

Welcome Back MYP Math 9!

| | Assignment Effort Grade (Circle One) | Comments (What was interesting or challenging?) |
|--|--|---|
| Monday Date: <u>1 - 8</u> Topic: <u>No homework over break :)</u> | 0 1 2 | |
| Tuesday Date: <u>1 - 9</u> Topic: <u>Sin, cos, tan, (& recipricals) Table</u> | 0 1 2 | |
| Wednesday Date: <u>1 - 10</u> Topic: <u>Sin, cos, (& tan) Graphs</u> | 0 1 2 | |
| Thursday Date: _____ Topic: _____ | 0 1 2 | |
| Friday Date: _____ Topic: _____ | 0 1 2 | |

Mathematician Monday
Islam's contribution to the study
of Mathematics and science.

Recall from before break:

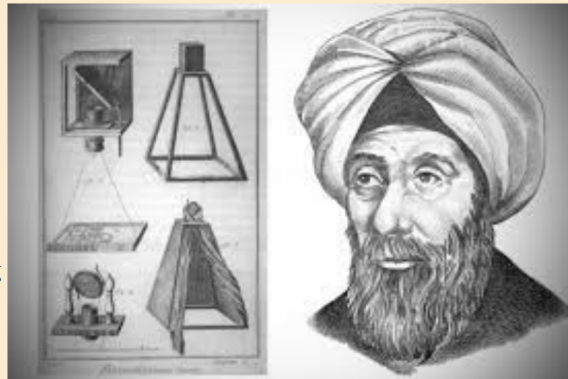
The term Algebra came from the Arabic term 'al-jabr' meaning "reunion of broken parts"

Today's video: What further contributions were shared in this video? How do the discoveries shown in this video relate to our world today?

Mathematician Monday

Ibn al Haytham the father of optics asked, "Why?"

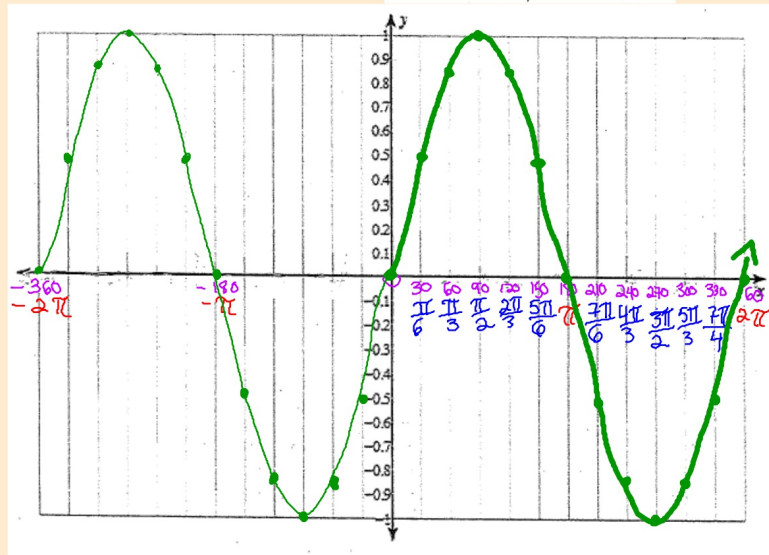
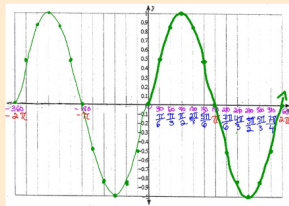
In his autobiography he explains how, as a youth, he thought about the conflicting religious views of the various religious movements and came to the conclusion that none of them represented the truth.



