

Precalculus · Graphs of Trigonometric Functions · Lesson

Common Core F-TF.B.5, F-IF.C.7e, F-BF.B.3 · mathovore.fr

This precalculus trig graphs lesson explains graphs of trigonometric functions in one printable page, with definitions, a method and a worked example.

A sinusoid is a sine or cosine wave written as $y = A \sin(B(x - C)) + D$. Its amplitude is $|A|$, its period is $2\pi/|B|$, its phase shift is C , and its midline is $y = D$. The tangent graph repeats every π and has vertical asymptotes instead of a maximum or minimum.

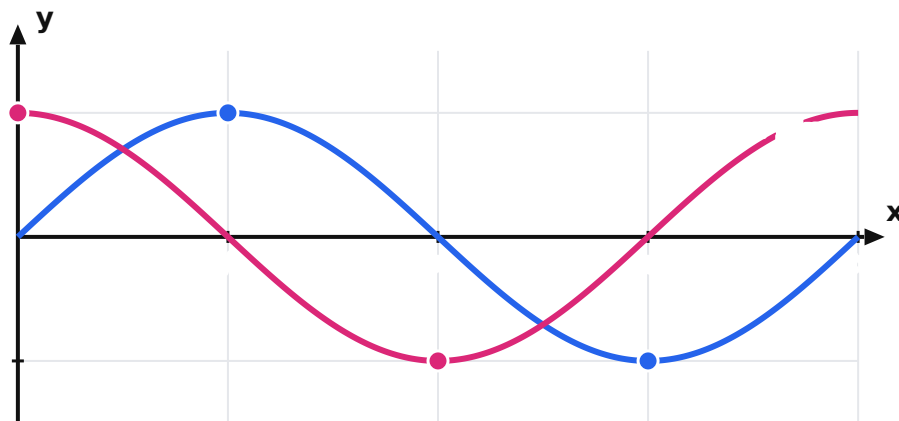
Precalculus Common Core: F-TF.B.5 · F-IF.C.7e · F-BF.B.3

Precalculus Trig Graphs Lesson: key facts

- Amplitude is half the distance between the maximum and the minimum.
- The period of sine and cosine is 2π divided by $|B|$; the period of tangent is π divided by $|B|$.
- A positive C shifts the graph right; a positive D shifts it up.
- Tangent has vertical asymptotes at $x = \pi/2 + k\pi$ and no amplitude.
- A periodic data set with a known maximum and minimum fits a model with $A = (M - m)/2$ and $D = (M + m)/2$.

What do the sine and cosine graphs look like?

The graphs of $y = \sin x$ and $y = \cos x$ are smooth waves that repeat every 2π radians. Both stay between -1 and 1 . The cosine wave is the sine wave moved left by $\frac{\pi}{2}$.



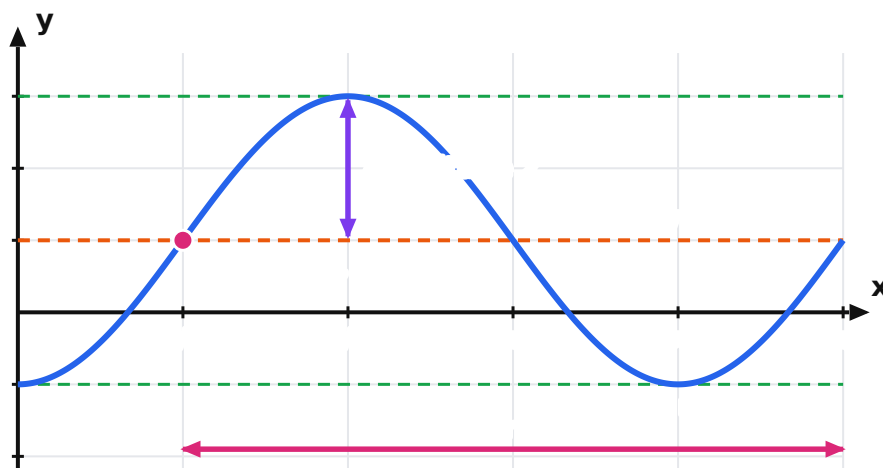
Sine (blue) and cosine (pink) on one full period.

