L5 – 5.3 Trig Applications
MHF4U

Example 1: A Ferris wheel has a diameter of 15m and is 6m above ground level at its lowest point. It takes the rider 30s from their minimum height above the ground to reach the maximum height of the ferris wheel. Assume the rider starts the ride at the min point.

a) Model the vertical displacement of the rider vs. time using a sine function.

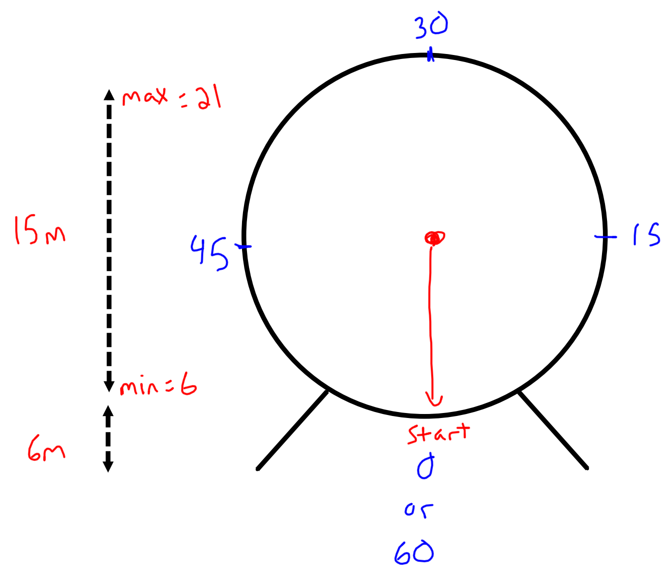
$$a = \frac{max - min}{2} = \frac{21-6}{2} = 7.5$$

$$k = \frac{2\pi}{period} = \frac{2\pi}{60} = \frac{\pi}{30}$$

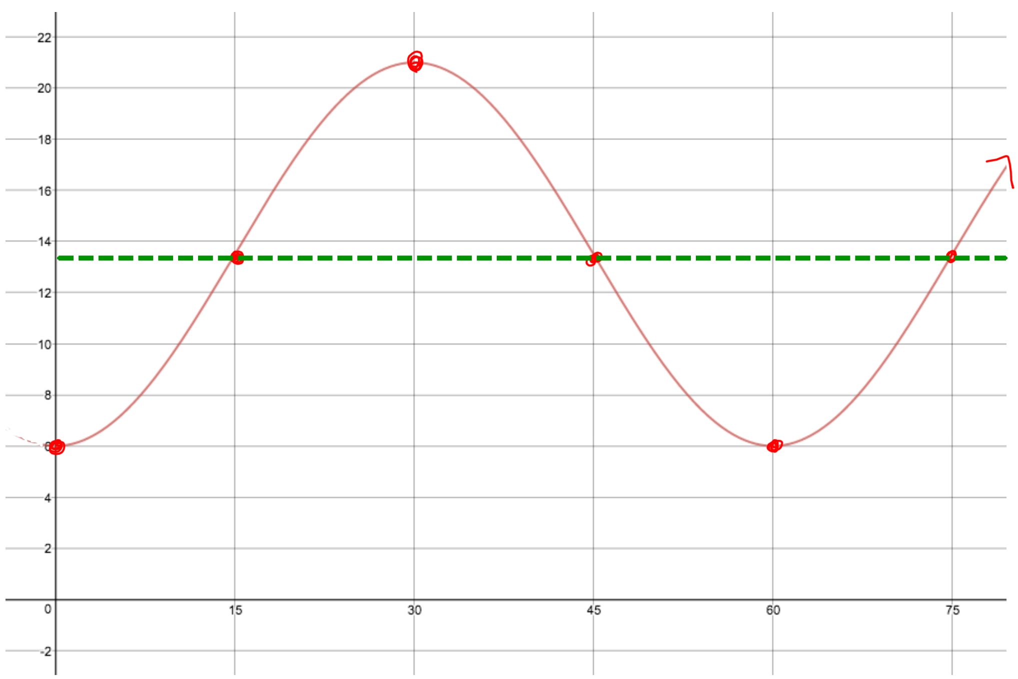
$$c = max - a = 21 - 7.5 = 13.5$$

$$d_{sin} = 15$$

$$h(t) = 7.5\sin\left[\frac{\pi}{30}(t-15)\right] + 13.5$$



b) Sketch a graph of this function



Example 2: Mr. Ponsen has the heating system, in this room, turn on when the room reaches a min of 66°F, it heats the room to a maximum temperature of 76°F and then turns off until it returns to the minimum temperature of 66°F. This cycle repeats every 4 hours. Mr. Ponsen ensures that this room is at its max temperature at 9 am.

a) Write a cosine function that gives the temperature at King's, *T*, in °F, as a function of *h* hours after midnight.