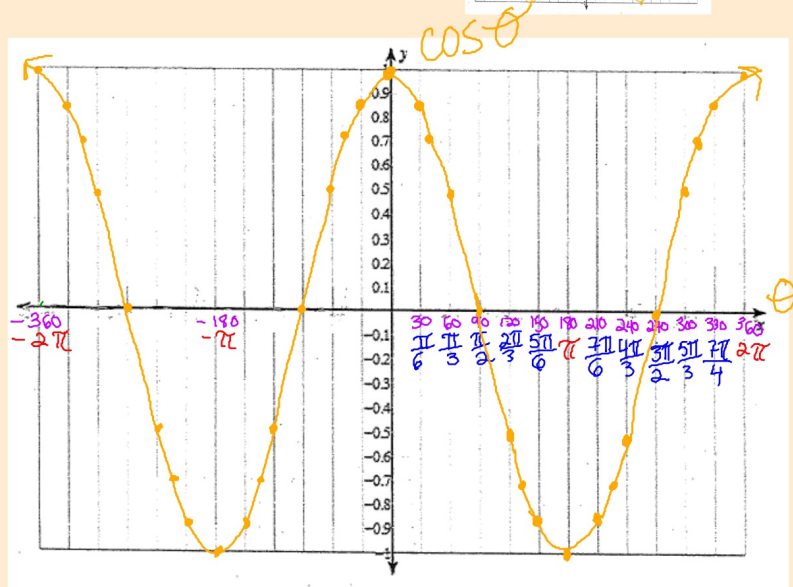
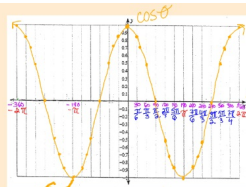
ibn al-Haytham became increasingly unhappy with his deep studies of religion and made a decision to devote himself entirely to a study of science which he found most clearly described in the writings of [Aristotle](#).

<http://www-history.mcs.st-andrews.ac.uk/Biographies/Al-Haytham.htm>

Graph of Sine



Graph of Cosine

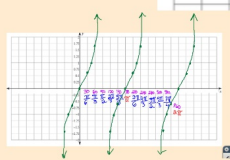
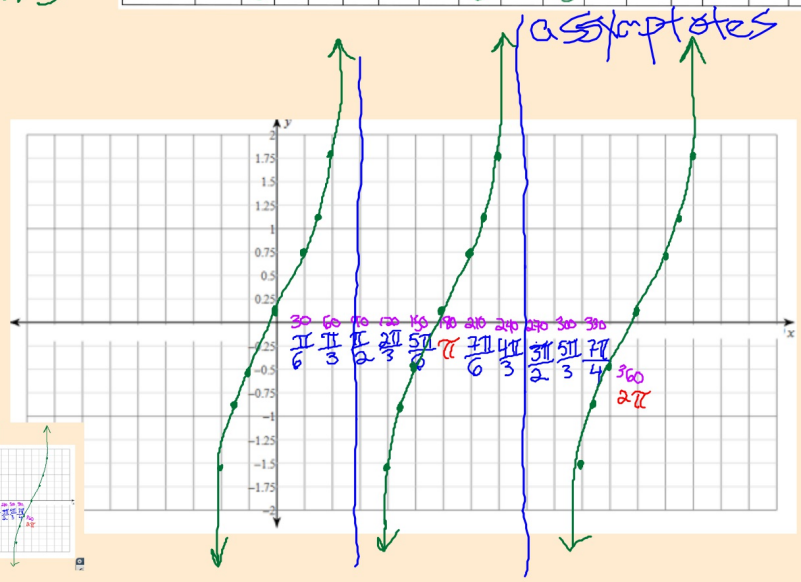


