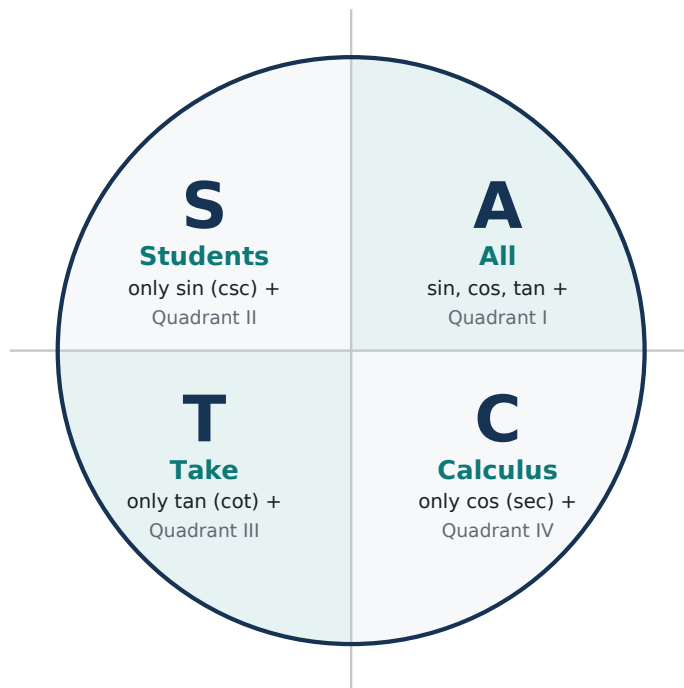


ASTC — All Students Take Calculus

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Which trig functions are positive in each quadrant of the unit circle



Pick the phrase you remember

All Students Take Calculus

All Silver Tea Cups

Add Sugar To Coffee

All Smart Trig Classes

Start in Quadrant I and go anticlockwise:
A, S, T, C. The letter names what is positive.

Reciprocals share a sign: csc goes with sin,
sec goes with cos, cot goes with tan.

Signs of all six functions

	Quadrant I 0°–90°	Quadrant II 90°–180°	Quadrant III 180°–270°	Quadrant IV 270°–360°
sin θ	+	+	–	–
cos θ	+	–	–	+
tan θ	+	–	+	–
csc θ	+	+	–	–
sec θ	+	–	–	+
cot θ	+	–	+	–

QUICK CHECK

Is each value positive or negative? Write + or –. No need to calculate it.

1 sin 200° = _____

4 sin 7 π /6 = _____

2 cos 300° = _____

5 cos 2 π /3 = _____

3 tan 100° = _____

6 tan 5 π /3 = _____

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ASTC Notes and Answers

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Reference angles, one worked example, and the quick-check answers

REFERENCE ANGLES

The acute angle θ' between the terminal side and the x-axis. Use it to find the size of the value.

	Quadrant I	Quadrant II	Quadrant III	Quadrant IV
Degrees	$\theta' = \theta$	$\theta' = 180^\circ - \theta$	$\theta' = \theta - 180^\circ$	$\theta' = 360^\circ - \theta$
Radians	$\theta' = \theta$	$\theta' = \pi - \theta$	$\theta' = \theta - \pi$	$\theta' = 2\pi - \theta$

WORKED EXAMPLE 1

Find $\sin 150^\circ$.

1. 150° is between 90° and 180° , so it is in Quadrant II.
2. Reference angle: $\theta' = 180^\circ - 150^\circ = 30^\circ$.
3. $\sin 30^\circ = 1/2$.
4. In Quadrant II, sin is positive (the S in ASTC).
5. So $\sin 150^\circ = +1/2$. Check on the chart: the y-coordinate at 150° is $1/2$.

WORKED EXAMPLE 2

Find $\cos 240^\circ$.

1. 240° is between 180° and 270° , so it is in Quadrant III.
2. Reference angle: $\theta' = 240^\circ - 180^\circ = 60^\circ$.
3. $\cos 60^\circ = 1/2$.
4. In Quadrant III only tan is positive, so cos is negative.
5. So $\cos 240^\circ = -1/2$. Check on the chart: the x-coordinate at 240° is $-1/2$.

QUICK-CHECK ANSWERS

- | | |
|---|--|
| 1. $\sin 200^\circ$: Quadrant III $\rightarrow -$ (negative) | 4. $\sin 7\pi/6$: Quadrant III $\rightarrow -$ (negative) |
| 2. $\cos 300^\circ$: Quadrant IV $\rightarrow +$ (positive) | 5. $\cos 2\pi/3$: Quadrant II $\rightarrow -$ (negative) |
| 3. $\tan 100^\circ$: Quadrant II $\rightarrow -$ (negative) | 6. $\tan 5\pi/3$: Quadrant IV $\rightarrow -$ (negative) |

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