

Graphing Sine, Cosine and Tangent Functions

Grade 12 – Precalculus math · Worksheet · Standards: F-TF.B.5, F-IF.C.7e, F-BF.B.3

Name: _____ Date: _____ Class: _____

These 20 problems cover amplitude, period, phase shift and midline, key points, reading equations from graphs, tangent graphs and sinusoidal models from data. They train standards F-TF.B.5, F-IF.C.7e and F-BF.B.3. The last six problems model pedals, daylight, springs, household voltage and tides.

Standards: F-TF.B.5, F-IF.C.7e, F-BF.B.3 · **Level:** Grade 12 Precalculus

Problem 1 Amplitude and Period (easy)

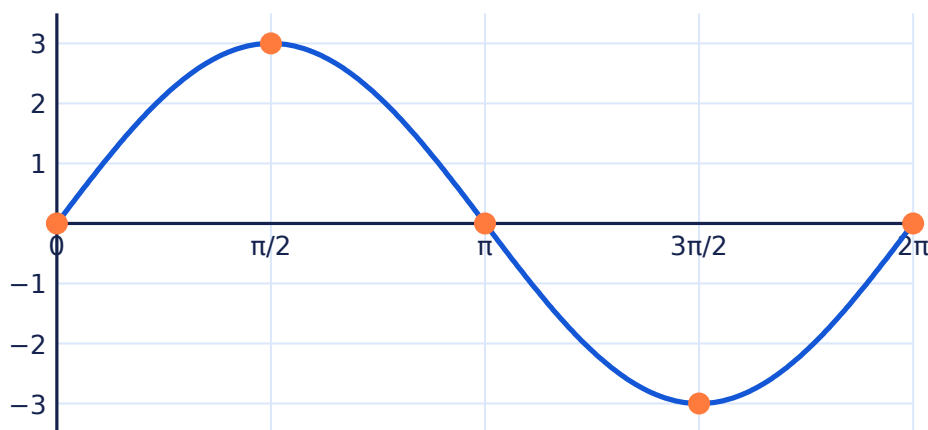
Find the amplitude and the period of each function. (a) $y = 3 \sin x$ (b) $y = -2 \cos(4x)$ (c) $y = (1/2) \sin(x/3)$ (d) $y = 5 \cos(\pi x)$

Problem 2 Midline and Range (easy)

Give the midline, the maximum and the minimum. (a) $y = 2 \sin x + 3$ (b) $y = -\cos x - 2$

Problem 3 Key Points of a Sine Wave (easy)

Complete a table of the five key points of $y = 3 \sin x$ for $x = 0, \pi/2, \pi, 3\pi/2$ and 2π . The graph below shows the curve.



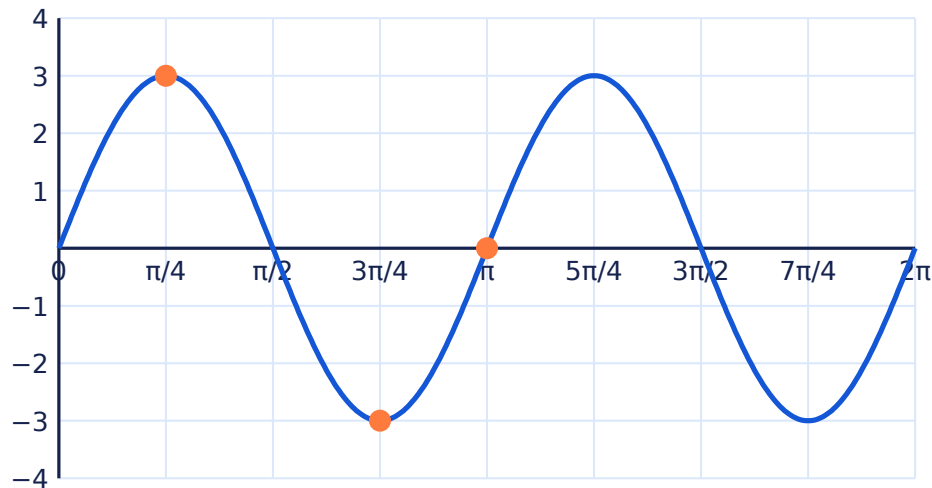
One period of $y = 3 \sin x$.