Graph of Tangent

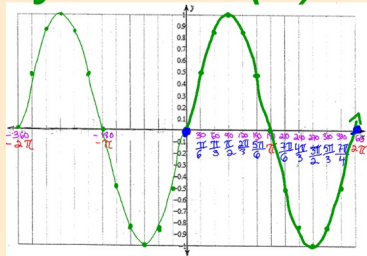
$$\frac{\sqrt{3}}{3} \approx .58$$

$$\frac{\sqrt{3}}{3} \approx 1.73$$

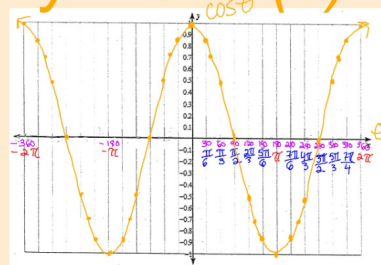
| θ (DEG) | 0 | 30 | 45 | 60 | 90 | 120 | 135 | 150 | 180 | 210 | 225 | 240 | 270 | 300 | 315 | 330 |
|-------------------|---|----------------------|----|------------|------|-------------|-----|-----------------------|-----|----------------------|-----|------------|------|-------------|-----|-----------------------|
| $\tan(\theta)$ | 0 | $\frac{\sqrt{3}}{3}$ | 1 | $\sqrt{3}$ | UND. | $-\sqrt{3}$ | -1 | $-\frac{\sqrt{3}}{3}$ | 0 | $\frac{\sqrt{3}}{3}$ | 1 | $\sqrt{3}$ | UND. | $-\sqrt{3}$ | -1 | $-\frac{\sqrt{3}}{3}$ |



Warm-up: $y = \sin(\theta)$



$y = \cos(\theta)$



1. What is the length of 1 revolution of sine and cosine graphs? $360 = 2\pi$

2. Max = 1 Min = -1

3. What is the distance between the max (or min) and the x-axis?

1

Class Plan:

1. Warm-up

2. What is a Periodic Function?

What is a Period?

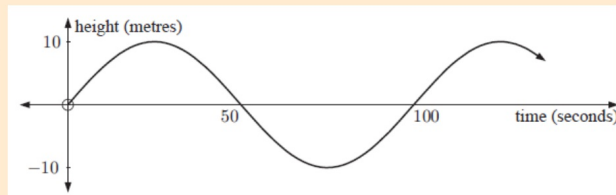
What is the Amplitude?

3. Practice

Periodic Function Investigation

Do:

1) Examine graph



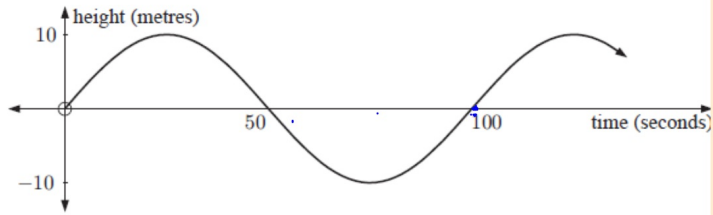
2) Answer questions.

3) Done? Help others! &





Investigation
Paddle Wheel



VOCABULARY

1) What is the minimum height of the paddle wheel?

-10

min

2) What is the maximum height of the paddle wheel?

10

max

3) What is the average of the max and the min height?

0

mean line

4) One full ride is one rotation of the wheel.

After how long does the paddle wheel begin a new rotation?

100 sec

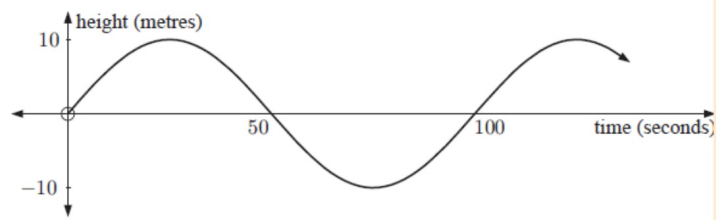
principal axis

period

5) What is the distance from the min (or max) to the principal axis?

10

amplitude



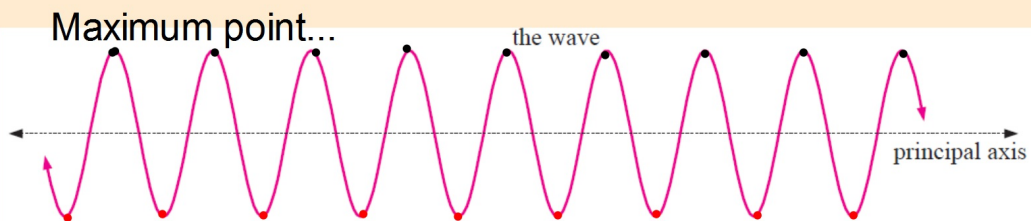
VOCABULARY

- 1) What is the minimum height of the paddle wheel? -10m Minimum
- 2) What is the maximum height of the paddle wheel? 10m Maximum
- 3) What is the average of the max and the min height? 0m Principal axis
- 4) One full ride is one rotation of the wheel.
After how long does the paddle wheel begin a new rotation? 100 sec Period
- 5) What is the distance from the min (or max) to the principal axis? 10m amplitude

A

OBSERVING PERIODIC BEHAVIOUR

A **periodic function** is one which repeats itself over and over in a horizontal direction.



