Last day's work: pp. 352-355 #1 – 8 7

Complete the cosine funcon sketch.

Note how it is different than y=sinx

Today's Learning Goal(s):

Date: May 14/19

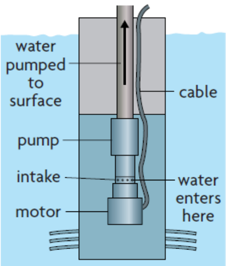
By the end of the class, I will be able to:

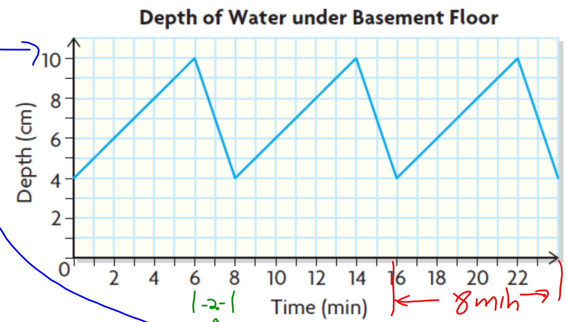
a) understand the properties and characteristics of sinusoidal functions.

b) relate the properties of sinusoidal functions to real world situations.

p. 354

7. Chantelle has a submersible pump in her basement. During a heavy rain, the pump turned off and on to drain water collecting under her house's foundation. The graph models the depth of the water below her basement floor in terms of time. The depth of the water decreased when the pump was on and increased when the pump was off.





a) Is the function periodic? yes

b) At what depth does the pump turn on? 10 cm

c) How long does the pump remain on? 2 min

d) What is the period of the function? Include the units of measure. 8 mins

e) What is the range of the function? $\{d \in \mathbb{R} \mid 4 \leq d \leq 10\}$

f) What will the depth of the water be at 3 min? 7 cm

g) When will the depth of the water be 10 cm? 6 min, 14 min, 22 min (every 8 mins during the heavy rain)

h) What will the depth of the water be at 62 min?

at 4 cm every 8 min.

∴ after 56 min, back to 4 cm

∴ 62 min ⇒ 6 min past 56

∴ 6 min past 0 ⟶ ∴ 10 cm (just before pump turns on again)

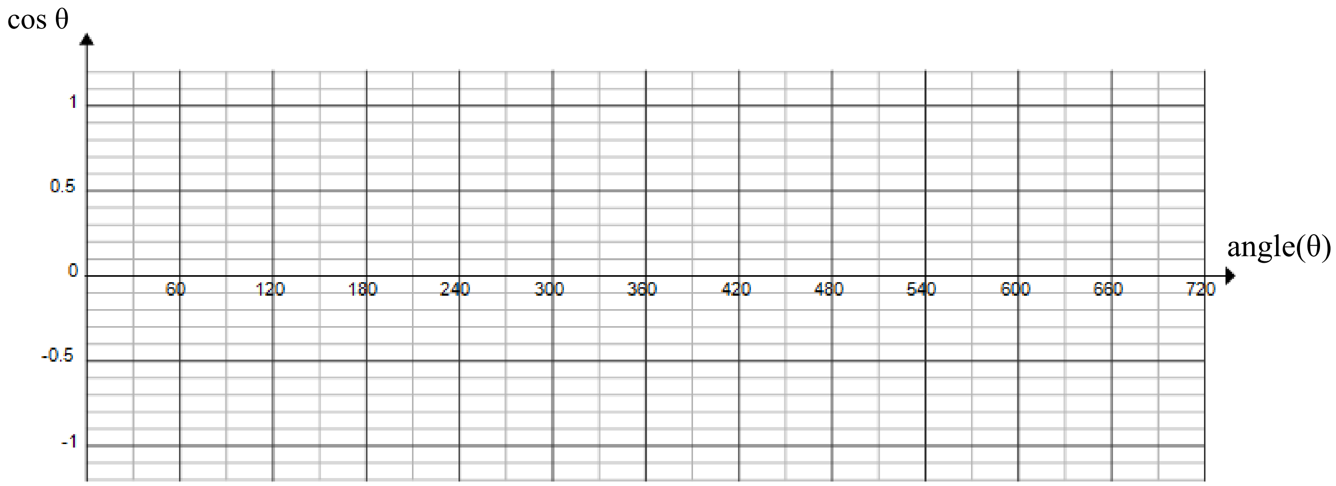
From yesterday

Developing the Cosine Function: $y = \cos\theta$ (or $y = \cos x$)