Problem 4 Read the Phase Shift (easy)

Describe the horizontal shift of each graph compared with $y = \sin x$ or $y = \cos x$. (a) $y = \sin(x - \pi/3)$ (b) $y = \cos(x + \pi/2)$ (c) $y = \sin(2x - \pi)$

Problem 5 Write an Equation from a Graph (easy)

The graph is a sine curve through the origin with peak $(\pi/4, 3)$, trough $(3\pi/4, -3)$ and a zero at $(\pi, 0)$. Find the amplitude, the period and an equation of the form $y = A \sin(Bx)$.



Graph of the curve.

Problem 6 Tangent Properties (easy)

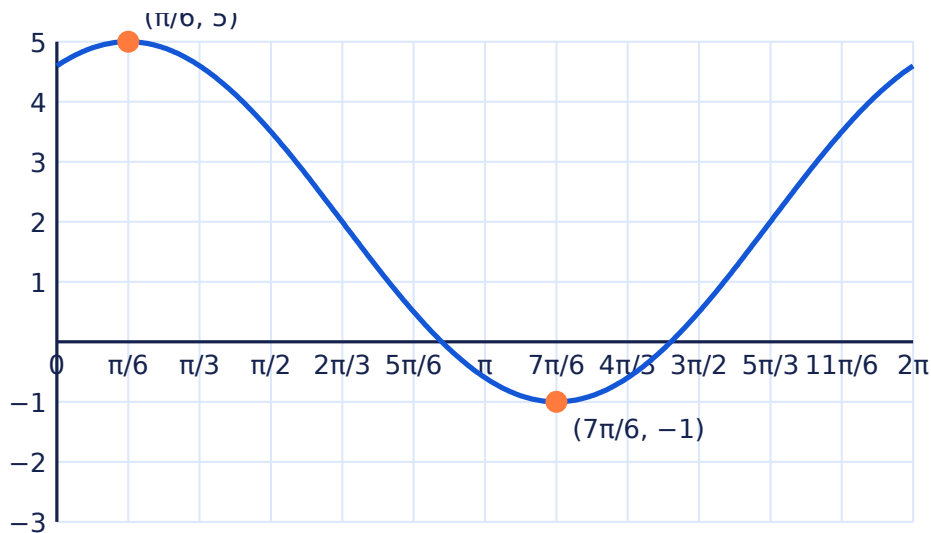
For $y = \tan x$ on the interval $[-\pi, \pi]$, list the vertical asymptotes and the zeros, and give the value at $x = \pi/4$.

Problem 7 Write a Cosine from a Description (medium)

A cosine function has amplitude 2.5, period 6, midline $y = -1$ and a maximum at $x = 0$. Write its equation.

Problem 8 Equation from a Maximum and a Minimum (medium)

One period of a cosine-shaped wave has a maximum at $(\pi/6, 5)$ and the next minimum at $(7\pi/6, -1)$. Find A , D , the period, and an equation $y = A \cos(B(x - C)) + D$.



The marked maximum and minimum.

Problem 9 Reflect, Shift and Compress (medium)

Write $y = -2 \sin(3x - \pi) + 4$ as $y = A \sin(B(x - C)) + D$ and list the amplitude, period, shift, midline, maximum and minimum.

Problem 10 Tangent Transformations (medium)

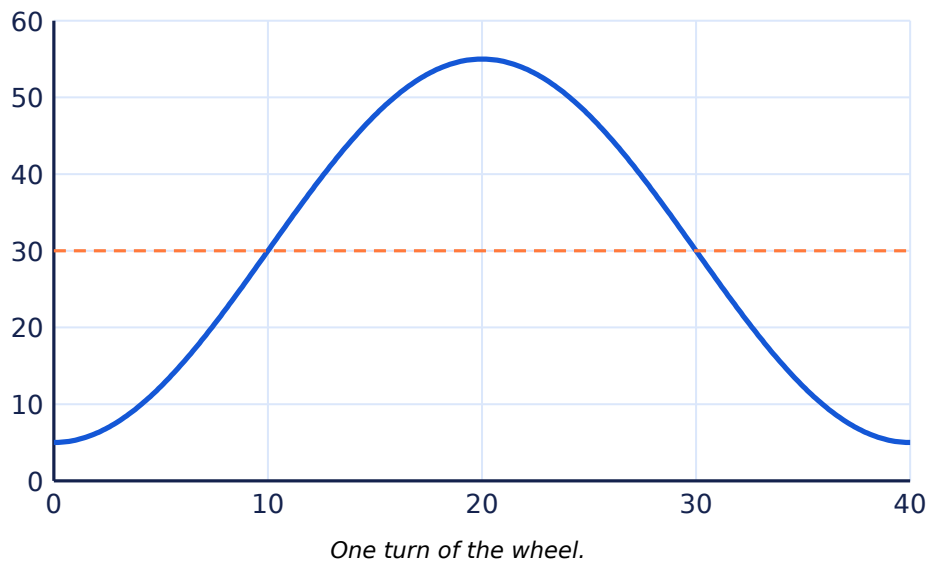
Find the period and the vertical asymptotes nearest the y-axis. (a) $y = 5 \tan(x/6)$ (b) $y = \tan(x + \pi/6) - 1$

Problem 11 Pier Water Depth (medium)

The water depth at a fishing pier is $d(t) = 4 \sin(\pi t/6) + 9$ feet, where t is the number of hours since the first reading. Find the period, the greatest and least depths, and $d(2)$ to the nearest tenth.