The wave oscillates about a horizontal line called the **principal axis** or **mean line**.

A **maximum point** occurs at the top of a crest, and a **minimum point** at the bottom of a trough.

A

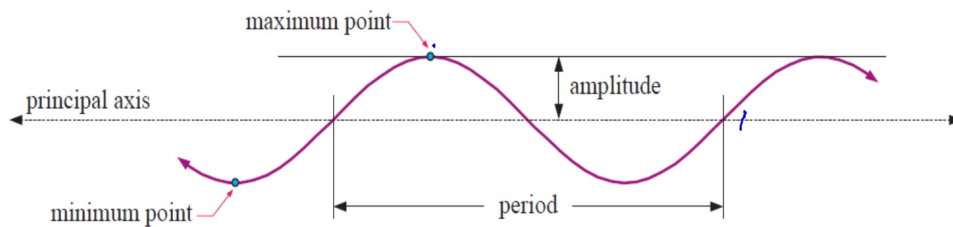
OBSERVING PERIODIC BEHAVIOUR

The **period** of a periodic function is the length of one repetition or cycle.

The **amplitude** of a periodic function is the distance between a maximum (or minimum) point and the principal axis.

$$\text{amplitude} = \frac{\text{max} - \text{min}}{2}$$

mean \bar{x}
principal axis $y = \frac{\text{max} + \text{min}}{2}$



A

OBSERVING PERIODIC BEHAVIOUR

The wave oscillates about a horizontal line called the **principal axis** or **mean line**.

A **maximum point** occurs at the top of a crest, and a **minimum point** at the bottom of a trough.

Mean line (Principal axis)
of graph = $y = 250$

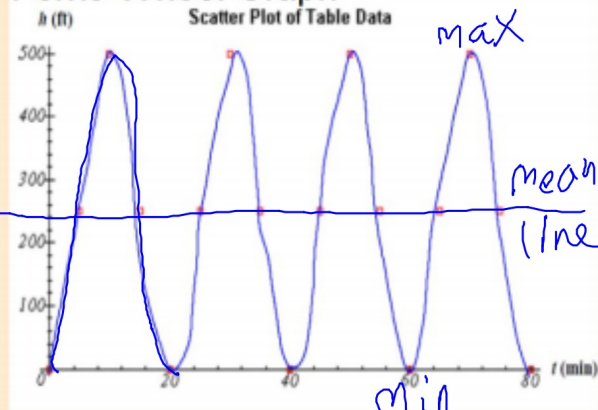
Amplitude = 250

Period = 20 min

Which wave is represented
by the Ferris Wheel? **Why?**

COSINE \rightarrow min on the y-axis

Ferris Wheel Graph

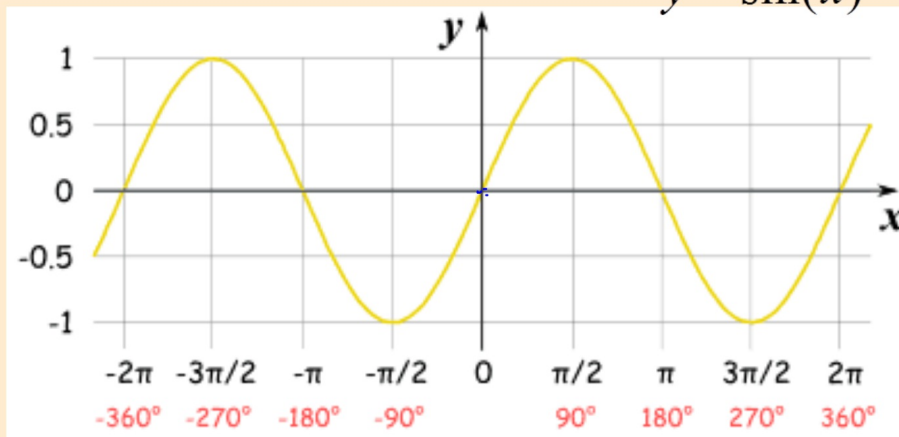


A**OBSERVING PERIODIC BEHAVIOUR**

How do we know if the wave is Sine or Cosine?