1. Complete the table.

Angle θ (°)	0	30	60	90	120	150	180	210	240	270	300	330	
Exact value of *y* (cosθ)													
Decimal value of *y* (2 decimal places)													
	360	390	420	450	480	510	540	570	600	630	660	690	720
Exact value of *y* (cosθ)													
Decimal value of *y* (2 decimal places)													

2. Use the decimal values of cosθ, and plot the ordered pairs (θ, cosθ) on the grid below. Join the points with a smooth continuous curve.



6.2_2 Sinusoidal Functions and Their Properties

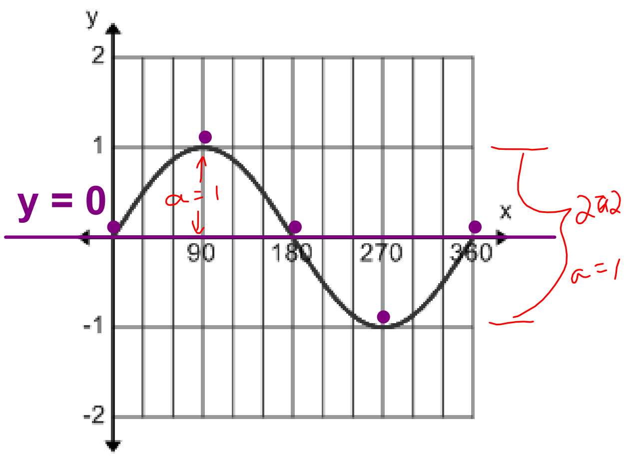
Date: May 14/19

A sinusoidal function is a periodic function whose graph looks like smooth symmetrical waves. Any portion of the wave can be horizontally translated onto another portion of the curve.

The sinusoidal functions are y = sin x and y = cos x

YOU NEED TO KNOW THIS AND RECITE IT IN YOUR SLEEP!!!

For y = sin x



Period : **360°**

Amplitude : **1**

Equation of Axis : **y = 0**

Max value : **1**

Min value : **-1**

Domain : **{xεR}**

Range : **{yεR | -1 ≤ y ≤ 1}**

Zeros are located at: **0°, 180°, 360°, ...**

We will use "5 Key Points" to make our sketches.

YOU NEED TO KNOW THIS AND RECITE IT IN YOUR SLEEP!!!

For $y = \cos x$

Period : **360°**

Amplitude : **1**

Equation of Axis : **y = 0**

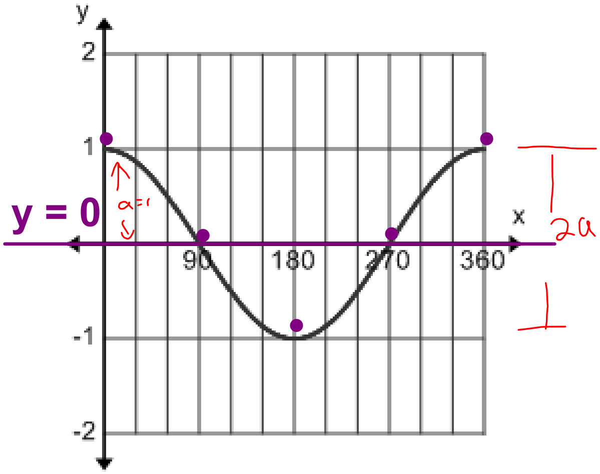
Max value : **1**

Min value : **-1**

Domain : **{xεR}**

Range : **{yεR | -1 ≤ y ≤ 1}**

Zeros are located at: **90°, 270°, 450°, ...**



We will use "5 Key Points" to make our sketches.