How do amplitude, period, and shifts change the graph?

Transformed sinusoid

$$y = A\sin(B(x-C)) + D \text{ or } y = A\cos(B(x-C)) + D$$

- Amplitude: $|A|$, the distance from the midline to a peak.
- Period: $\frac{2\pi}{|B|}$, the length of one full cycle.
- Phase shift: C , right if positive, left if negative.
- Midline: $y = D$, the vertical shift.



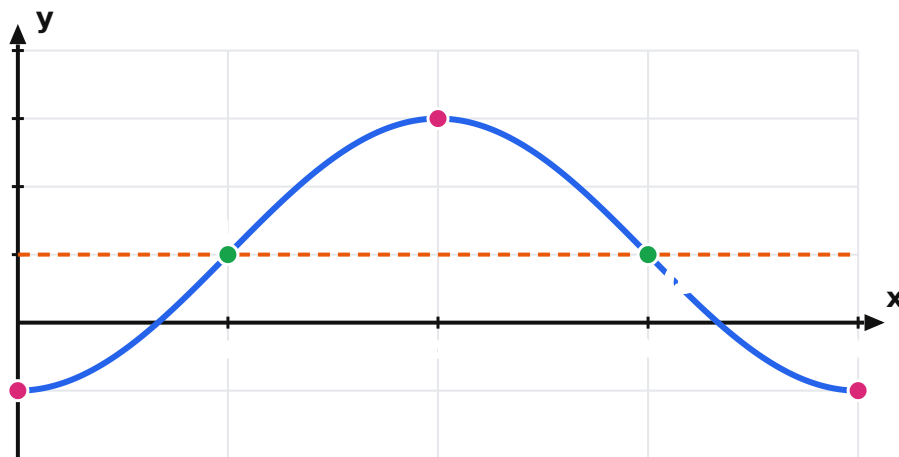
Here $A = 2$, $B = 2$, $C = \frac{\pi}{4}$, $D = 1$. The period is $\frac{2\pi}{2} = \pi$.

How do you graph a sinusoid step by step?

1. Read A , B , C , and D from the equation.

2. Draw the midline $y = D$ and the lines $y = D \pm |A|$.
3. Find the period $\frac{2\pi}{|B|}$ and divide it into four equal steps.
4. Plot the five key points, then sketch the wave.

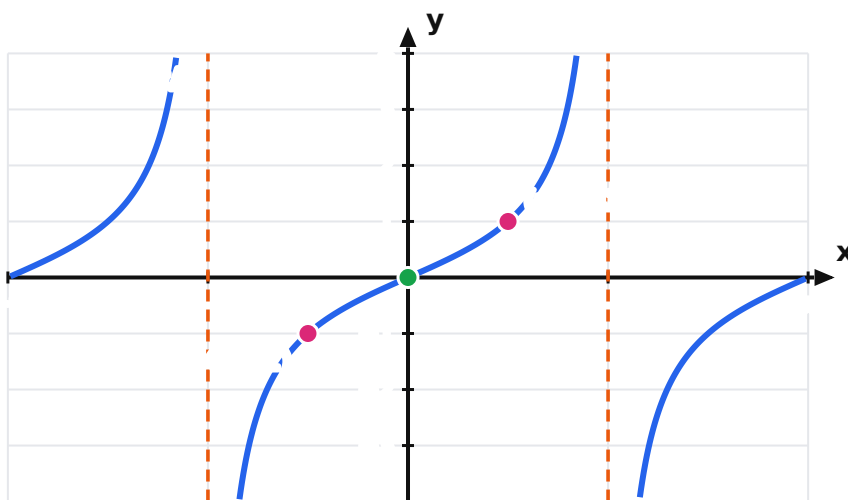
Example. Graph $y = -2\cos\left(\frac{x}{2}\right) + 1$. Here $|A| = 2$, the period is $\frac{2\pi}{1/2} = 4\pi$, and the midline is $y = 1$. The negative sign flips the cosine, so the wave starts at its minimum -1 and has key points every π .