Sine wave: Crosses the y -axis at
the mean line (principal axis) $y = a \sin(bx) + c$

$$y = \sin(x)$$

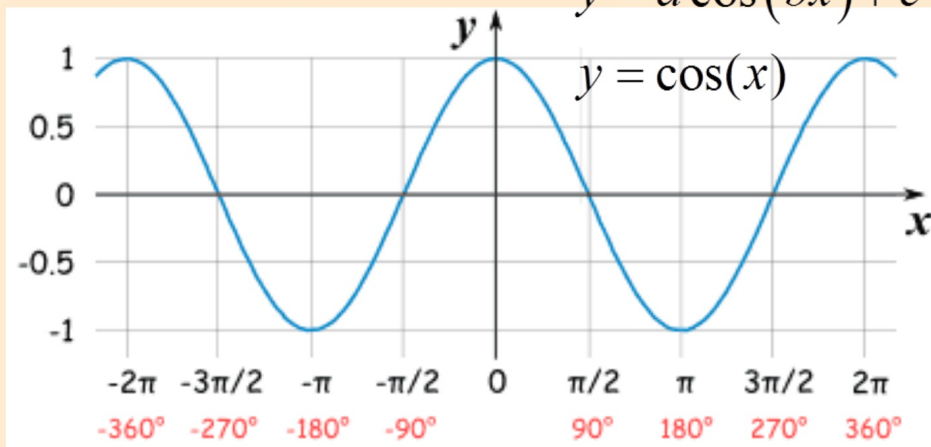


A**OBSERVING PERIODIC BEHAVIOUR**

How do we know if the wave is Sine or Cosine?

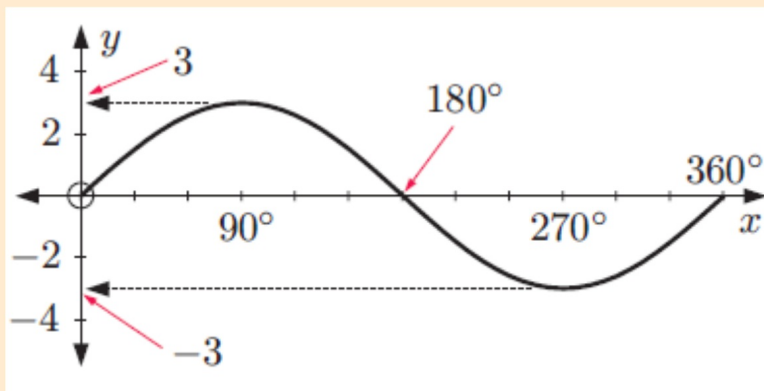
Cosine wave: Crosses the y -axis at the maximum (or minimum if reflected over x -axis)

$$y = a \cos(bx) + c$$

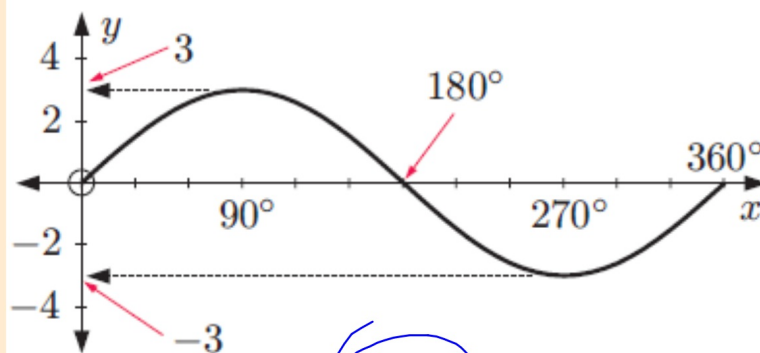


Examples:

- 1) Find the amplitude, period, and the principal axis of the graph.
- 2) Determine and **defend** whether the graph is a cosine or a sine wave.



