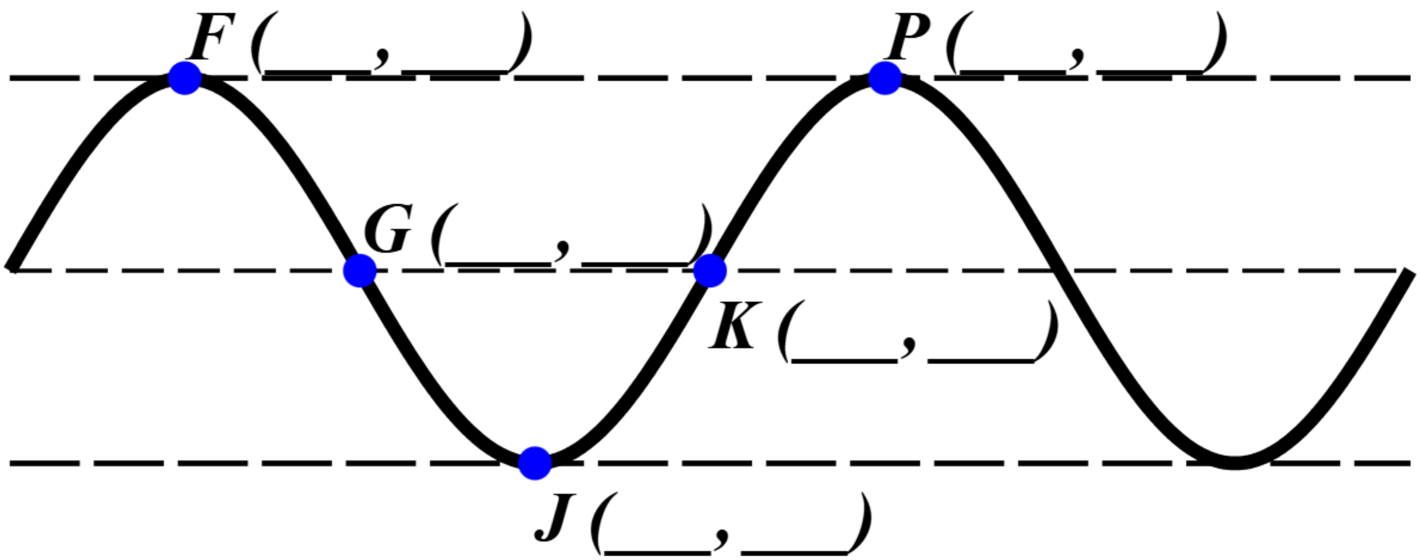
Periodic Graphs Day 4: Sinusoidal Functions in Context

<u>Warm-up!</u>

Let $f(x) = 3\cos\left(\frac{\pi}{4}(x+2)\right)$. Find coordinates of the five labelled points on the following graph of $f(x)$

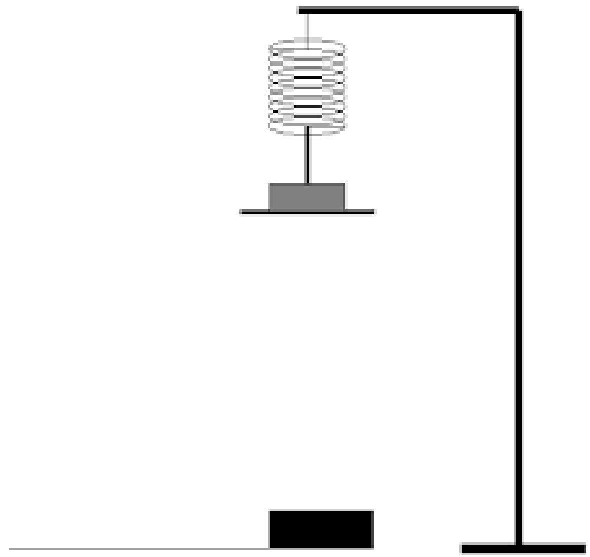


- Is this function even, odd, or neither?
- State an interval over which $f(x)$ is negative and increasing.
- State an interval over which $f(x)$ is decreasing at an increasing rate.
- State an interval over which the rate of change of $f(x)$ is positive and increasing.
- State an interval over which $f(x)$ is increasing and concave down.

<u>How to Read Word Problems about Sinusoidal Models</u>

1. Skim the first couple lines for context, but then skip to the end to see what $h(t)$ represents.
2. $h(t)$ values
   - Maximum
   - Minimum
   - Midline
   - Amplitude
3. t-values
   - At least one point
   - Period or Frequency

A 20lb weight hangs from the end of a spring. Jania stretches it downward so that the weight is 8 feet from the top of the system. From there, she releases it $(t = 0)$. The weight begins bobbing up and down. When the weight is at its closest to the ground, the weight is 8 feet from the top of the system. When the weight is at its furthest from the ground, the weight is 2 feet from the top of the system. The weight continues bobbing up and down, completing 20 cycles of the pattern every 60 seconds. The distance between the weight and the top of the system t seconds after the weight is released can be modelled by a sinusoidal function $h(t)$.



