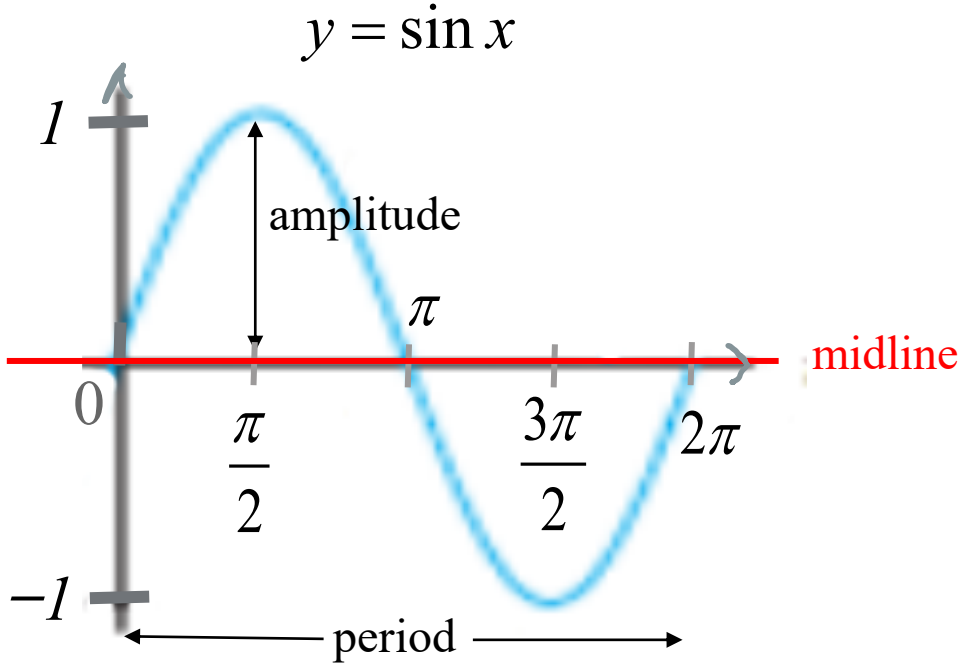
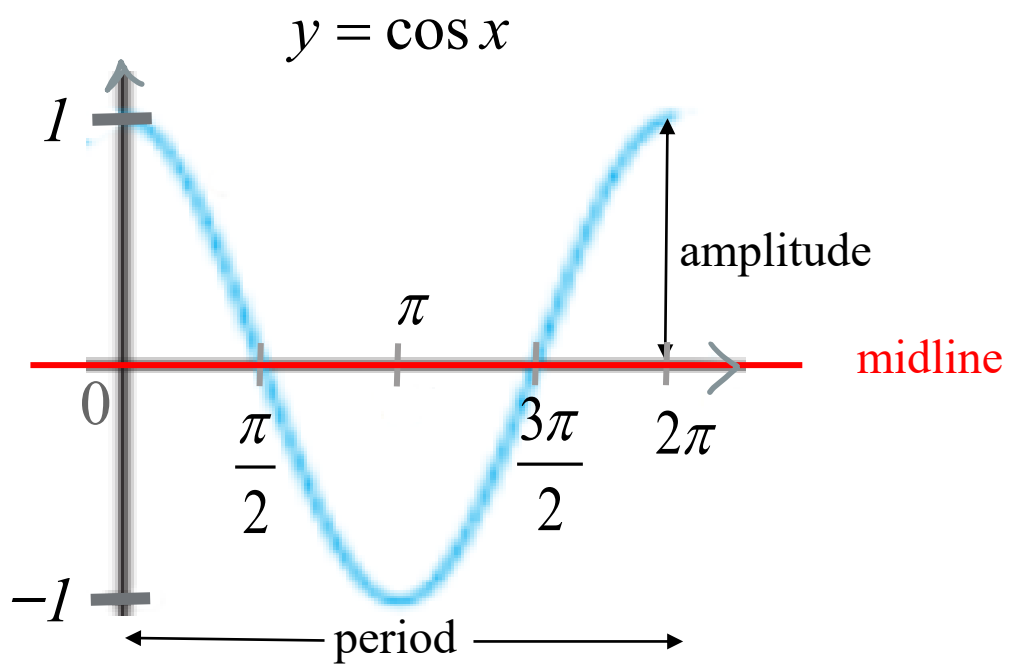
# MAT123