Example:



Amplitude: 3

Period: 360

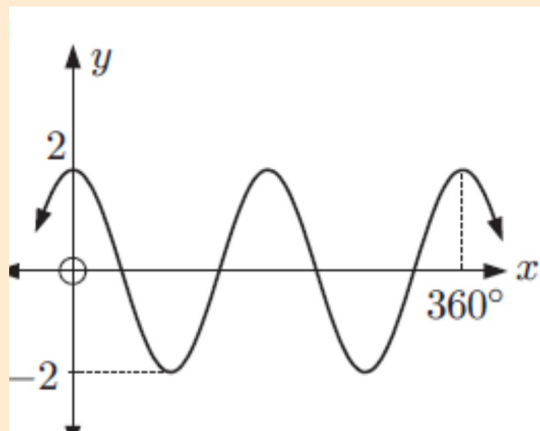
Principal axis: $y=0$

Sine or Cosine
Why?

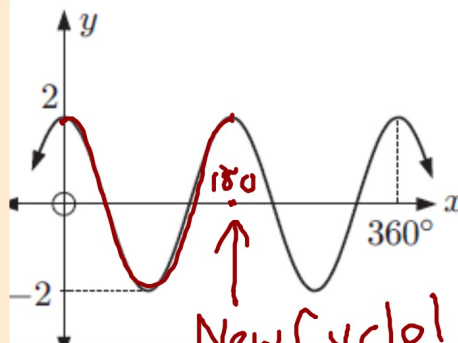
Wave crosses
y-axis on mean
line.

Find the amplitude, period, and the principal axis of the graph.

Example:



Example:



Amplitude: 2

Period: $180^\circ = \frac{360}{2 \text{ waves}}$

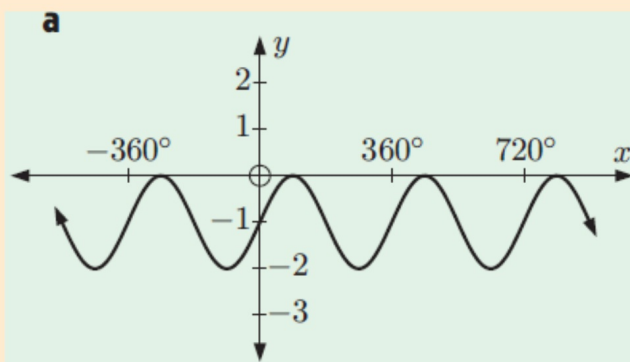
Principal axis: $y = 0$

New Cycle!
Sine or Cosine
Why?

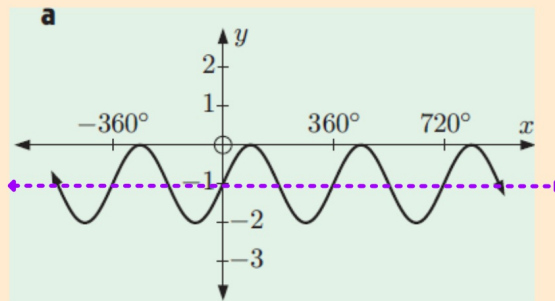
Graph crosses y-axis at the maximum.

Find the amplitude, period, and the principal axis of the graph.

