

1. For each of the following angles, find the degree measure of the angle with the given radian measure:

$$\frac{5\pi}{6}, \quad \frac{2\pi}{4}, \quad \frac{\pi}{3}, \quad \frac{5\pi}{2}, \quad 4\pi.$$

2. For each of the following angles, find the radian measure of the angle with the given degree measure:

$$-320^\circ, \quad 260^\circ, \quad -290^\circ, \quad 190^\circ, \quad -120^\circ.$$

3. For each of the following angles (in radian measure), find the sine of the angle (your answer cannot contain trig functions, it must be an arithmetic expression or number):

$$\frac{\pi}{6}, \quad \frac{\pi}{4}, \quad \frac{\pi}{3}, \quad \frac{\pi}{2}, \quad \pi, \quad 2\pi.$$

4. For each of the following angles (in radian measure), find the cosine of the angle (your answer cannot contain trig functions, it must be an arithmetic expression or number):

$$\frac{\pi}{6}, \quad \frac{\pi}{4}, \quad \frac{\pi}{3}, \quad \frac{\pi}{2}, \quad \pi, \quad 2\pi.$$

5. If $\cos(\theta) = \frac{3}{5}$, $0 \leq \theta \leq \pi/2$, then $\sin(\theta)$ equals what value.

6. Let $y(x) = 2 + 9 \cos(2x)$.

What is the amplitude, period, and vertical shift? Evaluate this function at $x = \frac{\pi}{2}$. Sketch a graph of this function.

7. Let $y(x) = -11 \cos\left(4\left(x + \frac{\pi}{5}\right)\right)$.

What is the amplitude, period, and phase shift? Evaluate this function at $x = \frac{\pi}{2}$. Sketch a graph of this function.

8. a. Let $y = 8 - 14 \sin(2x)$.

What is the amplitude, period, and vertical shift? Evaluate this function at $x = \frac{\pi}{2}$.

b. Create an equivalent model in the form $y(x) = A + B \sin(\omega(x - \phi))$, where $B > 0$, $\omega > 0$, and $\phi \in [0, T)$ with T being the period of the function. Sketch a graph of this function.

9. a. Let $y = -2 \sin\left(2x + \frac{2\pi}{5}\right)$.

What is the amplitude, period, and phase shift? Evaluate this function at $x = \frac{\pi}{2}$. Sketch a graph of this function.

b. Create an equivalent model in the form $y(x) = A \sin(\omega(x - \phi))$,

where $A > 0$, $\omega > 0$, and $\phi \in [0, T)$ with T being the period of the function.

10. a. Let $y(x) = 8 \cos\left(3\left(x + \frac{\pi}{4}\right)\right) - 5$.

What is the amplitude, period, vertical shift, and phase shift? Evaluate this function at $x = \frac{\pi}{2}$. Sketch a graph of this function.

b. Create an equivalent model in the form

$$y(x) = B \cos(\omega(x - \phi)) + A,$$

where $B > 0$, $\omega > 0$, and $\phi \in [0, T)$ with T being the period of the function.

11. a. Let $y = -9 \cos(4\pi(x + 4))$.

What is the amplitude, period, and phase shift? Evaluate this function at $x = 4$. Sketch a graph of this function.

b. Create an equivalent model in the form

$$y(x) = A \cos(\omega(x - \phi)),$$

where $A > 0$, $\omega > 0$, and $\phi \in [0, T)$ with T being the period of the function.

12. a. Let $y = 3 \sin\left(2\left(x + \frac{\pi}{4}\right)\right) + 7$.

What is the amplitude, period, vertical shift, and phase shift? Evaluate this function at $x = \frac{\pi}{2}$.

b. Create an equivalent model in the form

$$y(x) = A \sin(\omega(x - \phi)) + B,$$

where $B > 0$, $\omega > 0$, and $\phi \in [0, T)$ with T being the period of the function. Sketch a graph of this function.