Graph of Sine, Cosine - Applications

# Sine/Cosine Base Graphs – Review




Transformations: $y = A\sin(Bx - C) + D$

when $A$ is negative, graph reflects about the $x$-axis

Amplitude is $|A|$

Calculate period using $\frac{2\pi}{B}$

Vertical Shift is $D$

Phase Shift* is $\frac{C}{B}$ *opposite direction of sign

# Angles of Elevation/Depression

Angle of Elevation:

on the ground, looking up

Angle of Depression:

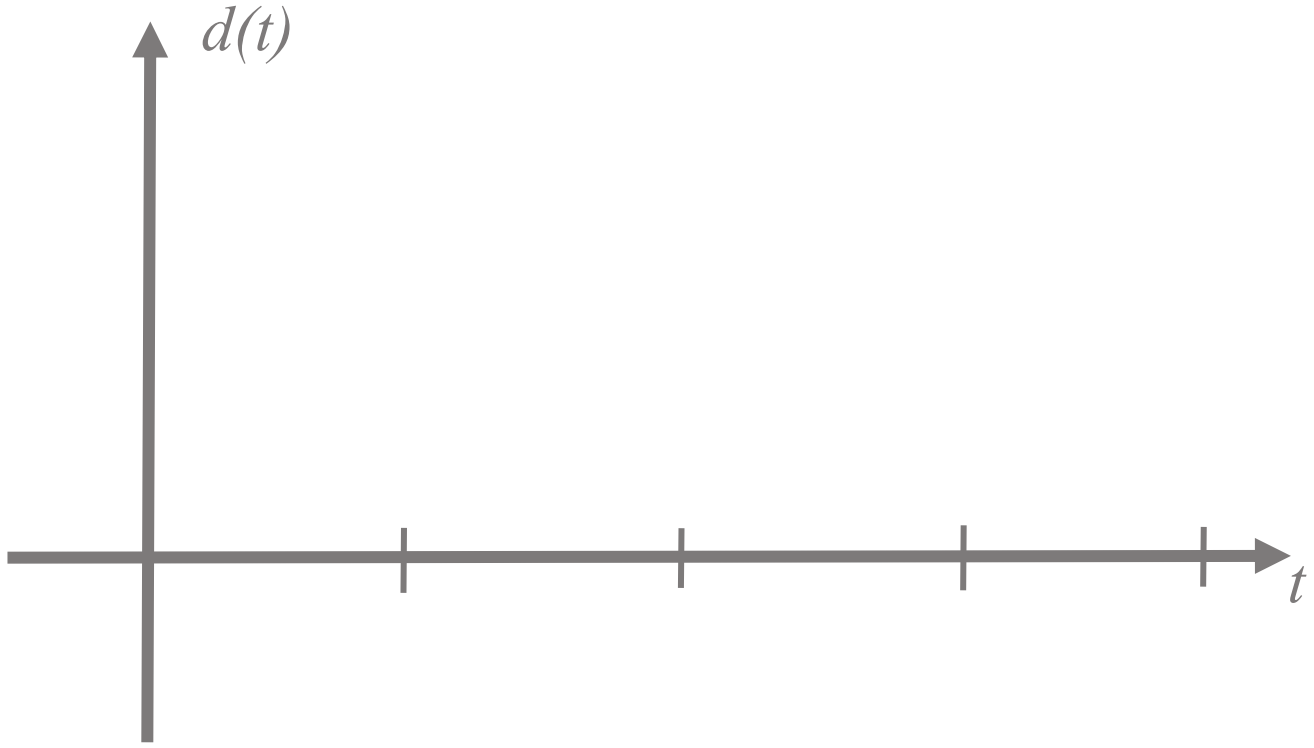
in the sky, looking down

# Application #1 - Tides

The water depth in a harbor is 15m at high tide and 7m at low tide.

One cycle is completed every 12 hours.