Example:



Example:



Mean
line
 $y = -1$

Amplitude: 1

Period: 360°

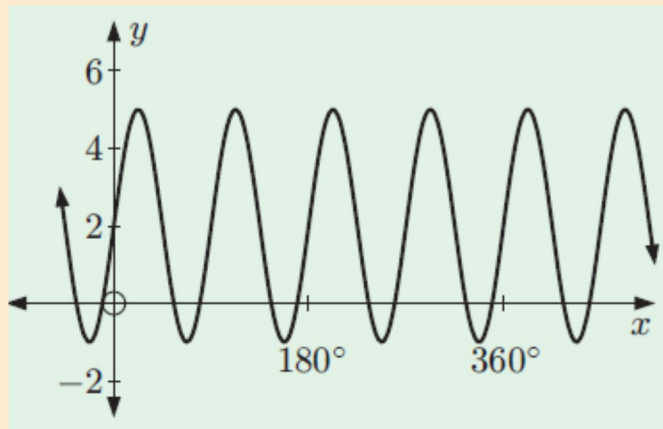
Principal axis: $y = -1$

Sine or Cosine
Why?

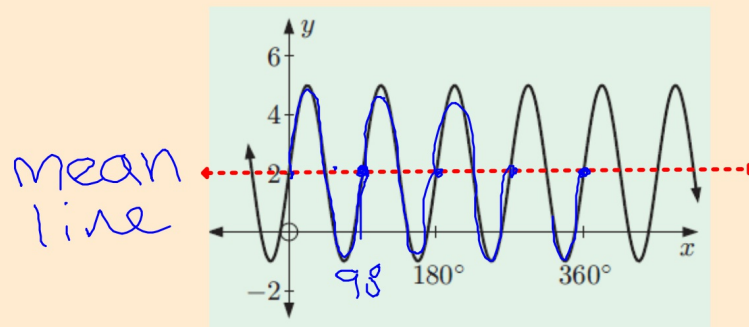
Graph crosses the
y-axis on the
principal axis.

Find the amplitude, period, and the principal axis of the graph.

Example:



Example:



Amplitude: 3

Period: $\frac{360}{4} = 90^\circ$

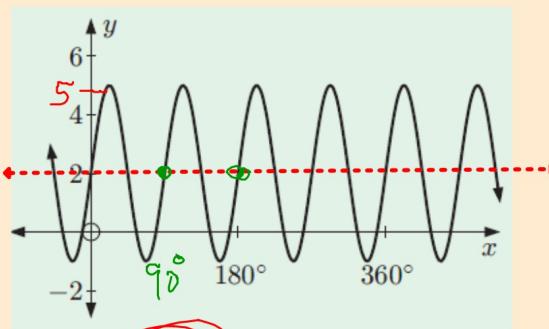
Principal axis: $y = 2$

Sine or Cosine

Why?

Sine because
the graph cross y-axis
on the mean line.

Example:



Amplitude: 3

Period: 2 cycles in 180°
 $90 = \text{period}$

Principal axis: $y=2$

Sine or Cosine
Why?

Wave crosses y-axis
on mean line

Exercises:

- 1) Find amplitude, period, and principal axis.
- 2) How does amp, period, & axis relate to coefficients of each trigonometric equation?

Challenge: Graph the equations (both handouts!)

Trigonometric Functions

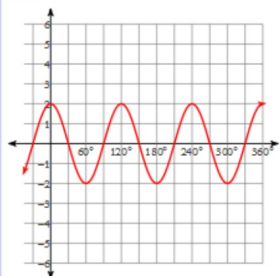
Name _____

Amplitude and Period

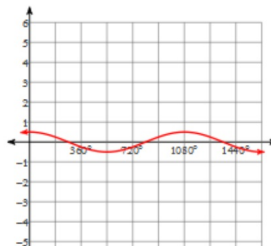
Date _____ Period _____

Find the amplitude, the period, and the principal axis of the graph.

1) $y = 2\cos 3\theta$



2) $y = \frac{1}{2} \cdot \cos \frac{\theta}{3}$



Solutions:

Trigonometric Functions

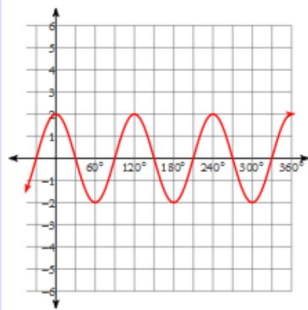
Name _____

Amplitude and Period

Date _____ Period _____

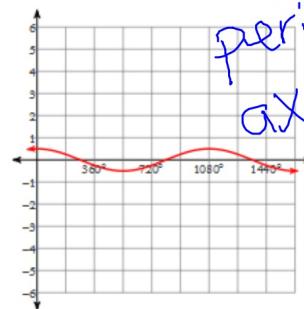
Find the amplitude, the period, and the principal axis of the graph.

