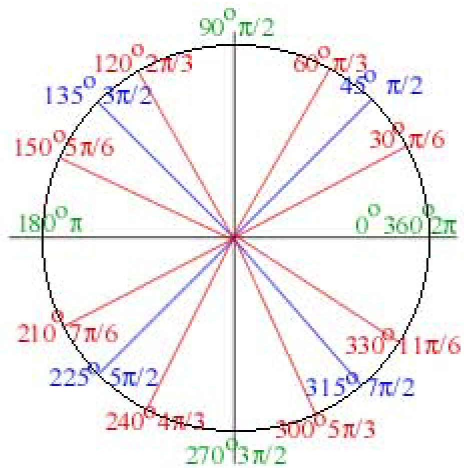
1.



The graphs for the following are in the short solutions.

3. period $T = \frac{2\pi}{3}$

5. period $T = \frac{2\pi}{(1/2)} = 4\pi$

7. period $T = \frac{2\pi}{(1/2)} = 4\pi$

9. period $T = \frac{2\pi}{3}$

11. a. The maximum in the heart is 140 ml of blood, and the minimum is 70 ml of blood, so its mean volume is given by

$$a = \frac{140 + 70}{2} = 105 \text{ ml.}$$

The value of the variation from the mean is $b = 35$ ml. There are 60 pulses/min, so the period $T = \frac{1}{60}$. Thus, we find $\omega = \frac{2\pi}{T} = 120\pi$. It follows that

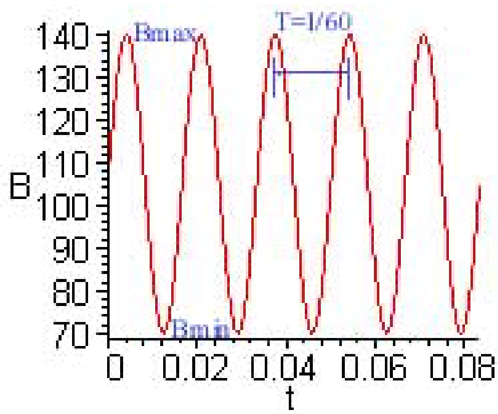
$$B(t) = 105 + 35\sin(120\pi t),$$

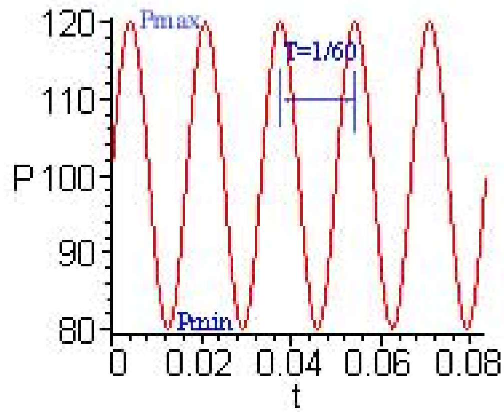
which is graphed below left. The maximum occurs when $B(t) = 140$, which is when $120\pi t = \pi/2$. It follows that the maximum occurs when $t = \frac{1}{240}$ min or 0.25 sec. Since the period of $B(t)$ is $\frac{1}{60}$ min or 1 sec, the maximum occurs every second after 0.25 or $t_{max} = 0.25, 1.25, 2.25, ...$ sec. The minimum occurs when $B(t) = 70$, which is when $120\pi t = 3\pi/2$. It follows that the minimum occurs when $t = \frac{3}{240} = \frac{1}{80}$ min or 0.75 sec, so $t_{min} = 0.75, 1.75, 2.75, ...$ sec.

b. First we find the mean pressure $c = \frac{120+80}{2} = 100$ mm Hg. The value of the variation from the mean is $d = 20$ mm Hg. There are 60 pulses/min, so the period $T = \frac{1}{60}$ min. Thus, we find $\omega = \frac{2\pi}{T} = 120\pi$, and we write the specific equation

$$P(t) = 100 + 20\sin(120\pi t),$$

which is graphed below right. The maxima and minima occur at the same times as above in Part a.





13. a. First we find the mean body temperature $A = \frac{75+104}{2} = 89.5$°F. The value of the variation from the mean is $B = 14.5$°F. The period is $T = 24$ hours. Thus, we find $\omega = \frac{2\pi}{T} = \frac{\pi}{12}$. To find the phase shift ϕ, we note that the maximum occurs at $t = 15$, and the sine function has a maximum at $\frac{\pi}{2}$. Thus,

$$\omega(t - \phi) = \frac{\pi}{12}(15 - \phi) = \frac{\pi}{2}.$$

Therefore,

$$15 - \phi = 6 \qquad \text{or} \qquad \phi = 9.$$

Thus, the formula for the temperature of the iguana is

$$T(t) = 89.5 + 14.5 \sin\left(\frac{\pi}{12}(t - 9)\right),$$

which is graphed below.

b. You can use the graph to estimate this, or find the times at which the temeprature reaches 88°F and then find the difference between them. $T(t) = 89.5 + 14.5 \sin\left(\frac{\pi}{12}(t - 9)\right) = 88$, shows that the time at which the temperature first rises above 88°F is 8.604 hours, and it cools below 88°F at 21.396 hours, so the time above 88°F is $21.396 - 8.604 = 12.79$ hours or 12 hours 48 min.