Equations of Sine and Cosine Curves

Precalculus

$$y = C + A \sin B(x - D)$$
$$y = C + A \cos B(x - D)$$

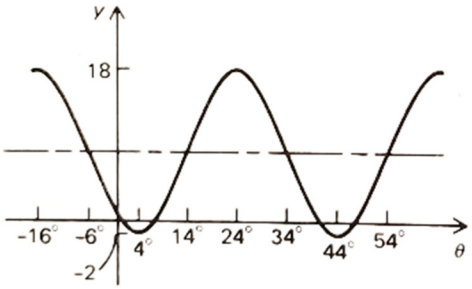
C = centerline
A = amplitude (from centerline to top of curve)
B = $\frac{360°}{\text{Length}}$ or $\frac{2\pi}{\text{Length}}$
D = shifts the function left and right

Sketch a graph of the function.

1. $y = 3 + 4 \cos 5(\theta - 10°)$
2. $y = -1 + 3 \sin 12(\theta + 6°)$
3. $y = -5 + 4 \sin {}^{1}/_{3} (x + {}^{\pi}/_{2})$
4. $y = 2 + 6 \cos {}^{\pi}/_{2} (x - 1)$

Write the equation of the sinusoid sketched.

5.



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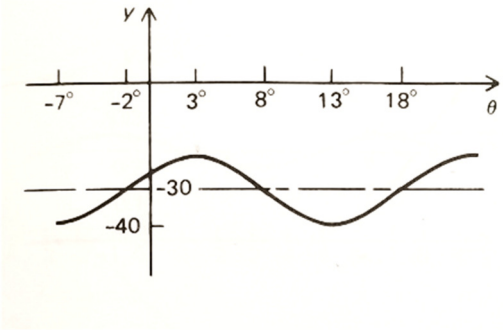

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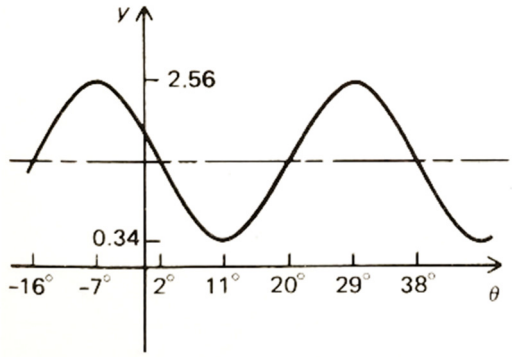

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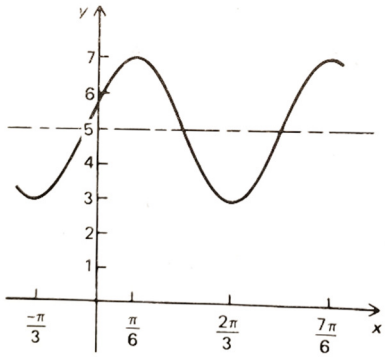
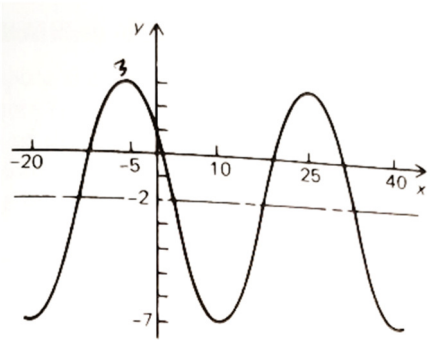
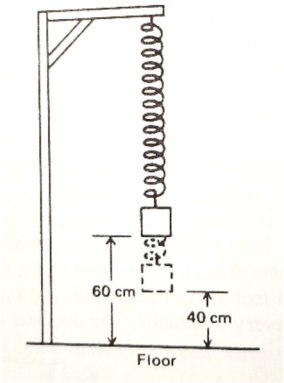


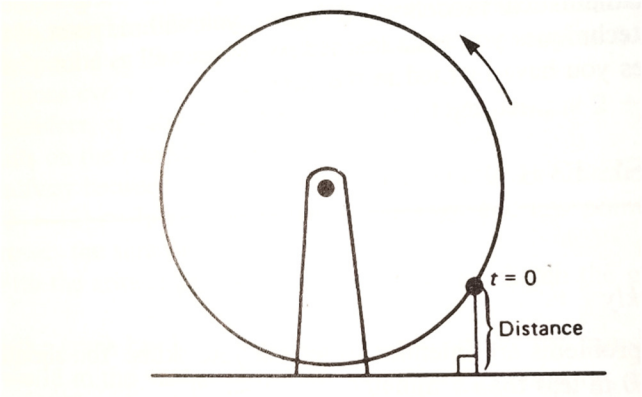
9. Use radians.



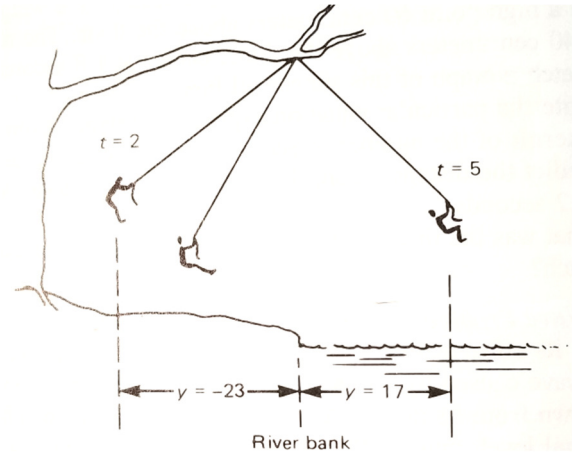
Word Problems



13. A weight attached to the end of a long spring is bouncing up and down. As it bounces, its distance from the floor varies sinusoidally with time. You start a stopwatch. When the watch reads 0.3 second, the weight reaches a high point of 60 centimeters above the floor. The next low point, 40 centimeters above the floor, occurs at 1.8 seconds.
    a. Sketch a graph of the sinusoidal function.
    b. Write the equation for the function.
    c. Predict the distance from the floor when the stopwatch reads:
        i. 17.2 seconds
        ii. 50.0 seconds.
    d. What was the distance from the floor when you started the stopwatch?



14. As you ride a Ferris wheel, your distance from the ground varies sinusoidally with time. When the last seat is filled and the Ferris wheel starts, your seat is at the position shown in the adjacent figure. You find that it takes 3 seconds to reach the top, 43 feet above the ground, and that the wheel makes a revolution once every 8 seconds. The diameter of the wheel is 40 feet.
    a. Sketch a graph of the sinusoidal function.
    b. Write the equation for the function.
    c. Predict your height above the ground when:
        i. t = 6 seconds
        ii. t = 4.33 seconds
        iii. t = 9 seconds
        iv. t = 0 seconds



15. Tarzan is swinging back and forth on his grapevine. As he swings, he goes back and forth across the river bank, going alternately over land and water. Jane decides to mathematically model his motion and starts her stopwatch. Assume that y is positive when Tarzan is over water and negative when he is over land. Jane finds that when t = 2, Tarzan is at one end of his swing and y = -23 feet. She finds that when t = 5, he reaches the other end of his swing and y = 17 feet.
    a. Sketch a graph of the sinusoidal function.
    b. Write the equation for the function.
    c. Predict y when:
        i. t = 2.8 seconds
        ii. t = 6.3 seconds
        iii. t = 15 seconds
    d. Where was Tarzan when Jane started the stopwatch?