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## **PRACTICE Trig Word Problems**

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1. Write the trigonometric equation for the function with a period of 6. The function has a maximum of 3 at  $x = 2$  and a low point of  $-1$ .
2. Write the trigonometric equation for the function with a period of 5, a low point of  $-3$  at  $x=1$  and an amplitude of 7.
3. Ruby has a pulse rate of 73 beats per minute and a blood pressure of 121 over 85. If Ruby's blood pressure can be modeling by a sinusoidal function, find an equation of this sinusoid.
4. A mass suspended from a spring is pulled down a distance of 2 feet from its rest position. The mass is released at time  $t=0$  and allowed to oscillate. If the mass returns to this position after 1 second, find an equation that describes its motion then find at what two times within one cycle is the spring at 1.5 feet above its rest position?
5. A city averages 14 hours of daylight in June, 10 in December, and 12 in both March and September. Assume that the number of hours of daylight varies sinusoidally over a period of one year. Write an expression for  $n$ , the number of hours of daylight, as a cosine function of  $t$ . Let  $t$  be in months and  $t = 0$  correspond to the month of January. What is the average amount of daylight hours in August?
6. The average depth of water at the end of a dock is 6 feet. This varies 2 feet in both directions with the tide. Suppose there is a high tide at 4 AM. If the tide goes from low to high every 6 hours, write a cosine function  $d(t)$  describing the depth of the water as a function of time with  $t = 4$  corresponding to 4 AM. At what two times within one cycle is the tide at a depth of 5 feet?
7. Astronomers have noticed that the number of visible sunspots varies from a minimum of about 10 to a maximum of about 110 per year. Further, this variation is sinusoidal, repeating over an 11 year period. If the last maximum occurred in 2003, write a cosine function  $n(t)$  which models this phenomenon in terms of the time  $t$  which represents the year.
8. (Frequency =  $1/\text{period}$ .) An electric current alternates with a frequency of 60 cycles per second. This is called quite aptly alternating current and is the type of electrical system we have in our homes and offices in the United States. Suppose that at time  $t = 0.01$  seconds, the current is at its maximum of  $I = 5$  amperes. If the current varies sinusoidally over time, write an expression for  $I$  amperes as a function of  $t$  in seconds. What is the current at  $t=0.3$  seconds?

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9. A group of RHS students decided to study the sinusoidal nature of tides. Values for the depth of the water level were recorded at various times. At  $t=2$  hours low tide was recorded at a depth of 1.8 m. At  $t=8$  hours, high tide was recorded at a depth of 3.6 m. (a) Sketch the graph of this function and write the equation expressing distance in terms of time. (b) give the depth of water at  $t=21$  hours.
10. An object attached to a spring oscillates around a stable (equilibrium) position according to the position formula given by  $s(t) = 8\sin(3t)$  where  $t$  is in seconds and  $s(t)$  is in feet. What are the period, frequency and the maximum displacement from the stable (equilibrium) position?
11. An object hangs from a spring in a stable (equilibrium) position. The spring is pulled 3 feet downward and the object begins to oscillate, making one complete oscillation every 4 seconds. What is an equation of the motion of this object? At what two times within one cycle is the spring 2 feet below the equilibrium position? Use these values to find the next two times it is in the same position.
12. A particle travels along the  $x$ -axis according to the position  $s(t) = 7\sin(4t)$  where  $t$  is in seconds and  $s$  is the  $x$ -coordinate of the particle. (a) What is the  $x$ -coordinate of the particle at time  $t = 7.4$  seconds? (b) What is the largest value for the  $x$ -coordinate giving position of the particle. (c) What is the frequency of this motion?
13. When you board a Ferris wheel your feet are 1 foot off the ground. At the highest point of the ride, your feet are 99 feet above the ground. It takes 30 seconds for the ride to complete one full revolution. Write a trigonometric equation for your height above the ground at  $t$  seconds after the ride starts. Find at what two times within one cycle you are exactly at 90 feet off the ground.
14. At high tide the water level at a particular boat dock is 9 feet deep. At low tide the water is 3 feet deep. On a certain day the low tide occurs at 3 A.M. and high tide occurs at 9 A.M. Find an equation for the height of the tide at time  $t$ , where  $t=3$  is 3 A.M. What is the water level at 2 P.M.?

