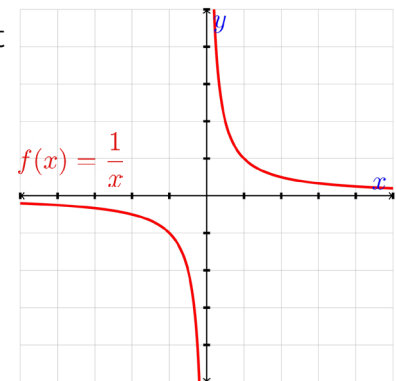
7. Radical Functions (e.g., $y = \sqrt{x}$)

- **Graph:** Varies with the radical type; square roots gradually increase, and cube roots increase in both directions.
- **Characteristics:** Not defined by “degree” like polynomials. The index affects the graph’s smoothness.
- **End Behavior:** Depends on the radical type; generally, y increases as x approaches infinity.
- **Roots/zeros:** The points where the function meets the x -axis, typically at $x = 0$ for basic forms.



8. Rational Functions ($y = \frac{p(x)}{q(x)}$)

- **Graph:** Features vertical asymptotes, and/or horizontal or slant asymptotes; shape depends on the polynomials’ degrees.
- **Characteristics:** Influenced by the degrees of numerator and denominator; affects asymptotes and behavior.
- **End Behavior:** Determined by the degrees of $p(x)$ and $q(x)$; may approach horizontal or slant asymptotes.
- **Roots/zeros:** x -values where $p(x) = 0$ (function crosses the x -axis); denominator roots indicate vertical asymptotes.



9. Trigonometric Functions (e.g., $y = \sin x$, $y = \cos x$, $y = \tan x$)

- **Graph:** Sine and cosine functions produce wave-like patterns (sinusoidal) starting from different points but with the same shape and period. Tangent functions have a repeating pattern with vertical asymptotes.
- **Period:** Sine and cosine have a period of 2π , meaning the pattern repeats every 2π units. Tangent has a period of π .
- **Amplitude:** The height from the midline to the peak or trough.
- **Asymptotes (for tangent):** Vertical lines where the function is undefined and the graph approaches infinity.