$$a = \frac{max - min}{2} = \frac{76 - 66}{2} = 5$$

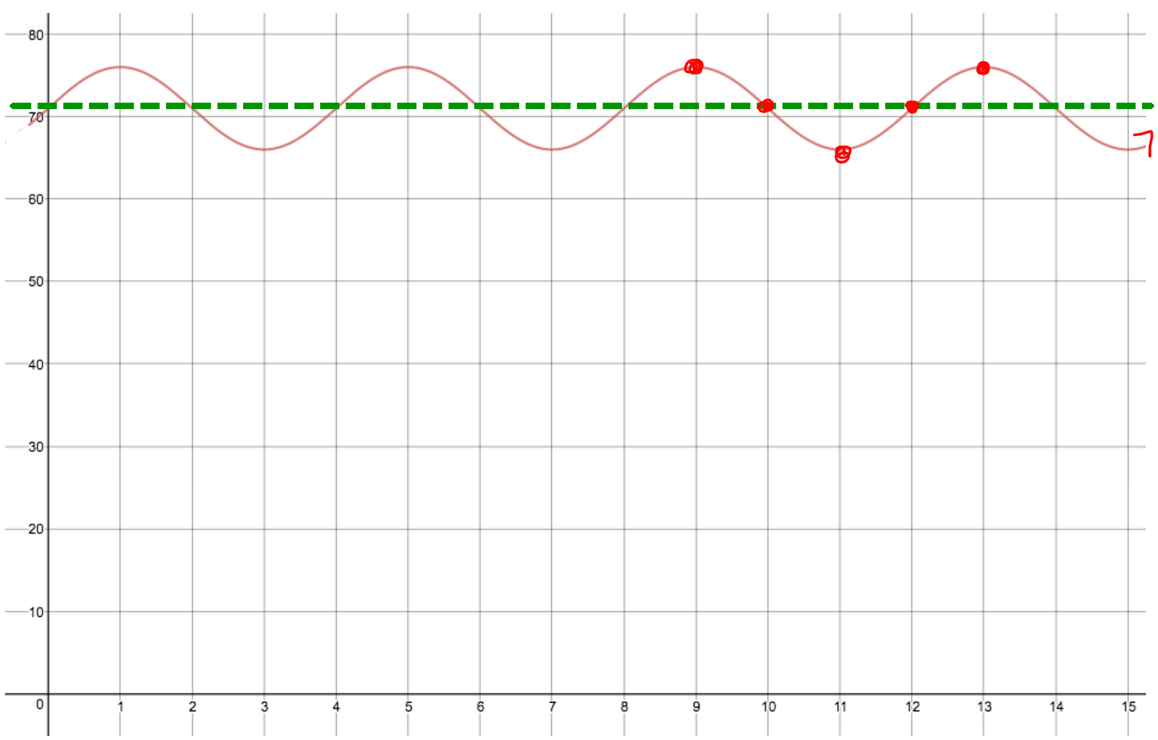
$$k = \frac{2\pi}{period} = \frac{2\pi}{4} = \frac{\pi}{2}$$

$$c = max - a = 76 - 5 = 71$$

$$d_{cos} = 9$$

$$T(h) = 5\cos\left[\frac{\pi}{2}(h - 9)\right] + 71$$

b) Sketch a graph of the function.



Example 3: The tides at Cape Capstan, New Brunswick, change the depth of the water in the harbor. On one day in October, the tides have a high point of approximately 10 meters at 2 pm and a low point of 1.2 meters at 8:15 pm. A particular sailboat has a draft of 2 meters. This means it can only move in water that is atleast 2 meters deep. The captain of the sailboat plans to exit the harbor at 6:30 pm. Assuming $t = 0$ is noon, find the height of the tide at 6:30 pm. Is it safe for the captain to exit the harbor at this time?

$$a = \frac{max - min}{2} = \frac{10 - 1.2}{2} = 4.4$$

$$k = \frac{2\pi}{period} = \frac{2\pi}{12.5} = \frac{4\pi}{25}$$

Note: *Horizontal distance between max and min points represent half a cycle. Since max and min tide are 6.25 hours apart, one cycle must be 12.5 hours.*

$$c = max - a = 10 - 4.4 = 5.6$$

$$d_{cos} = 2$$

$$h(t) = 4.4\cos\left[\frac{4\pi}{25}(t-2)\right] + 5.6$$

$$h(6.5) = 4.4\cos\left[\frac{4\pi}{25}(6.5-2)\right] + 5.6$$

$$h(6.5) = 4.4\cos\left[\frac{4\pi}{25}(4.5)\right] + 5.6$$

$$h(6.5) = 4.4\cos\left[\frac{18\pi}{25}\right] + 5.6$$

$h(6.5) \cong 2.8$ meters

Since the depth of the water is greater than 2 meters, the sailboat can safely exit the harbor.