Ex. 1 The graph of the function $f(x) = 4\sin(3x) + 2$ is shown below.
Determine if the function is periodic and sinusoidal.
Then determine the period, equation of the axis, the amplitude, domain & range.

Yes it is periodic and sinusoidal.

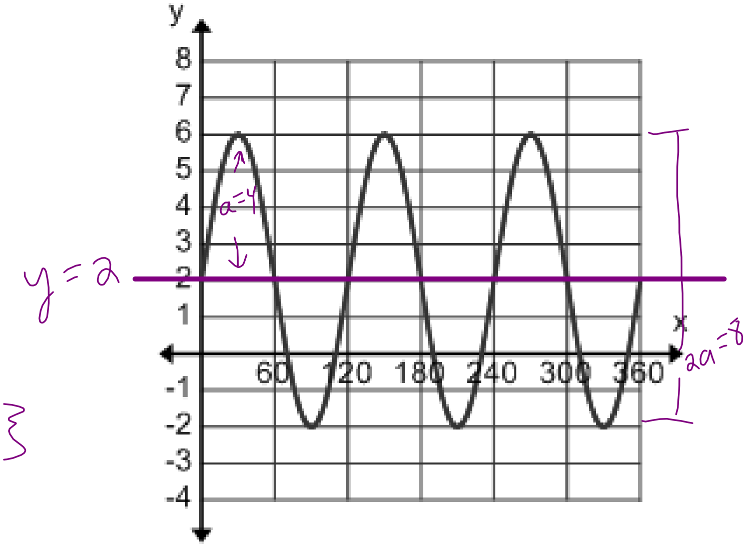
Period : $120°$

Equation of Axis : $y = 2$

Amplitude = 4

Domain : $\{x \in \mathbb{R}\}$

Range : $\{y \in \mathbb{R} \mid -2 \le y \le 6\}$



Eq'n of the axis

$y = \frac{max + min}{2}$

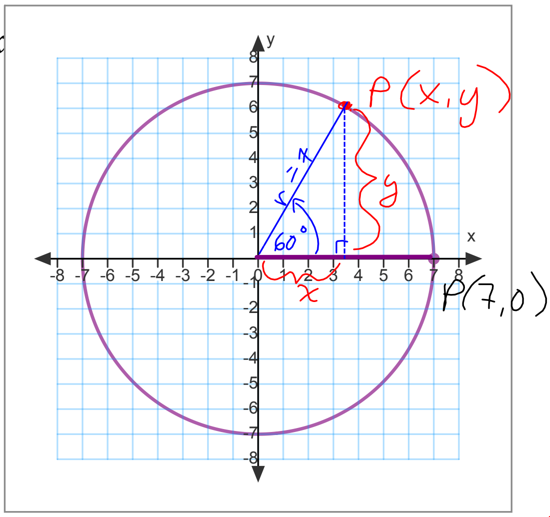
Amplitude:

$a = \frac{max - min}{2}$

Ex. 2 Find the coordinates of P(x, y) after a rotation of 60^0 about the origin from the point (7, 0).

What do we know?

x



radius = 7

SOH

$\cos 60^\circ = \frac{adj}{hyp}$ $\quad$ $\sin 60^\circ = \frac{opp}{hyp}$

$= \frac{x}{r}$ $\quad$ $= \frac{y}{r}$

$\cos 60^\circ = \frac{x}{7}$ $\quad$ $\sin 60^\circ = \frac{y}{7}$

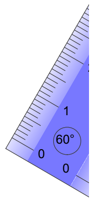
$x = 7\cos 60$ $\quad$ $y = 7\sin 60^\circ$

