Achievable

Glossary of identities

AMC 10/12 DUMP SHEET

Algebra

Area of triangle equations

- $a^2 - b^2 = (a-b)(a+b)$
- $a^2 + 2ab + b^2 = (a+b)(a+b)$
- $a^2 - 2ab + b^2 = (a-b)(a-b)$
- $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$
- $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$
- $x^0 = 1$
- $(x^y)(x^z) = x^{y+z}$
- $\frac{x^y}{x^z} = x^{y-z}$
- $x^{-z} = \frac{1}{x^z}$
- $(x^y)^z = x^{yz}$
- $(x^z)(y^z) = (xy)^z$
- $log\,(ab) = log\,a + log\,b$
- $log\,(\frac{a}{b}) = log\,a - log\,b$
- $log\,(a^n) = n\,log\,a$
- $e^{i\pi} + 1 = 0$ Euler's identity

Geometry

$tan(x) = sin(x)/cos(x)$

$sin^2\,\theta + cos^2\,\theta = 1$
$1 + tan^2\,\theta = sec^2\,\theta$
$1 + cot^2\,\theta = csc^2\,\theta$
$sin\,(2\theta) = 2\,sin\theta\,cos\theta$
$cos\,(2\theta) = cos^2\,\theta - sin^2\,\theta$

$$sin^2\,\theta = \frac{1 - cos\,2\theta}{2}$$

$$cos^2\,\theta = \frac{1 + cos\,2\theta}{2}$$

Number theory

LCM(a,b)×GCF(a,b)=a×b

If $a \equiv b \pmod{m}$, then

- $a + c \equiv b + c \pmod{m}$
- $a - c \equiv b - c \pmod{m}$
- $ac \equiv bc \pmod{m}$

Counting and probability

- $\binom{n}{k} = \binom{n}{n-k}$
- $\binom{n}{k} = \binom{n-1}{k} + \binom{n-1}{k-1}$ Pascal's rule
- $(x+y)^n = \sum_{k=0}^{n} \binom{n}{k} x^{n-k} y^k$
- $1 + 2 + 3 + \ldots + n = \frac{n\,(n+1)}{2}$
- $1^2 + 2^2 + \ldots + n^2 = \frac{n\,(n+1)\,(2n+1)}{6}$
- $1^3 + 2^3 + \ldots + n^3 = \left(\frac{n\,(n+1)}{2}\right)^2$