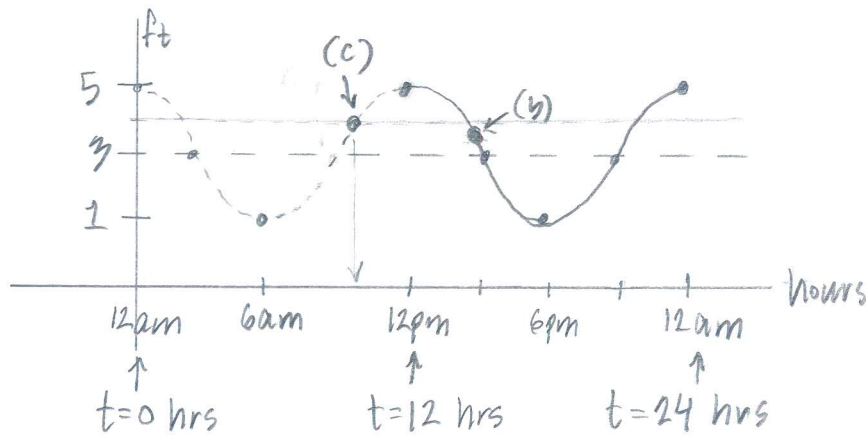


# Sinusoidal Functions as Mathematical Models

1.



$$\text{amp} = 2$$

$$\text{vs} = 3$$

$$\text{pd} = 12 \text{ hours}$$

$$\text{ps} = 12$$

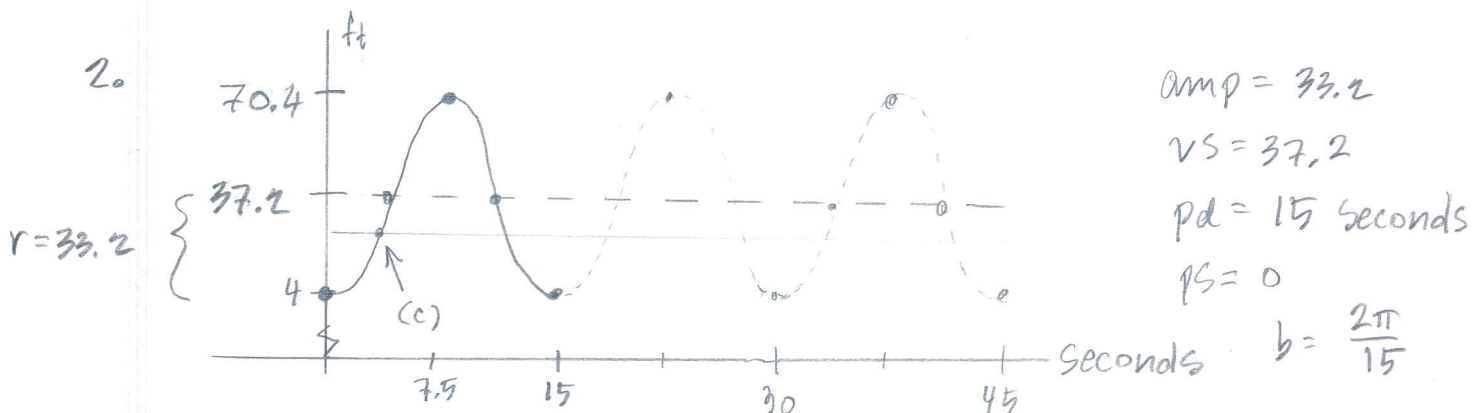
$$b = \frac{2\pi}{12} = \frac{\pi}{6}$$

$$(a) \quad h(t) = 2 \cos \frac{\pi}{6} (t - 12) + 3$$

$$(b) \quad 2:30 \text{ pm} \rightarrow t = 14.5 \text{ hours} \rightarrow h(14.5) = \boxed{3.5 \text{ feet}}$$

$$(c) \quad \boxed{10 \text{ am}} \quad (\text{find intersection of } h(t) \text{ and } y=4)$$

2.



$$\text{amp} = 33.2$$

$$\text{vs} = 37.2$$

$$\text{pd} = 15 \text{ seconds}$$

$$\text{ps} = 0$$

$$b = \frac{2\pi}{15}$$

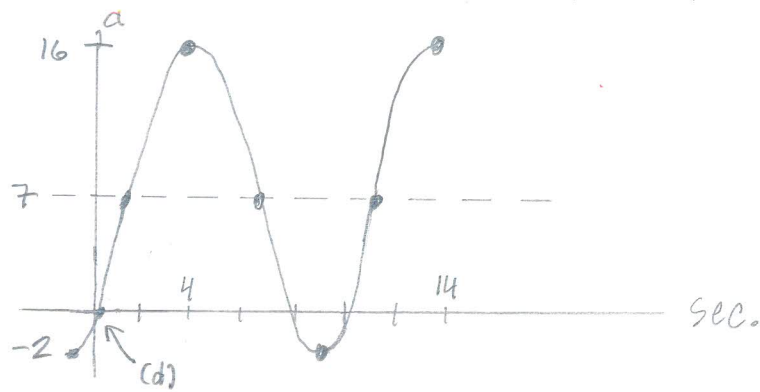
$$(a) \quad h(t) = -33.2 \cos \frac{2\pi}{15} t + 37.2$$

$$(b) \quad h(52) = \boxed{69.7 \text{ ft.}}$$

$$(c) \quad \boxed{3 \text{ seconds}} \quad (\text{find intersection of } h(t) \text{ and } y=27)$$

