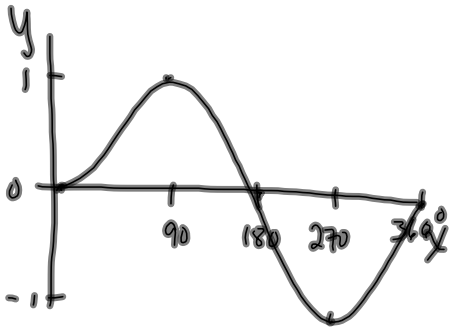
Applications of Sinusoidal Functions



Parameters

Amp ⟷ vertical stretch

SA ⟷ vertical translation

period ⟷ (related to) horizontal stretch

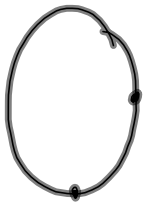
PS ⟷ horizontal translation

Example: P = 30 sec

→ 30 sec to make one complete cycle (max → max)
(min → min)
(↑SA → ↑SA)

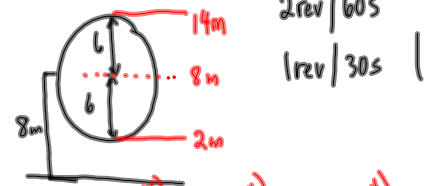
→ 15 sec to go from max to min
min to max

→ 7.5 sec to go from max to SA
min to SA



Example - Ferris Wheel Problem

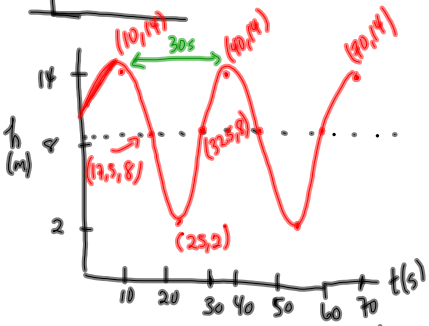
You have a ferris wheel 12m in diameter. The centre of the wheel is 8m above the ground. It makes 2 complete revolutions in 1 minute. You reach the top 10s after it begins its first full revolution.



2 rev / 60s

1 rev / 30s (15s to go from bottom to top)

* so you must not have started at the bottom.



Amp: 6

SA: $y = 8$

Period: 30s

PS: 32.5s

$$\frac{1}{\text{Amp}}(y - \text{SA}) = \sin\left(\frac{360}{\text{Period}}(x - \text{PS})\right)$$

$$\frac{1}{6}(y - 8) = \sin\left(\frac{360}{30}(x - 32.5)\right)$$

transformational form

$$\frac{1}{6}(y - 8) = \sin(12(x - 32.5))$$

$$(y - 8) = 6\sin(12(x - 32.5))$$

functional form

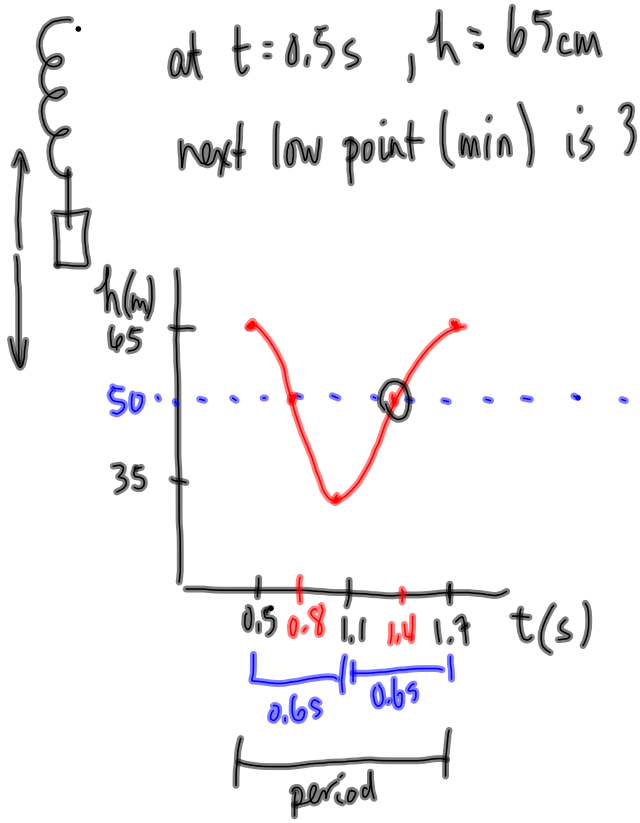
$$y = 6\sin(12(x - 32.5)) + 8$$

where
- x is the time (s)
- y is the height (m)

What if:

1. The ferris wheel had a diameter of 13 m instead of 12.
   - the amplitude would be 6.5m instead of 6m
2. The ferris wheel was travelling twice as fast?
   - the period will be 15s instead of 30s
3. The centre of the wheel was 9 m above the ground?
   - the sinusoidal axis is now $y = 9$ instead of $y = 8$.

Example - Oscillating Mass Attached to Spring



Amp: 15 cm
SA: y = 50 cm
Period: 1.2s
PS: 1.4

$$\frac{1}{Amp}(y - SA) = \sin\left(\frac{360}{period}(x - PS)\right)$$

transformational form

$$\frac{1}{15}(y - 50) = \sin\left(\frac{360}{1.2}(x - 1.4)\right)$$

$$(y - 50) = 15\sin\left(300(x - 1.4)\right)$$

functional form

$$y = 15\sin\left(300(x - 1.4)\right) + 50$$

where x is time (s)
h is the height (m)

TODO
① p 112/17 cod
② Sheet (Sinusoidal Modeling)