1) $y = 2\cos 3\theta$



amp = 2
period = 120°
axis = 0

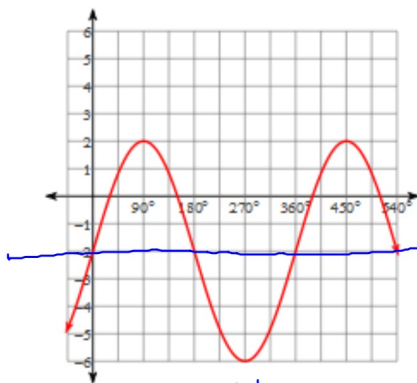
2) $y = \frac{1}{2} \cdot \cos \frac{\theta}{3}$



amp = .5
period = 1080°
axis = 0

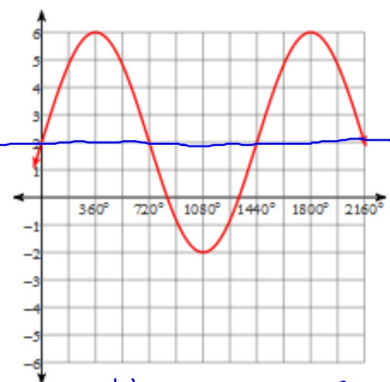
Solutions:

3) $y = 4\sin \theta - 2$



amp = 4
period = 360°
axis = -2

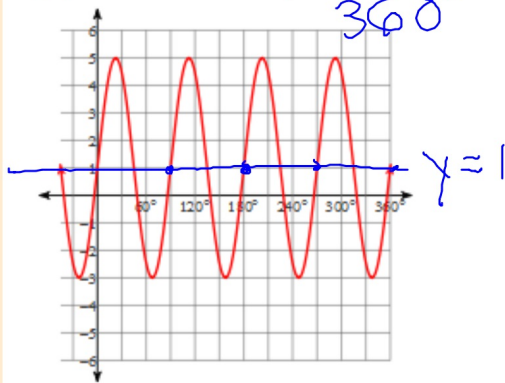
4) $y = 4\sin \frac{\theta}{4} + 2$



amp = 4
period = 1440°
axis = 2

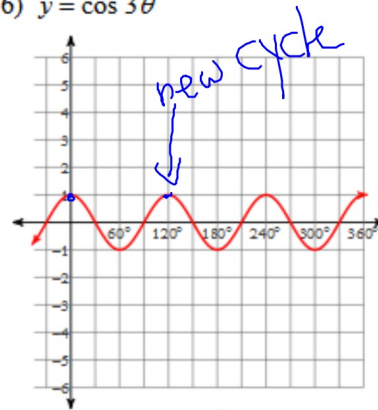
Solutions:

5) $y = 1 + 4\sin 4\theta$ 4 waves in 360°



amp = 4
period = 90°
axis = 1

6) $y = \cos 3\theta$



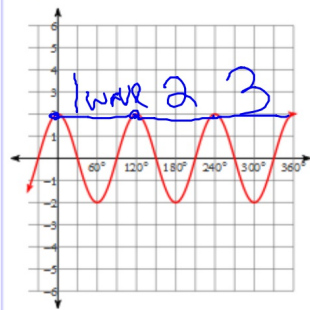
amp = 1
period = 120°
axis = 0

Solutions:

2) How does amp, period, & axis relate to coefficients of each trigonometric equation?

$$y = a \cos(b\theta) + c$$

1) $y = 2 \cos 3\theta$



amp = 2
period = 120°
axis = 0

$$y = a \cos(bx) + c$$

$$y = \cos(x)$$

a = amplitude

c = principal axis

b = # of waves in 360°
(3 waves in 360°)