↑  
first

3.



$$\begin{aligned} \text{amp} &= 9 \\ \text{vs} &= 7 \\ \text{pd} &= 10 \\ \text{ps} &= 4 \\ b &= \frac{2\pi}{10} = \frac{\pi}{5} \end{aligned}$$

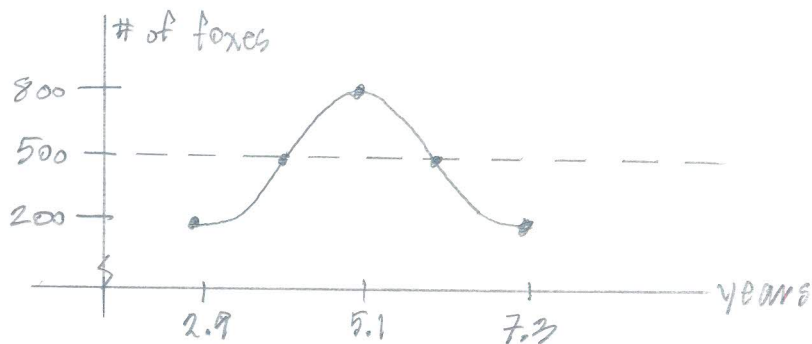
$$(a) \quad d(t) = 9 \cos \frac{\pi}{5}(t-4) + 7$$

(b)  $\boxed{-2 \text{ ft.}}$   $\rightarrow$  the wheel goes underwater

$$(c) \quad d(17) = \boxed{4.2 \text{ feet}}$$

(d) When  $h=0$ ,  $\boxed{t=0.08 \text{ sec.}}$ ; coming out of the water

4.



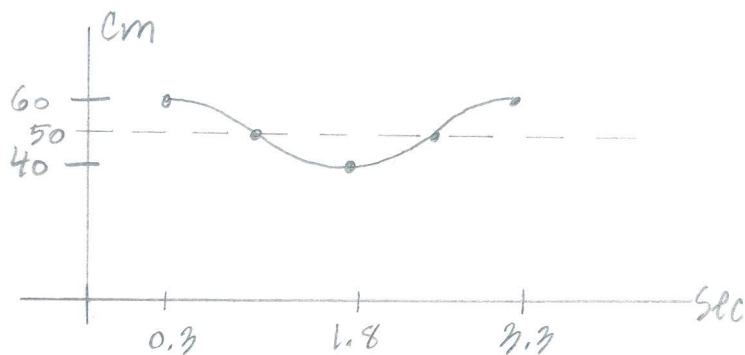
$$\begin{aligned} \text{amp} &= 300 \\ \text{vs} &= 500 \\ \text{pd} &= 4.4 \\ \text{ps} &= 2.9 \\ b &= \frac{2\pi}{4.4} = \frac{\pi}{2.2} \end{aligned}$$

$$(a) \quad f(t) = -300 \cos \frac{\pi}{2.2}(t-2.9) + 500$$

$$\begin{aligned} (b) \quad f(7) &= 227 \text{ foxes} \\ f(8) &= 338 \text{ foxes} \\ f(9) &= 727 \text{ foxes} \\ f(10) &= 727 \text{ foxes} \end{aligned}$$

(c) between 2.3 years to 3.5 years

5.



$$\text{amp} = 10$$

$$VS = 50$$

$$pd = 3$$

$$ps = 0.3$$

$$b = \frac{2\pi}{3}$$

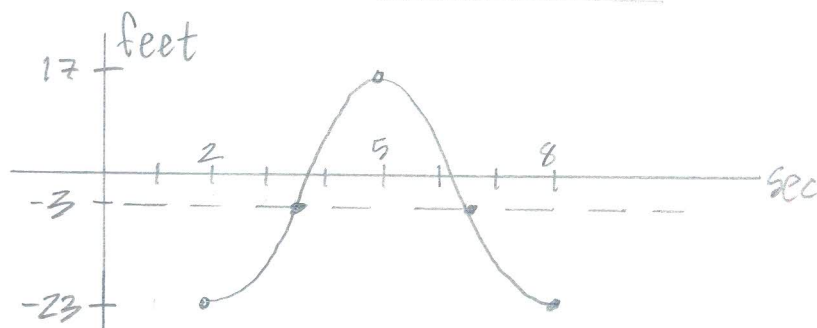
$$(a) d(t) = 10 \cos \frac{2\pi}{3}(t - 0.3) + 50$$

$$(b) d(17.2) = \boxed{43.3 \text{ cm}}$$

$$(c) d(0) = \boxed{58.1 \text{ cm}}$$

$$(d) \text{ when } d = 59, \boxed{t = 0.08 \text{ sec}}$$

6.