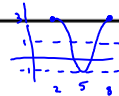
$$\begin{aligned} \text{axis} &= \frac{\text{MAX} + \text{MIN}}{2} = \frac{3 + (-1)}{2} = 1 \\ a &= \text{MAX} - \text{axis} \\ &= 3 - 1 \\ &= 2 \end{aligned}$$

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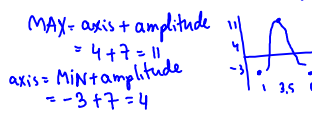
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**PRACTICE Trig Word Problems**

1. Write the trigonometric equation for the function with a period of 6. The function has a maximum of 3 at  $x = 2$  and a low point of  $-1$ .  $y = 2 \cos\left[\frac{2\pi}{6}(x-2)\right] + 1$



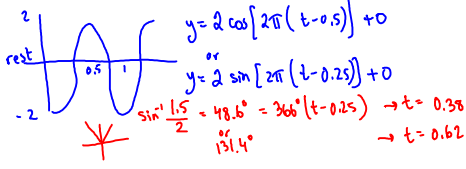
2. Write the trigonometric equation for the function with a period of 5, a low point of  $-3$  at  $x=1$  and an amplitude of 7.  $y = 7 \cos\left[\frac{2\pi}{5}(x-3.5)\right] + 4$  or  $y = 7 \sin\left[\frac{2\pi}{5}(x-2.35)\right] + 4$



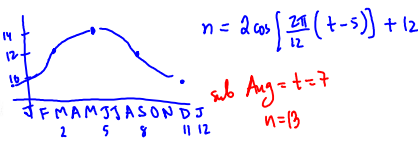
3. Ruby has a pulse rate of 73 beats per minute and a blood pressure of 121 over 85. If Ruby's blood pressure can be modeling by a sinusoidal function, find an equation of this sinusoid.  $y = 18 \sin(146\pi x) + 103$

MAX = 121  
MIN = 85  
axis = 103  
a = 18  
 $p = \frac{1}{73}$   
 $y = 18 \sin(146\pi x) + 103$

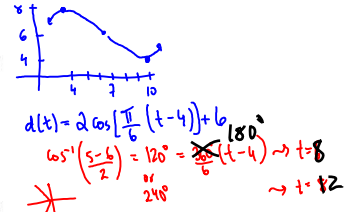
4. A mass suspended from a spring is pulled down a distance of 2 feet from its rest position. The mass is released at time  $t=0$  and allowed to oscillate. If the mass returns to this position after 1 second, find an equation that describes its motion then find at what two times within one cycle is the spring at 1.5 feet above its rest position? (0.35 and 0.62)



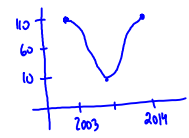
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6. The average depth of water at the end of a dock is 6 feet. This varies 2 feet in both directions with the tide. Suppose there is a high tide at 4 AM. If the tide goes from low to high every 6 hours, write a cosine function  $d(t)$  describing the depth of the water as a function of time with  $t = 4$  corresponding to 4 AM. At what two times within one cycle is the tide at a depth of 5 feet? (6 and 8)

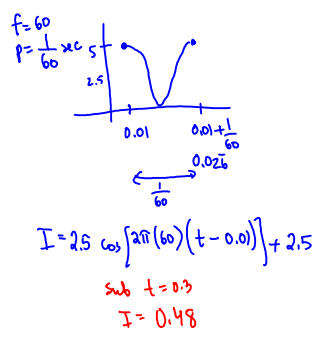


7. Astronomers have noticed that the number of visible sunspots varies from a minimum of about 10 to a maximum of about 110 per year. Further, this variation is sinusoidal, repeating over an 11 year period. If the last maximum occurred in 2003, write a cosine function  $n(t)$  which models this phenomenon in terms of the time  $t$  which represents the year.