Problem 12 Ferris Wheel Height (medium)

A rider's height on a Ferris wheel is $H(t) = 30 - 25\cos(\pi t/20)$ feet, t in seconds. The graph shows one turn. Find $H(0)$, $H(10)$ and $H(20)$, and the first time the rider is 42.5 feet high.



Problem 13 Model from a Table (medium)

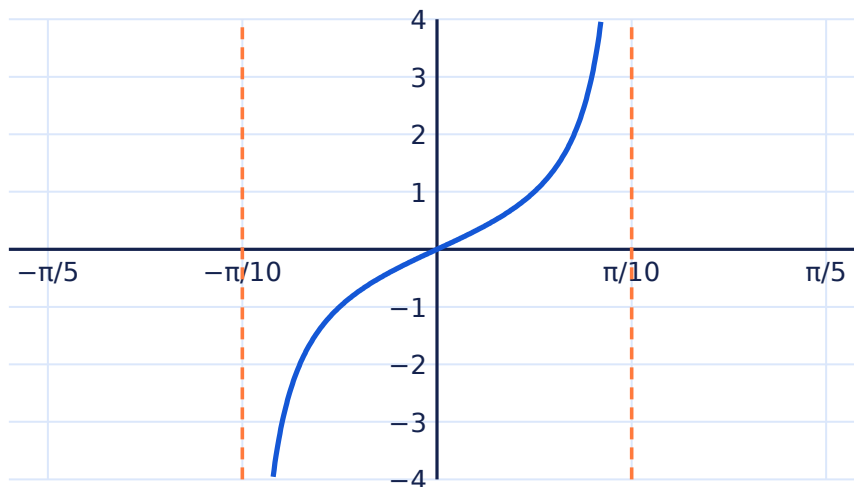
A sinusoidal function has these values.

x	0	2	4	6	8
y	1	5	9	5	1

Find its amplitude, midline, period and an equation using cosine.

Problem 14 Graph of a Compressed Tangent (medium)

The graph shows $y = \tan(5x)$ with its asymptotes on the interval $[-\pi/5, \pi/5]$. State the period, the asymptotes shown, the zeros on this interval, and the value of y at $x = \pi/20$.



The central branch of $y = \tan(5x)$.

Problem 15 Describe the Transformations (medium)

Describe, in order, how the graph of $y = \sin x$ is transformed to give $y = -2 \sin(x/2) + 3$. State the amplitude, period and range.

Problem 16 Pedal Height (hard)

A bicycle pedal moves in a circle of radius 8 inches whose center is 14 inches above the ground. The pedal starts at its lowest point and makes one turn every 1.2 seconds, so $h(t) = 14 - 8\cos(5\pi t/3)$. Find the lowest and highest heights, $h(0.3)$, and the first time the pedal is 18 inches high.

Problem 17 Hours of Daylight (hard)

A city has 15.4 hours of daylight on day 172 and 8.6 hours on day 355. Model the daylight with $D(d) = A\cos(2\pi(d - 172)/365) + 12.0$ after finding A . Find $D(80)$ and the number of days with at least 14 hours of daylight.

Problem 18 Mass on a Spring (hard)

A mass on a spring has displacement $y = 6 \sin(4\pi t)$ centimeters, t in seconds. Find the amplitude, period and frequency, and the two times in the first cycle when the displacement is 3 centimeters.

Problem 19 Household Voltage (hard)

Voltage in a house circuit is $V(t) = 170 \sin(120\pi t)$ volts, t in seconds. Find the peak voltage, the period, the voltage at $t = 1/240$, and the first two times the voltage is 85 volts.

Problem 20 Model the Tide from Data (hard)

High tide is 7.8 feet at 3:00 a.m. and the next low tide is 0.6 feet at 9:12 a.m. Write a cosine model $h(t)$ with t in hours after midnight, then find the height at 6:00 a.m. and at noon.