If high tide occurs at midnight, write an equation for water depth as a function of time.
(assume $t$ is the # of hours since midnight)




Amplitude:

Period:

Maximum height:

Minimum height:

Midline:

# Demonstration – Weight on a Spring

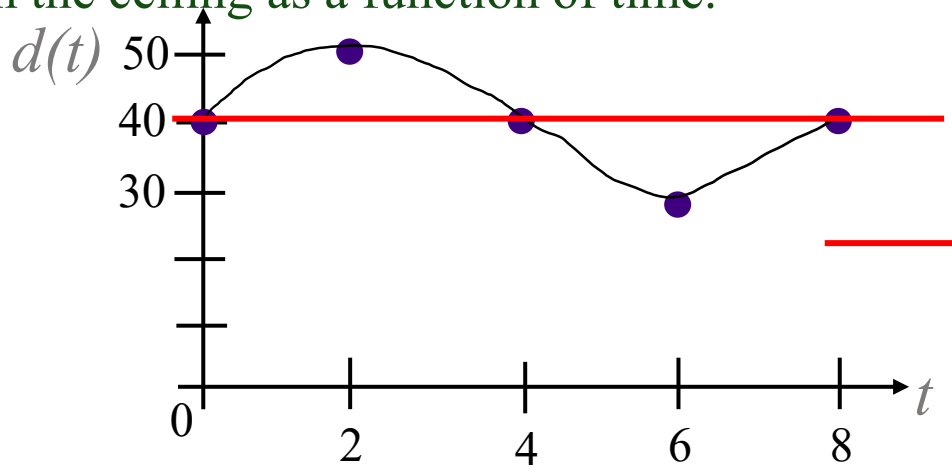
# Application #2 – Weight on a Spring

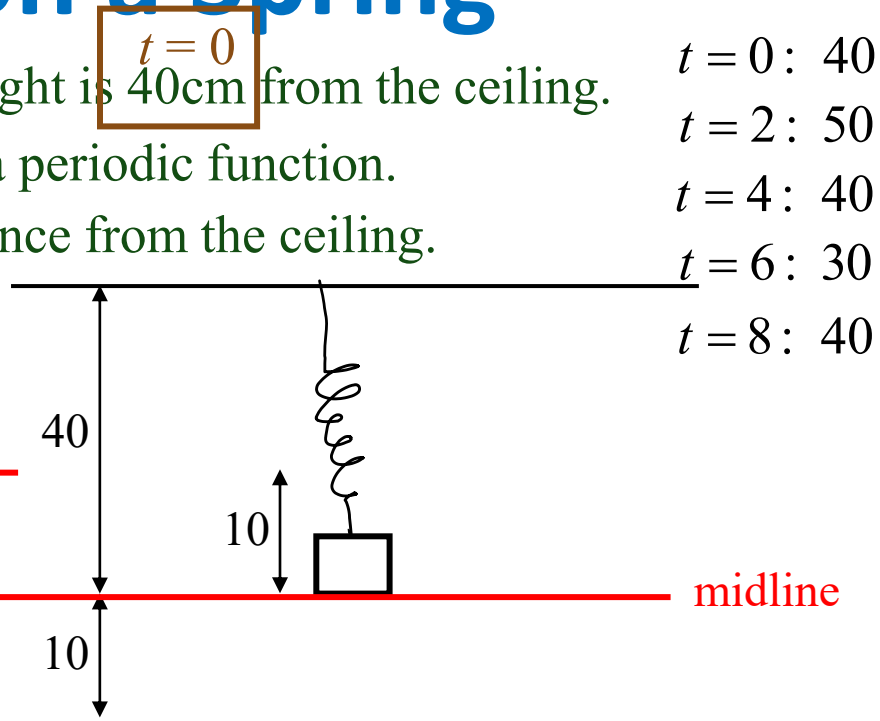
A weight is attached to a spring and hangs from the ceiling. At rest, the weight is 40cm from the ceiling.

When the weight is pulled down 10cm and released, its movement models a periodic function.

It takes 2 seconds in cycle to go from the resting point to its maximum distance from the ceiling.

Write an equation for height from the ceiling as a function of time.




