

Graphing Sine, Cosine and Tangent Functions

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

Each solution shows the work with a scoring note. Award separate points for amplitude and midline, for period, and for the shift, so one slip does not erase credit for a correct method.

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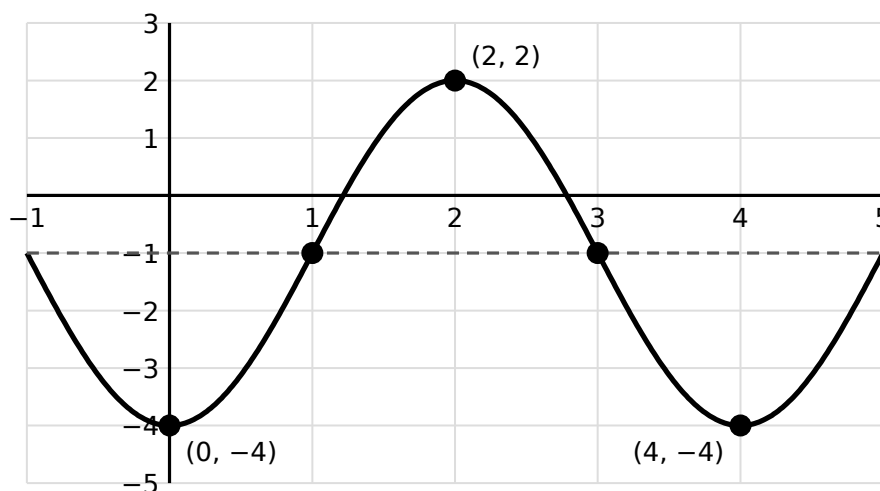
Question 1 Features of a Sinusoid (2 points)

(a) Amplitude **5**; period $2\pi/4 = \pi/2$.

(b) Factor $4x - \pi = 4(x - \pi/4)$: shift **$\pi/4$ to the right**; midline **$y = 2$** .

Scoring: 1 point per part.

Question 2 Equation from a Graph (2 points)



The midline is $y = -1$.

a. $A = (2 - (-4))/2 = \mathbf{3}$; midline $D = (2 + (-4))/2 = \mathbf{-1}$; the period is 4 (from minimum to minimum), so $B = \pi/2$.

b. The graph rises through the midline at $x = 1$, so no reflection is needed: **$y = 3 \sin(\pi/2 (x - 1)) - 1$** .

Scoring: 1 point for A, D and the period; 1 point for a correct equation (any equivalent form accepted).

Question 3 Tangent Features (2 points)

(a) Period $\pi/3$.

(b) $3x = \pm\pi/2$ gives $x = \pi/6$ and $x = -\pi/6$.

Scoring: 1 point per part.

Question 4 Write a Model from Extremes (3 points)

a. $A = (14 + 6)/2 = 10$; $D = (14 - 6)/2 = 4$.

b. Half period is $8 - 2 = 6$, so the period is **12** and $B = 2\pi/12 = \pi/6$.

c. $y = 10\cos(\pi/6 (x - 2)) + 4$.

Scoring: 1 point per part.

Question 5 Bobbing Buoy (3 points)

a. $2\pi \div (\pi/3) = 6$ seconds.

b. Maximum $4 + 2.5 = 6.5$ ft; minimum $4 - 2.5 = 1.5$ ft.

c. $h(1) = 2.5 \sin(\pi/3) + 4 = 4 + 1.25\sqrt{3} \approx 6.17$ ft.

Scoring: 1 point per part.

Question 6 Buoy at a Given Height (2 points)

$2.5 \sin(\pi t/3) = 1.25$, so $\sin(\pi t/3) = 1/2$. Then $\pi t/3 = \pi/6$ or $5\pi/6$, giving **$t = 0.5$ s and $t = 2.5$ s**.

Scoring: 1 point for setting up $\sin = 1/2$; 1 point for both times.

Question 7 Monthly Temperatures (3 points)

a. $A = (94 - 38)/2 = 28$, $D = (94 + 38)/2 = 66$, $B = 2\pi/12 = \pi/6$ and the maximum is at $m = 7$: **$T(m) = 28\cos(\pi/6 (m - 7)) + 66$** .

b. $T(3) = 28\cos(-2\pi/3) + 66 = 28(-1/2) + 66 = 52^\circ\text{F}$.

Scoring: 1 point for A and D; 1 point for B and the shift; 1 point for the March value.

Question 8 Transformation Description (3 points)

a. Stretch vertically by 2 and reflect over the x-axis; stretch horizontally by a factor of 2; shift up 3.

b. Period $2\pi \div (1/2) = 4\pi$.

c. Maximum $3 + 2 = 5$, minimum $3 - 2 = 1$: range **[1, 5]**.

Scoring: 1 point per part.