$\therefore P(x, y) = (7\cos 60^\circ, 7\sin 60^\circ)$

$= \left(3.5, \frac{7\sqrt{3}}{2}\right)$

In general,

$P(x, y) = (r\cos\theta, r\sin\theta)$

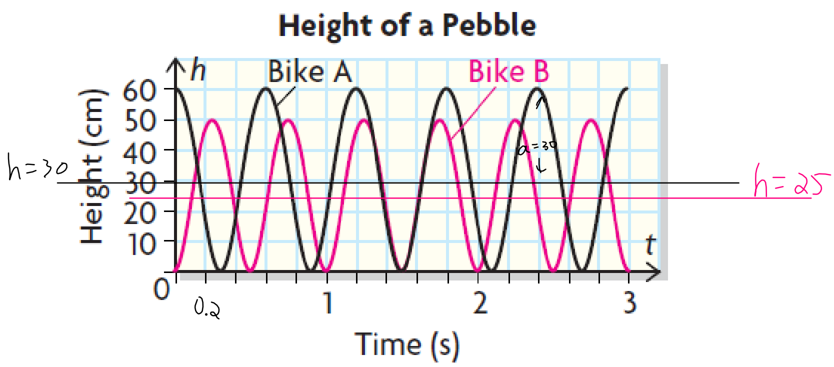


6.3 Interpreting Sinusoidal Functions

Date: May 14/19

Ex. 1

Two students are riding their bikes. A pebble is stuck in the tire of eachbike.
The two graphs show the heights of the pebbles above the ground(in terms of time).



1. What information can we get from these graphs? p.349 peak vs. trough
2. How are the graphs the same/different?
   Are both wheels the same diameter?
   Bike A: diameter = 60 cm Bike B: diameter = 50 cm
3. Calculate and compare:

a) the amplitude Bike A: amplitude = 30 cm Bike B: amplitude = 25 cm

b) the period

Bike A: period = 0.6 sec
The pebble takes 0.6 s to complete 1 revolution.

Bike B: period = 0.5 sec
The pebble takes 0.5 s to complete 1 revolution

Note: This is NOT the speed of the wheel!
We will compare speeds in part d)

c) the equation of the axis

Bike A: $\frac{60 + 0}{2} = 30$

The equation of the axis for Bike A is $h = 30$.

Bike A's wheel axle is 30 cm above the ground.

Bike B: $\frac{50 + 0}{2} = 25$

The equation of the axis for Bike B is $h = 25$.

Bike B's wheel axle is 25 cm above the ground.

d) the speed of each bike

Speed is equal to distance divided by time, so we first have to figure out how far each bike travels when the wheel completes one revolution. This distance is the circumference.

Circumference:

Bike A

$C_A = 2\pi r_A$

$C_A = 2\pi(30)$

$C_A = 60\pi$

$C_A \doteq 188.5$ cm

$C_A \doteq 1.885$ m

Speed:

$s_A = \frac{d}{t}$

$s_A = \frac{1.885}{0.6}$

$s_A \doteq 3.14$ m/s

Circumference:

Bike B

$C_B = 2\pi r_B$

$C_B = 2\pi(25)$

$C_B = 50\pi$

$C_B \doteq 157.1$ cm

$C_B \doteq 1.571$ m

Speed:

$s_B = \frac{d}{t}$

$s_B = \frac{1.571}{0.5}$

$s_B \doteq 3.14$ m/s

What does the amplitudes being different for these two graphs mean?
That the diameters for the two bike wheels are different

Are there any Homework Questions you would like to see on the board?

Last day's work: pp. 352-355 #1 – 8

Complete the cosine funcon sketch.

Note how it is different than y=sinx

Today's Homework Practice includes:

READ pp. 359-363 Ex.1 – "Need to Know"

(If time: *Demo p.363 8a on TI-84*)

pp. 363-364 #1 – 4, 8, 9 [15,16]

pp. 370-372 #1 – 8, 13 [15]