

6.4 Transformations of Trigonometric Functions

$$y = -x^2$$

$$y = af[k(x-d)] + c$$

WHAT DO a, k, ⁴⁷d, and c
do???

6.4 Transformations of Trigonometric Functions

$$y = af[k(x-d)] + c$$

$$y = 5x^3 - 1$$

This is a vertical stretch by factor 5

$|a|$ $|a| > 1$ $0 < |a| < 1$

gives the vertical stretch/compression factor.

If $a < 0$, there is also a reflection in the x-axis

$$y = (0.5x)^3 - 1$$

$\left|\frac{1}{k}\right|$ $0 < |k| < 1$ $|k| > 1$

gives the horizontal stretch/compression factor.

If $k < 0$, there is also a reflection in the y-axis.

This is a horizontal stretch by factor

$$\frac{1}{5} = 5$$

$$\frac{1}{0.5} = 2$$

A function with a horizontal stretch of 5.

$$y = 3\left(\frac{1}{5}(x-2)\right)^3 + 3$$

$$y = 2\left(\frac{1}{5}(x-3)\right)^3 + 9$$

A function with h.c. $\frac{2}{3}$

$$y = 3\left(\frac{3}{2}(x-2)\right)^3 + 3$$

A function with h.c. $0.68 = \frac{68}{100}$

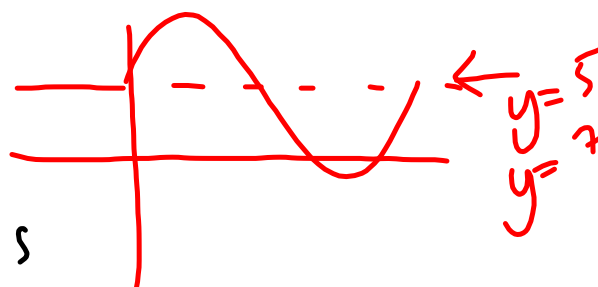
$$= \frac{17}{25}$$

Example 1: The following transformations are applied

to the graph of $y = \sin x$, where $0 \leq x \leq 2\pi$

- a vertical compression by factor 0.5
- a horizontal stretch by factor 2
- a horizontal translation $\pi/3$ to the right
- a vertical translation 2 up

What is the equation?



amplitude
equation of the axis
period
phase shift

Sketch any sinusoidal function and label the following:

Amplitude

Equation of the axis

Period

Phase shift

Transformations a, k, d, c	Characteristics of the Transformed Function
a	
k	
d	
c	

Transformations of Parent Function	Characteristics of the Transformed Function
$ a $ gives the vertical stretch/compression factor. If $a < 0$, there is also a reflection in the x-axis.	$ a $ gives the amplitude
$ 1/k $ gives the horizontal stretch/compression factor. If $k < 0$, there is also a reflection in the y-axis.	$2\pi/ k $ gives the period
d gives the horizontal translation	d gives the horizontal translation - phase shift
c gives the vertical translation	$y = c$ gives the equation of the axis

Example 1: The following transformations are applied to the graph of $y=\sin x$, where $0 \leq x \leq 2\pi$

- a vertical compression by factor 0.5
- a horizontal stretch by factor 2
- a horizontal translation $\pi/3$ to the right
- a vertical translation 2 up

Example 2:

a) State the period, amplitude, horizontal translation, and equation of the axis for each of the following trig functions.

$$y = 5 \cos(-2(x + \pi/2)) - 3$$

b) Create a table of values for the transformed function.

A New Word!

ARGUMENT: The expression on which a function operates.

eg. $\sin(4x+3)$

Here \sin is the function and it operates on the expression $(4x+3)$; so $(4x+3)$ is the argument.

Example 2:

a) State the period, amplitude, horizontal translation, and equation of the axis for each of the following trig functions.

$$y = 5 \cos\left(-2x + \frac{\pi}{3}\right) - 2$$

b) Create a table of values for the transformed function.

Example 3: A mass on a spring is pulled toward the floor and released, causing it to move up and down. Its height, in centimetres, above the floor after t seconds is given by the function

$$h(t) = 10\sin(2\pi t + 1.5\pi) + 15, 0 \leq t \leq 3$$

Sketch a graph of height versus time. Then use your graph to predict when the mass will be 18 cm above the floor as it travels in an upward direction.

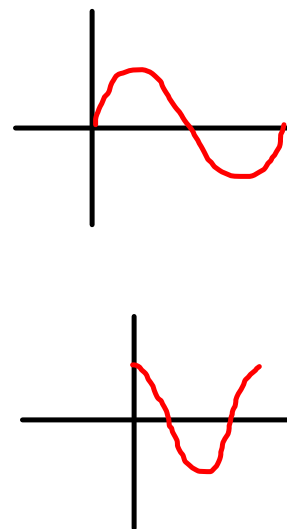
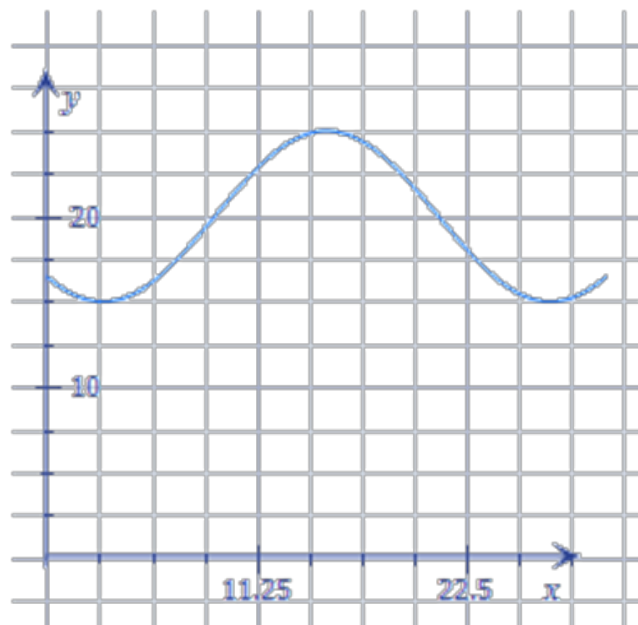
STEP 1: Divide out the common factor from the ARGUMENT.

STEP 2: Identify a , k , d and c

STEP 3: Determine the period, equation of the axis, amplitude and phase shift

STEP 4: Sketch the graph

Example 4: The following graph shows the temperature in Redwan's room over a 24 h period.



The axis of the equation?

Amplitude?

Period?

Phase Shift?

pg 344#4-10, 14