Five key points of the worked example.

What does the tangent graph look like?

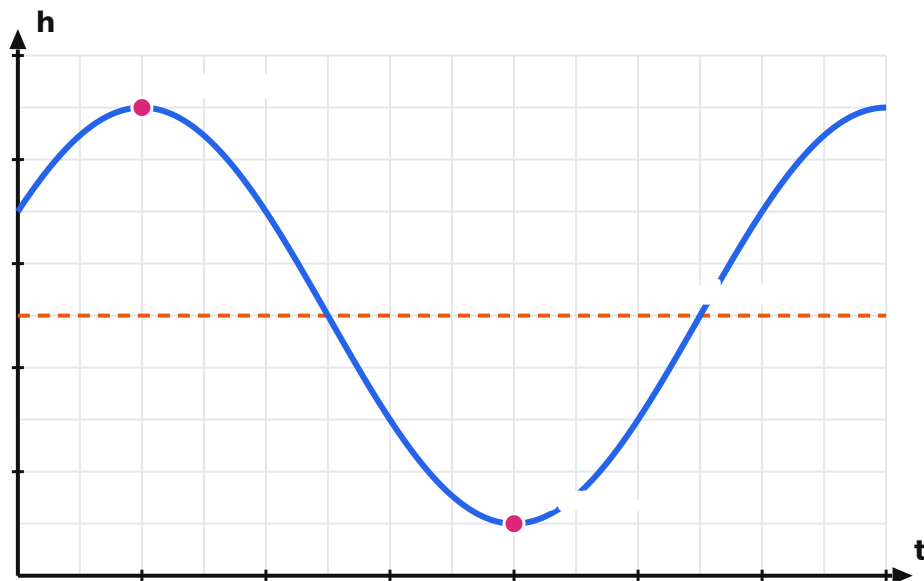
The graph of $y = \tan x$ has period π , crosses the x-axis at multiples of π , and has vertical asymptotes at $x = \frac{\pi}{2} + k\pi$. For $y = A\tan(Bx)$ the period is $\frac{\pi}{|B|}$. It has no amplitude because it is unbounded.



One full branch of tangent sits between each pair of dashed asymptotes.

How do you write a sinusoidal model from data?

Use the maximum M and minimum m : $A = \frac{M-m}{2}$ and $D = \frac{M+m}{2}$. The time from a maximum to the next minimum is half a period, so $B = \frac{2\pi}{\text{period}}$. A tide rises to 9 ft at hour 2 and drops to 1 ft at hour 8. Then $A = 4$, $D = 5$, the period is 12, and $h = 4\cos\left(\frac{\pi}{6}(t-2)\right) + 5$.



Tide model built from one high and one low.

Graphs of Trigonometric Functions: frequently asked questions

What is the difference between amplitude and period?

Amplitude measures how tall the wave is: the distance from the midline to a peak. Period measures how long one full cycle takes along the x-axis.

How do you find the phase shift of $y = \sin(2x - \pi)$?

Factor the inside as $2(x - \pi/2)$. The phase shift is $\pi/2$ to the right. Always factor out B before reading the shift.

Why does tangent have asymptotes?

Tangent equals sine divided by cosine. At $x = \pi/2 + k\pi$ the cosine is zero, so the quotient is undefined and the graph climbs without bound.

Can a sine function be written as a cosine function?

Yes. Cosine is sine shifted left by $\pi/2$, so $\sin x = \cos(x - \pi/2)$. Both can describe the same wave with different phase shifts.

How do you choose between sine and cosine for a model?

Use cosine when the data starts at a maximum or minimum, and sine when it starts on the midline. Either works if you pick the right shift.

How to use this precalculus trig graphs lesson

Use this precalculus trig graphs lesson before the worksheet, then check what you learned with the quiz.