1. Skim the first couple lines for context, but then skip to the end to see what $h(t)$ represents.
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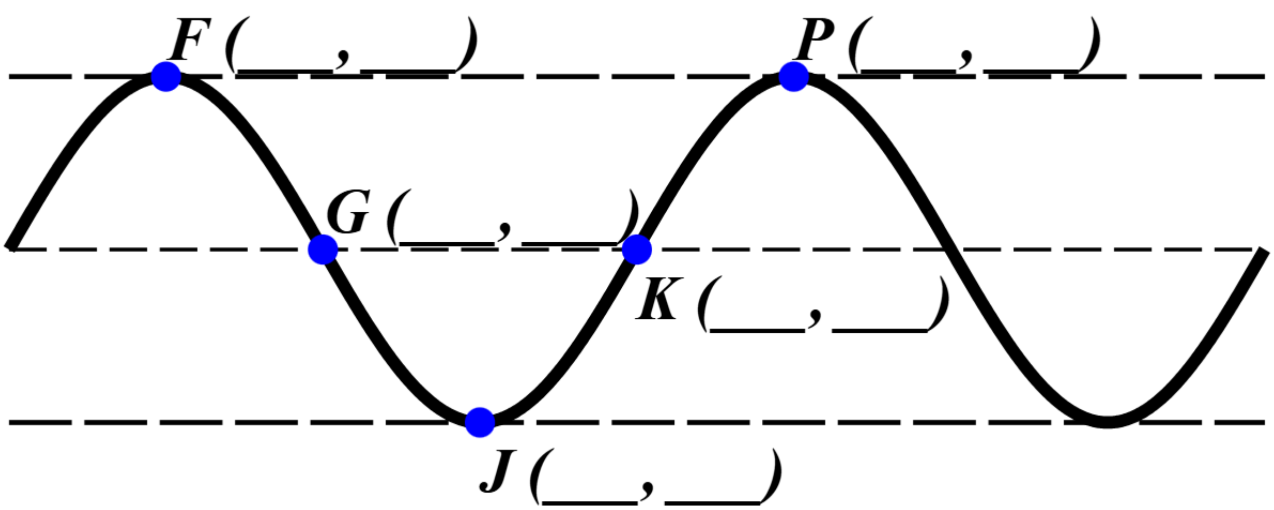
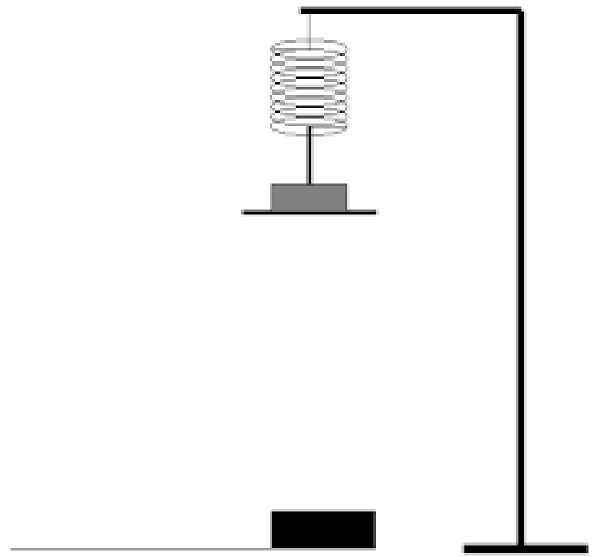


The function h can be written in the form $h(t) = a\sin\big(b(t + c)\big) + d$.

Find values of constants a, b, c, and d.

A 20lb weight hangs from the end of a spring. Jania stretches it downward so that the weight is 8 feet from the top of the system. From there, she releases it ($t = 0$). The weight begins bobbing up and down. When the weight is at its closest to the ground, its speed is 0 feet per second. 1.5 seconds later, the weight is at its furthest from the ground, and its speed is again 0 feet per second. But when the weight is halfway between those points, it reaches its maximum speed of 6 feet per second. The speed of the weight t seconds after the weight is released can be modelled by a sinusoidal function $h(t)$.



