



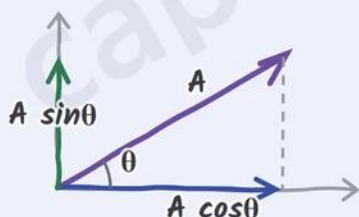
Trigonometry - 1



the unit circle's ratios, extended to any angle at all

Trigonometric Functions and the Unit Circle

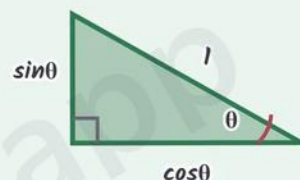
- circle radius r , centre at the origin: $P(x,y)$ lies on the terminal ray of angle θ
- $\cos\theta = \frac{x}{r}$, $\sin\theta = \frac{y}{r}$
- on the **unit circle** ($r=1$), $P(x,y)$ is just $P(\cos\theta, \sin\theta)$ directly
- ratios are the SAME on the whole terminal ray: independent of r , identical for coterminal angles



a length A at angle θ resolved onto the axes:
horizontal leg $A \cos \theta$, vertical leg $A \sin \theta$, the same picture with A in place of r

Six ratios from x, y, r

cosine	$\cos\theta = \frac{x}{r}$
sine	$\sin\theta = \frac{y}{r}$
tangent	$\tan\theta = \frac{y}{x}$
cosecant	$\operatorname{cosec}\theta = \frac{r}{y}$
secant	$\sec\theta = \frac{r}{x}$
cotangent	$\cot\theta = \frac{x}{y}$



on the unit circle, $r=1$: the right triangle behind
 $\sin^2\theta + \cos^2\theta = 1$, opposite $\sin\theta$, adjacent $\cos\theta$,
hypotenuse 1

last three are reciprocals of the first three:
 $\operatorname{cosec}\theta = 1/\sin\theta$, $\sec\theta = 1/\cos\theta$, $\cot\theta = 1/\tan\theta$, when
the denominator isn't zero

Where a ratio breaks down *

$\cos\theta = 0$, i.e. $\theta = (2n+1)\frac{\pi}{2}$	→ $\tan\theta$ and $\sec\theta$ are undefined there
$\sin\theta = 0$, i.e. $\theta = n\pi$	→ $\cot\theta$ and $\operatorname{cosec}\theta$ are undefined there
$\theta = 0$	→ $\sin\theta = 0$, $\cos\theta = 1$, $\tan\theta = 0$: the base case every identity builds from
$\theta = 90^\circ$	→ $\cos\theta = 0$, $\sin\theta = 1$: $\tan\theta$ and $\sec\theta$ blow up right here

