

AP Precalculus Formula Sheet

| Linear Functions | | Factoring | | Average Rate of Change | | Binomial Theorem | |
|--|--|--|---|--|---|---|---|
| $y = mx + b$ | $\updownarrow m_1 = m_2$ | $a^2 - b^2 = (a - b)(a + b)$ $a^{2n} - b^{2n} = (a^n - b^n)(a^n + b^n)$ $a^2 \pm 2ab + b^2 = (a \pm b)^2$ $a^3 \pm b^3 = (a \pm b)(a^2 \mp ab + b^2)$ | | $AROC = \frac{f(b) - f(a)}{b - a}$ | | $(a + b)^n = \sum_{r=0}^n \binom{n}{r} a^{n-r} b^r$ $\binom{n}{r} = {}^n C_r = \frac{n!}{(n-r)!r!}$ | |
| $y - y_1 = m(x - x_1)$ | $\perp m_1 \times m_2 = -1$ | | | Concave Up | Concave Down | | |
| $\uparrow x = a$ | $\leftrightarrow y = b$ | $y = mx = (\tan \alpha)x$ $\theta = \alpha$ | | CU : AROC \uparrow | CD : AROC \downarrow | Trig Identities | |
| Even Functions | Odd Functions | $(f \circ f^{-1})(x) = f(f^{-1}(x)) = x$ | | Inflection Point | | $\sin^2 \theta + \cos^2 \theta = 1$ $1 + \tan^2 \theta = \sec^2 \theta$ $1 + \cot^2 \theta = \csc^2 \theta$ | |
| $f(-x) = f(x)$ e.g. $\cos(-\theta) = \cos \theta$ | $f(-x) = -f(x)$ e.g. $\sin(-\theta) = -\sin \theta$ | $(f^{-1} \circ f)(x) = f^{-1}(f(x)) = x$ | | CU \rightarrow CD or CD \rightarrow CU | | | |
| Quadratic Function ($a \neq 0$) | | Special Triangles | | Sine Transformations | | | |
| $f(x) = ax^2 + bx + c = a(x - h)^2 + k$ $\Delta = \text{discriminant} = b^2 - 4ac$ $(h, k) = \left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right) = \left(-\frac{b}{2a}, \frac{-\Delta}{4a}\right)$ | | $45^\circ : 45^\circ : 90^\circ \Delta$ $x : x : x\sqrt{2}$ | $30^\circ : 60^\circ : 90^\circ \Delta$ $x : x\sqrt{3} : 2x$ | $g(\theta) = a \sin(b(\theta + c)) + d$ | | $\csc \theta = \frac{1}{\sin \theta}$ | $\sec \theta = \frac{1}{\cos \theta}$ |
| | | $\sin \frac{\pi}{4} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$ | $\sin \frac{\pi}{6} = \cos \frac{\pi}{3} = \frac{1}{2}$ | \updownarrow Dilation by $ a $ | \leftrightarrow Dilation by $\frac{1}{ b }$ | $\tan \theta = \frac{\sin \theta}{\cos \theta}$ | $\cot \theta = \frac{1}{\tan \theta}$ |
| Zeros/x - Intercepts : $f(x) = 0$ $ax^2 + bx + c = 0$ | | $\cos \frac{\pi}{4} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$ | $\sin \frac{\pi}{3} = \cos \frac{\pi}{6} = \frac{\sqrt{3}}{2}$ | $d \uparrow$ | $\leftarrow c$ | $P = \frac{2\pi}{ b }$ | $f = \frac{ b }{2\pi}$ |
| $x = \begin{cases} \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, & b^2 - 4ac \geq 0 \\ \frac{-b \pm i\sqrt{ b^2 - 4ac }}{2a}, & b^2 - 4ac < 0 \end{cases}$ | | $\tan \frac{\pi}{4} = 1$ | $\tan \frac{\pi}{6} = \frac{\sqrt{3}}{3}$ | Domain = $(-\infty, \infty)$ Range = $[d - a , d + a]$ | | $y = \sin^{-1} x, y \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ | |
| | | Doubling Time | | Half Life Time | | $y = \tan^{-1} x, y \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ | |
| | | $Q = Q_0 \cdot 2^{t/T_{double}}$ | $Q = Q_0 \cdot \left(\frac{1}{2}\right)^{t/T_{half}}$ | $f(\theta) = a \tan(b(\theta + c)) + d$ | | $y = \cos^{-1} x, y \in [0, \pi]$ | |
| Arithmetic Series | | Geometric Series | | Sum and Difference | | Polar Functions | |
| $f(1) = a_1, f(n) = f(n - 1) + d, n \geq 2$ | | $f(1) = a_1, f(n) = r \cdot f(n - 1), n \geq 2$ | | $\sin(A \pm B) = \sin(A) \cos(B) \pm \cos(A) \sin(B)$ | | $(r, \theta) = (f(\theta), \theta)$ | |
| $a_n = a_1 + (n - 1)d, n \geq 1$ | | $a_n = a_1 r^{n-1}, n \geq 1$ | | $\sin(2A) = 2\sin(A) \cos(A)$ | | $r = \sqrt{x^2 + y^2}$ | |
| $a_n = a_k + (n - k)d, n \geq k$ | | $a_n = a_k r^{n-k}, n \geq k$ | | $\cos(A \pm B) = \cos(A) \cos(B) \mp \sin(A) \sin(B)$ | | | |
| $S_n = \frac{n}{2}(a_1 + a_n) = \frac{n}{2}[2a_1 + (n - 1)d]$ | | $S_n = \frac{a_1(1 - r^n)}{1 - r}$ | $S_\infty = \frac{a_1}{1 - r}, r < 1$ | $\cos(2A) = \cos^2(A) - \sin^2(A)$ $\cos(2A) = 2\cos^2(A) - 1 = 1 - 2\sin^2(A)$ | | $\theta = \tan^{-1} \frac{y}{x} \quad (+\pi \text{ if } x < 0)$ | |
| Exponential Properties | | Logarithm Properties ($b \neq 0, b \neq 1$) | | Symmetry | | | |
| $b^{-n} = \frac{1}{b^n}$ | $\frac{1}{b^n} = {}^n \sqrt{b}$ | $y = b^x \Leftrightarrow x = \log_b y$ | | $y = e^x \Leftrightarrow x = \ln y$ | | Polar / X - axis : $(r, -\theta)$ | |
| $a^n = b^n \Rightarrow a = b $ | $b^m b^n = b^{m+n}$ | $\log_b xy = \log_b x + \log_b y$ | | $\log_b a = \frac{\log(a)}{\log(b)}$ | $\log_b a = \frac{1}{\log_a b}$ | Y - axis $(-r, -\theta)$ or $(r, \pi - \theta)$ | |
| $b^{f(x)} = b^{g(x)} \Rightarrow f(x) = g(x)$ | $\frac{b^m}{b^n} = b^{m-n}$ | $\log_b \left(\frac{x}{y}\right) = \log_b x - \log_b y$ | | Semi - Log Plots | | Origin $(-r, \theta)$ or $(r, \pi + \theta)$ | |
| $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$ | $\frac{m}{b^n} = {}^n \sqrt{b^m}$ | $(b^m)^n = b^{mn}$ | $\log_b x^n = n \log_b x$ | $b^{\log_b N} = N$ | $y = ab^x \Rightarrow y = (\log_n b)x + \log_n a$ | | $(x, y) = (r \cos \theta, r \sin \theta)$ |