

Graphing Waves: Sine and Cosine Models

Grade 11 – Algebra 2 math · Test Answer Key · Standards: F-TF.B.5, F-IF.C.7e

Each answer shows the features and the check at one point. Give partial credit for a correct midline and amplitude when the period is wrong, and total the points out of 20.

Standards: F-TF.B.5, F-IF.C.7e · **Level:** Grade 11 Algebra 2

Question 1 Features of a sine function (3 points)

- 3.
- $2\pi/4 = \pi/2$.
- Midline $y = 2$, maximum 5, minimum -1 .**

Scoring: 1 point per part.

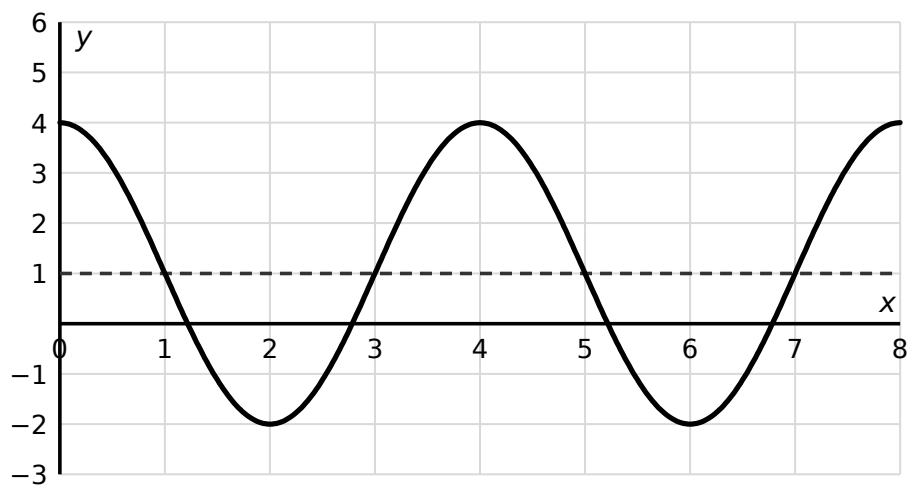
Question 2 Phase shift and range (2 points)

The shift is $\pi/3$ to the left. The midline is -1 and the amplitude is 2, so the range is $-3 \leq y \leq 1$.

Scoring: 1 point for the shift, 1 point for the range.

Question 3 Equation from a graph (3 points)

The maximum is 4 and the minimum is -2 . Midline $D = (4 - 2)/2 = 1$, amplitude $A = 3$. Peaks at 0 and 4 give period 4, so $B = 2\pi/4 = \pi/2$. **$y = 3 \cos(\pi x/2) + 1$.**



Answer figure: the wave with midline y equals 1, maximum 4 and minimum minus 2

Scoring: 1 point each for D , A and B .

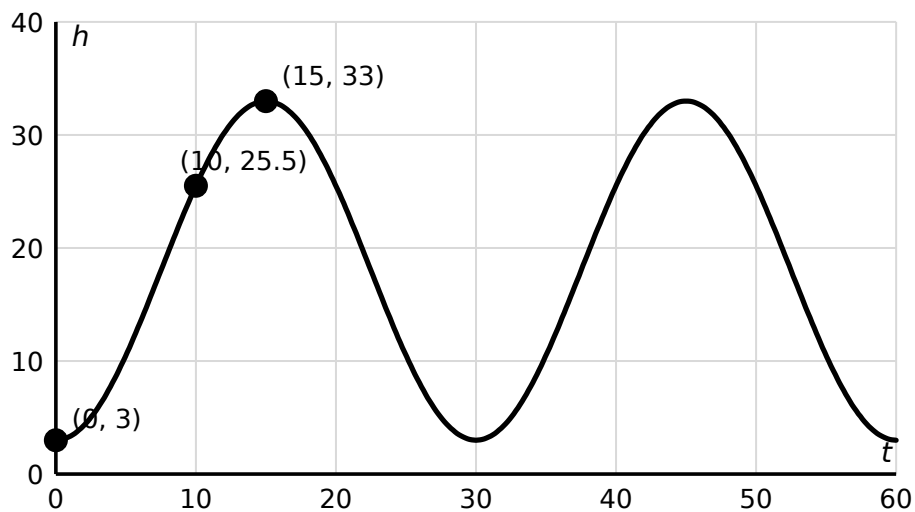
Question 4 Write a model (2 points)

Midline $(11 - 3)/2 = 4$, amplitude 7, $B = 2\pi/8 = \pi/4$. **$y = 7 \cos(\pi x/4) + 4$.**

Scoring: 1 point for midline and amplitude, 1 point for B and the equation.

Question 5 Ferris wheel (3 points)

- a. $-15 \cos 0 + 18 = 3$ feet.
- b. $-15 \cos(2\pi/3) + 18 = 7.5 + 18 = 25.5$ feet.
- c. The top is at 33 feet when $\cos(\pi t/15) = -1$, so $\pi t/15 = \pi$ and **$t = 15$ seconds.**



Answer figure: height curve with points $(0, 3)$, $(10, 25.5)$ and $(15, 33)$

Scoring: 1 point per part.

Question 6 Tide depth (2 points)

High tide: $7 + 2 = 9$ ft. Low tide: $7 - 2 = 5$ ft. At $t = 2$: $2 \cos(\pi/3) + 7 = 2(0.5) + 7 = 8$ ft. **9 ft, 5 ft, 8 ft.**

Scoring: 1 point for the two extremes, 1 point for $d(2)$.

Question 7 Maximum points (2 points)

A maximum occurs when $3x = \pi/2 + 2\pi k$. For $k = 0$: $x = \pi/6$. For $k = 1$: $3x = 5\pi/2$, $x = 5\pi/6$. **$x = \pi/6$ and $5\pi/6$.**

Scoring: 1 point for each maximum.

Question 8 Model from a table (2 points)

Midline 5 (the average of 8 and 2), amplitude 3, the cycle repeats at $x = 8$, so $B = 2\pi/8 = \pi/4$. **y**

= **$3 \sin(\pi x/4) + 5$** . Check: at $x = 2$, $3 \sin(\pi/2) + 5 = 8$.

Scoring: 1 point for midline and amplitude, 1 point for B.

Question 9 Maximum of a reflected cosine (1 point)

The maximum is $3 + 2 = 5$, and it occurs when $\cos x = -1$. **Maximum 5 at $x = \pi$.**

Scoring: 1 point for both.