13. Place the letter of the Graph next to each function listed below: (You must enter A, B, C, D, E, or F for the answer to work.)

1. $y = 3 - 2 \cos(2\pi(x + 1))$

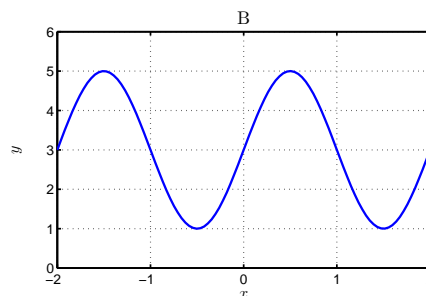
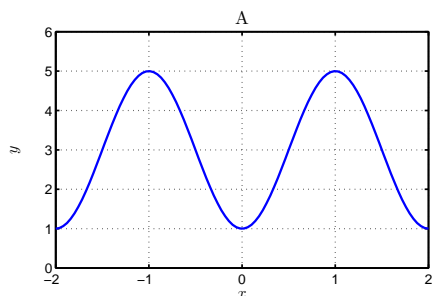
2. $y = 3 - 2 \cos(\pi x)$

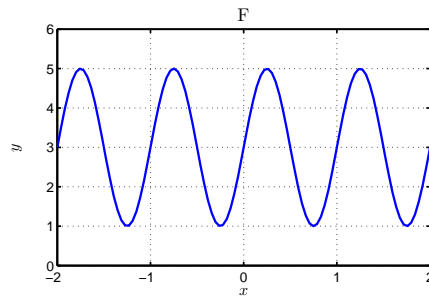
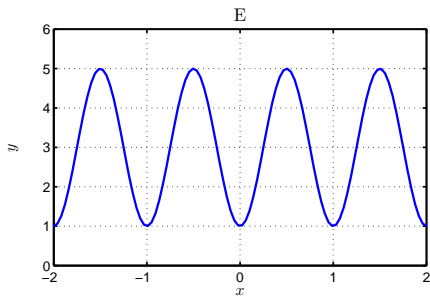
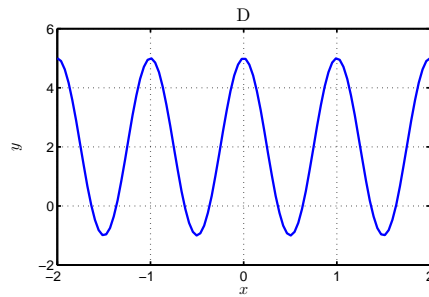
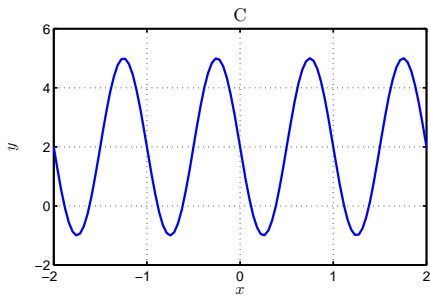
3. $y = 2 + 3 \cos(2\pi(x - 1))$

4. $y = 2 - 3 \sin(2\pi x)$

5. $y = 3 + 2 \sin(2\pi(x + 1))$

6. $y = 3 + 2 \sin(\pi x)$





14. A hawk is flying at an elevation of 320 feet. It spots a rabbit below with the angle of depression to the rabbit being 50° . Find the distance between the hawk and the rabbit. Find the distance between a point on the ground directly below the hawk and the rabbit.

15. A scientist is 35 m from the base of a tree. She measures the angle to the top of the tree and finds that it is $\frac{\pi}{5}$ radians. How tall is the tree?

16. The lungs do not completely empty or completely fill in normal breathing. The volume of the lungs normally varies between 2200 ml and 2800 ml with a breathing rate of 24 breaths/min. This exchange of air is called the tidal volume. One approximation for the volume of air in the lungs uses the cosine function written in the following manner:

$$V(t) = A + B \cos(\omega t),$$

where A , B , and ω are constants and t is in minutes. Use the data above to create a model, finding the constants A , B , and ω . Simulate the normal breathing of an individual for one minute. Graph the function for 10 sec., clearly showing the maximum and minimum volumes, and frequency of inhalation.