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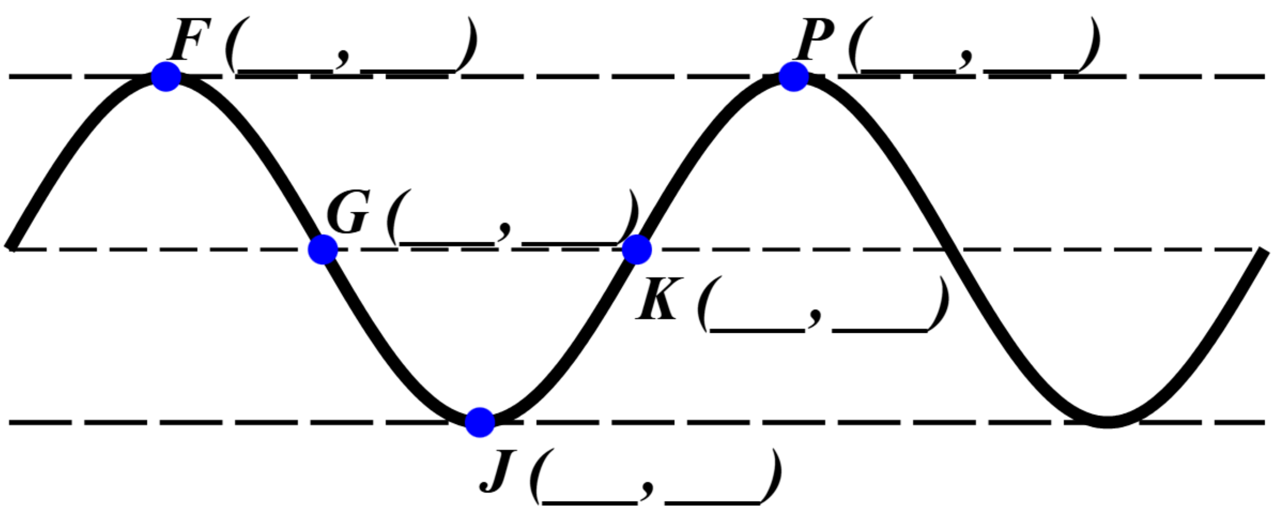

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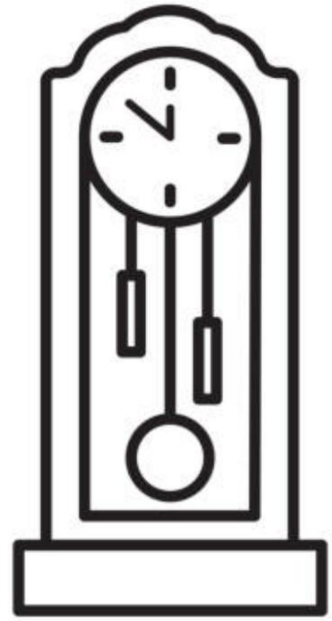
Find values of constants a, b, c, and d.

An ant clings to the tip of the minute hand on a clock. The minute hand is 4 inches long and the center of the face of the clock is 72 inches off the ground. As time passes, the minute hand spins. Believe it or not, it makes one full revolution every 60 minutes. At 7:00 PM, the minute hand points straight up. The height of the ant t minutes after 7:00 PM can be modelled by the function $h(t)$.



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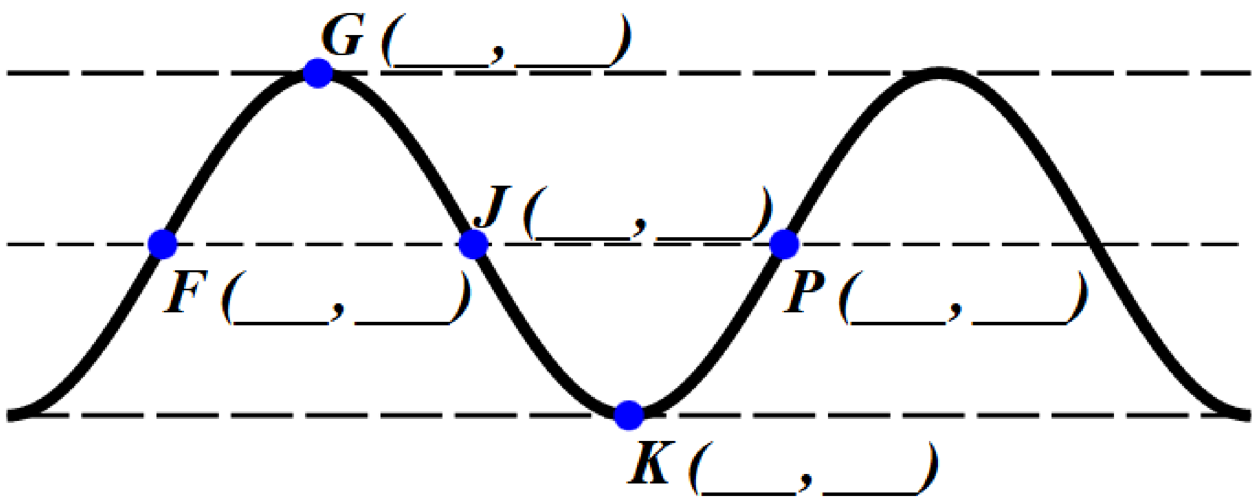

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