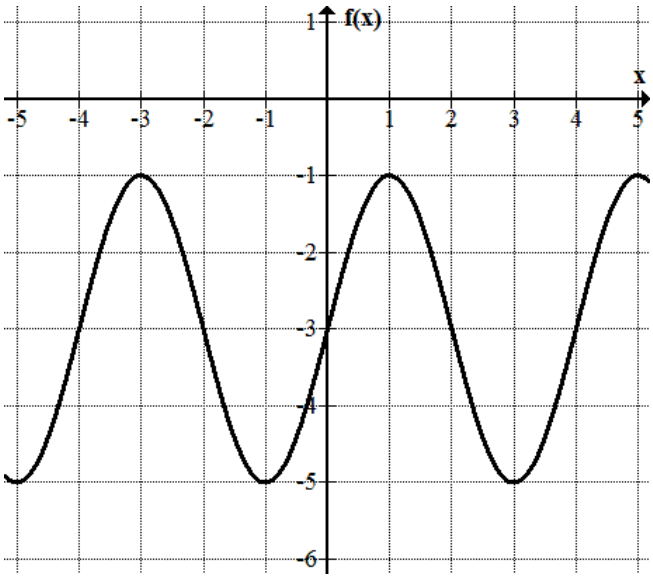
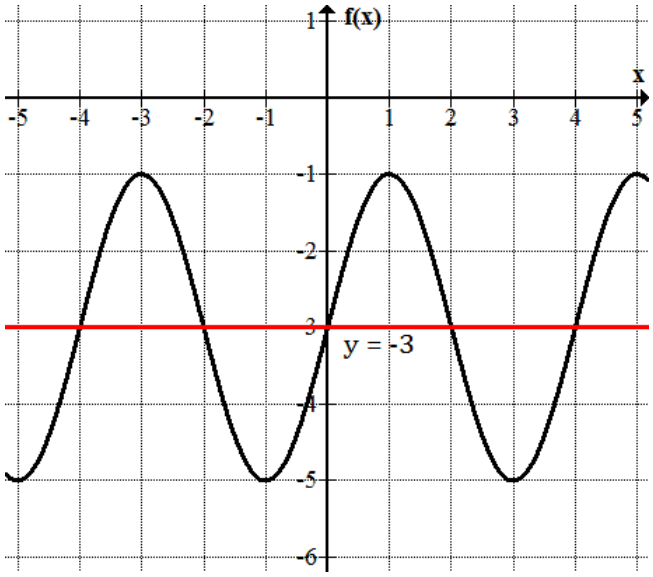
Determine the amplitude, midline, period and an equation involving the sine function for the graph shown in the figure below.



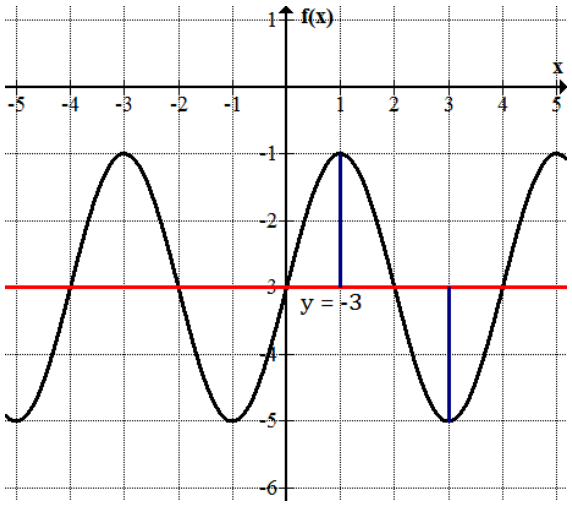
Solution

To write the sine function that fits the graph, we must find the values of A, B, C and D for the standard sine function $f(x) = A\sin(Bx - C) + D$. The value of D comes from the vertical shift or midline of the graph. The midline is a horizontal line that runs through the graph having the maximum and minimum points located at equal distances from the line. For this graph the midline is y = -3, therefore D = -3.



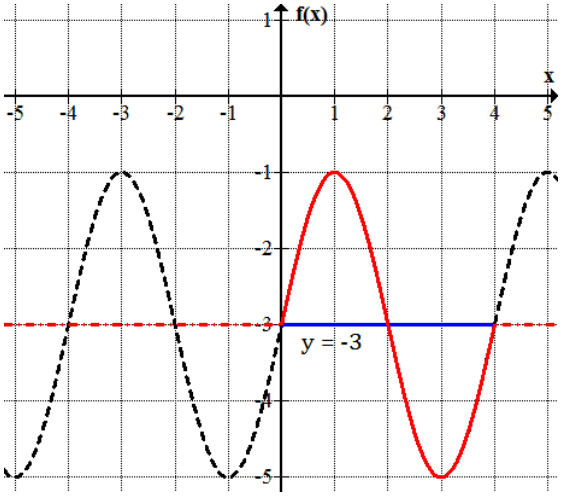
The midline intersects the graph at the y-intercept, therefore there is no phase shift and C = 0.

The value of A comes from the amplitude of the function which is the distance of the maximum and minimum values from the midline. Looking at the graph, the amplitude is 2, making $|A| = 2$.



The graph shows the sine function is increasing (as x increases) after the intersection point with the midline at the y-intercept. This makes the value of A positive, A = 2.

The last value that must be found is the value of B. The value of B comes from the period of the function: $period = \frac{2\pi}{B}$, so $B = \frac{2\pi}{period}$. The period is the distance along the x-axis for one cycle of the function. One complete cycle of this sine function starts at the midline, increases to a maximum, decreases to a minimum passing through the midline and will then increase to end at the midline.



The period of this function is 4, therefore $B = \frac{2\pi}{4} = \frac{\pi}{2}$.

The sine function that is shown in the graph is $f(x) = 2\sin\left(\frac{\pi}{2}x\right) - 3$.