17. a. The heart pumps blood at a regular rate of about 60 pulses per minute. The heart volume is about 140 ml, and it pushes out about $\frac{1}{2}$ its volume (70 ml) with each beat. Use a model of the following form to simulate the volume of blood, $B(t)$, in the heart at any time t :

$$B(t) = a + b \sin(\omega t),$$

where a , b , and ω are constants and t is in minutes. Find the volume in the heart after 1 sec ($t = \frac{1}{60}$). Sketch a graph of this function for 5 sec., clearly showing the maximum and minimum volumes, and frequency of the beating heart.

b. When the heart pushes out blood, the pressure, $P(t)$, in the aorta and arterioles increases to 120 mm Hg. When the heart fills with blood, the pressure falls to about 80 mm Hg. Use a similar model of the form

$$P(t) = c + d \sin(\omega t),$$

where c , d , and ω are constants and t is in minutes. Find the blood pressure from the model after 1 sec ($t = \frac{1}{60}$). Sketch a graph of this function for 5 sec., clearly showing the maximum and minimum volumes, and frequency of the beating heart.

c. Consider your answer in Part b, and determine an equivalent cosine model of the form

$$P(t) = C + D \cos(\nu(t - \phi)),$$

where $D > 0$, $\nu > 0$, and $\phi \in [0, T)$ with T being the period of the heart.

18. The average body temperature for a human is about $37^\circ C$. However, this temperature normally varies a few tenths of a degree in each individual with distinct regularity. The body is usually at its hottest around 10 or 11 am and at its coolest in the late evening, which helps encourage sleep. When an individual switches to night shift work, his body temperature cycle has to switch also.

a. Suppose that a worker on the night shift finds his hottest body temperature to be at 2 am with a body temperature of $37.1^\circ C$, then 12 hours later his body temperature achieves a minimum of $36.7^\circ C$. Assume that the body temperature can be modeled using a trigonometric function and is given by

$$T(t) = A + B \cos(\omega(t - \phi)),$$

where A , $B > 0$, and $\phi \in [0, 24)$, are constants and t is in hours. Use the data above to find the four parameters. Find the body temperature according to this model for this individual at 9 am ($t = 9$). Sketch a graph for the body temperature of this individual for one day.

b. Determine an equivalent temperature model of the form

$$T(t) = C + D \sin(\nu(t - \psi)),$$

where C , $D > 0$, $\nu > 0$, and $\psi \in [0, 24)$ are constants. Use the data above to find the four parameters.

Also, find a value of the phase shift, $\psi_2 \in [-24, 0)$, which produces an equivalent model.

19. a. Iguanas are cold-blooded or ectothermic organisms with their body temperature depending on the external temperature. Their natural habitat lies near the equator, where the sun shines about 12 hours a day. The iguana's temperature cycles during the day, with a low of $75^\circ F$ at about 3 am and a high of $104^\circ F$ at about 3 pm. Assume that the body temperature of an iguana can be modeled using the following function:

$$T(t) = A + B \sin(\omega(t - \phi)),$$

where A , B , ω , and ϕ are constants and t is in hours. Use the data above to find the four parameters. Find the body temperature according to this model for this individual at 6 am ($t = 6$). Sketch a graph for the temperature of a typical iguana for one day.

b. A temperature of $88^\circ F$ for at least 12 hours a day is critical for the health of an iguana. Does this model suggest that the iguana receives enough heat for good health? (Use the graph which you have created to make a reasonable estimate.)

c. Determine an equivalent temperature model of the form

$$T(t) = C + D \cos(\nu(t - \psi)),$$

where $C, D > 0$, $\nu > 0$, and $\psi \in [0, 24)$. Also, find a value of the phase shift $\psi \in [-24, 0)$, which produces an equivalent model.