$$\text{amp} = 20$$

$$VS = -3$$

$$pd = 6$$

$$ps = 2$$

$$b = \frac{2\pi}{6} = \frac{\pi}{3}$$

$$(a) y = -20 \cos \frac{\pi}{3}(t - 2) - 3$$

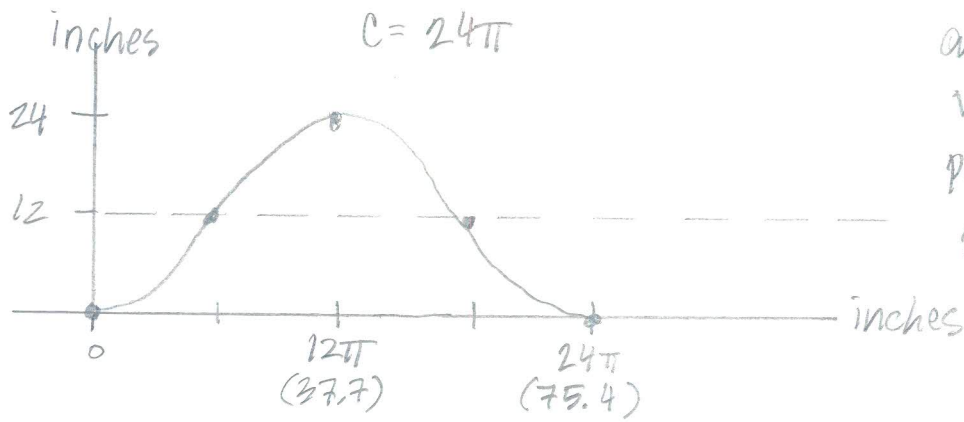
$$(b) y(13.2) = \boxed{-16.4 \text{ ft}}; \text{ over land}$$

$$(c) \text{ when } y = 0, \boxed{x = 0.36 \text{ sec}}$$

$$(d) \boxed{y = -3} \text{ which is the vertical shift}$$



9.



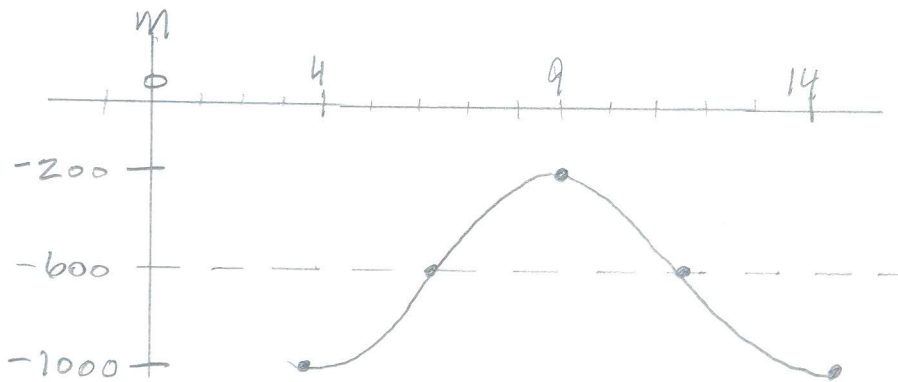
$$\begin{aligned} \text{amp} &= 12 \\ v_s &= 12 \\ p_d &= 24\pi \\ p_s &= 0 \\ b &= \frac{2\pi}{24\pi} = \frac{1}{12} \end{aligned}$$

$$(a) \quad h(t) = -12 \cos \frac{x}{12} + 12$$

$$(b) \quad h(15) = \boxed{8.22 \text{ inches}}$$

$$(c) \quad h = 11 \text{ inches at } \boxed{17.8 \text{ inches and } 57.5 \text{ inches}}$$

10.



$$\begin{aligned} \text{amp} &= 400 \\ v_s &= -600 \\ p_d &= 10 \\ p_s &= 4 \\ b &= \frac{2\pi}{10} = \frac{\pi}{5} \end{aligned}$$

$$(a) \quad d(t) = -400 \cos \frac{\pi}{5} (x-4) - 600$$

$$(b) \quad d(0) = -276 \text{ m} \rightarrow \boxed{\text{yes}} \text{ the sub can communicate}$$

$$(c) \quad \text{the sub cannot communicate between } \boxed{0.15 \text{ min and } 7.85 \text{ min}} \\ \text{or } 9 \text{ seconds and } 471 \text{ seconds}$$