$n(t) = 50 \cos\left[\frac{2\pi}{11}(t-2003)\right] + 60$

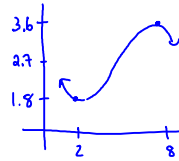
8. (Frequency = 1/period.) An electric current alternates with a frequency of 60 cycles per second. This is called quite aptly alternating current and is the type of electrical system we have in our homes and offices in the United States. Suppose that at time  $t = 0.01$  seconds, the current is at its maximum of  $I = 5$  amperes. If the current varies sinusoidally over time, write an expression for  $I$  amperes as a function of  $t$  in seconds. What is the current at  $t=0.3$  seconds? (0.48)



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$$d = 0.9 \cos\left[\frac{\pi}{6}(t-8)\right] + 2.7$$

$$d(21) = 3.5$$

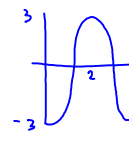
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$$\text{period} = \frac{360}{3} = \frac{2\pi}{3} \approx 2.09 \text{ sec}$$

$$f = \frac{1}{P} = 0.478$$

$$\text{Max displacement} = \text{amplitude} = 8$$

11. An object hangs from a spring in a stable (equilibrium) position. The spring is pulled 3 feet downward and the object begins to oscillate, making one complete oscillation every 4 seconds. What is an equation of the motion of this object? At what two times within one cycle is the spring 2 feet below the equilibrium position? Use these values to find the next two times it is in the same position. 1.46, 2.54, 5.46, 6.54



$$y = 3 \cos\left[\frac{2\pi}{4}(x-2)\right] + 0$$

$$\cos^{-1}\left(\frac{2}{3}\right) = 48^\circ, 2 = \frac{360^\circ}{4}(x-2) \rightarrow x = 2.54 + 4 \text{ for next}$$

$$\text{or } 311.8^\circ \rightarrow x = 5.46 + 4 \text{ for next}$$

12. A particle travels along the x-axis according to the position  $s(t) = 7\cos(4t)$  where  $t$  is in seconds and  $s$  is the x-coordinate of the particle. (a) What is the x-coordinate of the particle at time  $t = 7.4$  seconds? (b) What is the largest value for the x-coordinate giving position of the particle. (c) What is the frequency of this motion? (-1.6, 7, 0.64)

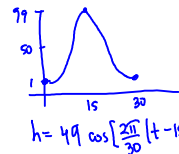
$$s(7.4) = 7 \cos[4 \times 7.4]$$

$$f_{\text{req}} = \frac{1}{P} = \frac{4}{2\pi}$$

$$\text{in radians } 4 \times 90 = 4 \times 180^\circ = 720^\circ$$

$$\text{in degrees } \frac{720}{3.14} = 229.3^\circ$$

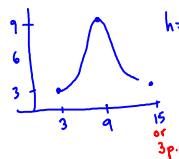
13. When you board a Ferris wheel your feet are 1 foot off the ground. At the highest point of the ride, your feet are 99 feet above the ground. It takes 30 seconds for the ride to complete one full revolution. Write a trigonometric equation for your height above the ground at  $t$  seconds after the ride starts. Find at what two times within one cycle you are exactly at 90 feet off the ground. (12.1, 17.9)



$$\cos^{-1}\left(\frac{90-50}{49}\right) = 35^\circ = \frac{360^\circ}{30}(t-15) \rightarrow t = 17.9$$

$$\text{or } 325^\circ \rightarrow t = 42.1 \text{ or } 12.1$$

14. At high tide the water level at a particular boat dock is 9 feet deep. At low tide the water is 3 feet deep. On a certain day the low tide occurs at 3 A.M. and high tide occurs at 9 A.M. Find an equation for the height of the tide at time  $t$ , where  $t=3$  is 3 A.M. What is the water level at 2 P.M.? (3.4)



$$h = 3 \cos\left[\frac{2\pi}{12}(t-9)\right] + 6$$

$$\text{Sub } t = 14$$