$t = 0$: 40
$t = 2$: 50
$t = 4$: 40
$t = 6$: 30
$t = 8$: 40

Amplitude:

Period:

Maximum distance: $= 40 + 10 = 50$

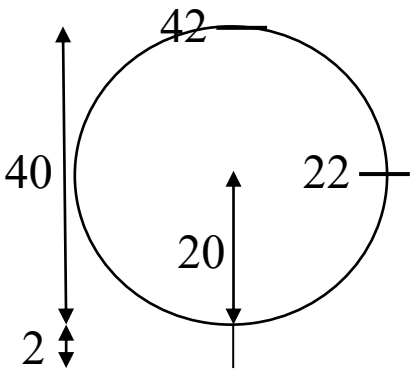
Minimum distance: $= 40 - 10 = 30$

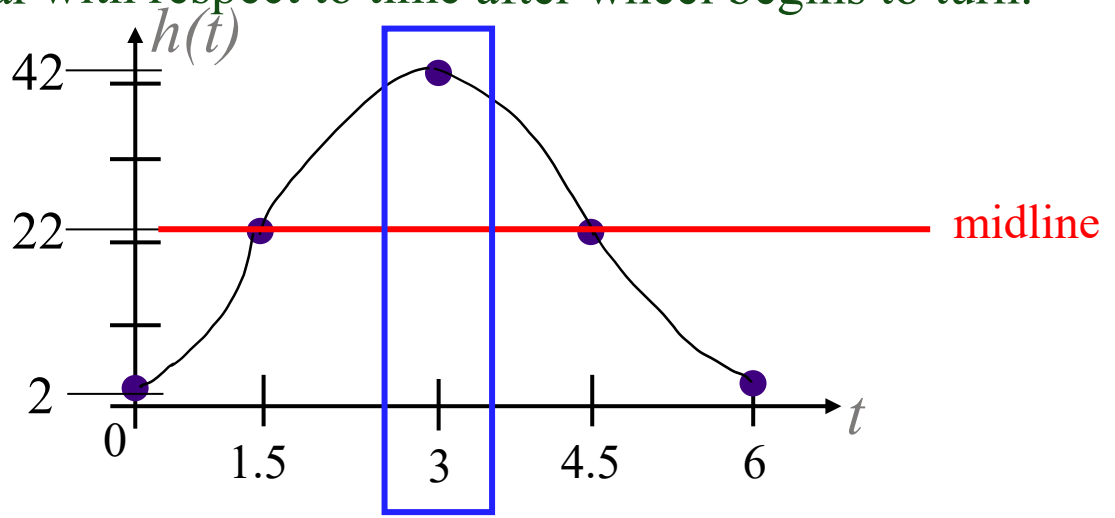
Midline: 40

# Application #3 - Ferris Wheel

A Ferris wheel 40m in diameter boards from a platform 2m above the ground and at 6 o'clock position on Ferris wheel. Wheel completes a full rotation in 6 minutes.

*h(t)* represent the height of loaded car with respect to time after wheel begins to turn.




Amplitude: 20

Period: 6

Do: find *B*

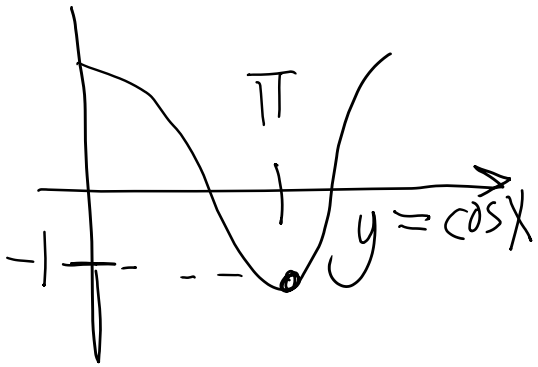
Maximum height: 42

Minimum height: 2

Midline: 22

$y = A\cos(Bx) + D$ reflected about *midline*!

$$h(t) = -20\cos\left(\frac{\pi}{3}t\right)+22$$




A: $h(3) = -20\cos(\frac{\pi}{3}\cdot 3)+22$

$= -20\cos\pi + 22$

$= -20(-1) + 22 = 20 + 22 =$ $\boxed{42m}$

How high is the car after 3 minutes? $42m$

look at graph

Q: what if only have function?