U6D3_T_Vert Stretch Trig

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U6D3_T_Ve
rt Stretch ...

U6D3   MCR 3UI
Vertical Stretches of Periodic Functions

5-Point Graphing Method

Rather than using a table of many values to determine the general shape of a trig function, a convenient, 5-point method can be used when you know the functions amplitude and period.

In *sine* and *cosine* graphs, there are 5 key points that one can use to graph. These key points occur at angle values of 0°, 90°, 180°, 270° and 360°

One reason why these are key points is because, each cycle of a sine or cosine function includes a maximum, a minimum and three zeros.

Notice that the angle values are equally spaced apart. The key points split the function's period into quarters: $\frac{360°}{4} = 90°$ (key points occur every 90°)

The "Sinusoidal Axis" is the horizontal line halfway between the maximum and the minimum.

Example 1:
Use the 5-Point method to graph the sine and cosine functions for 2 periods.
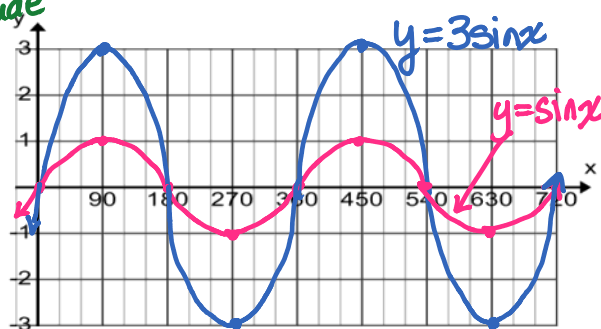
x	$sinx$	$cosx$
0°	0	1
90°	1	0
180°	0	−1
270°	−1	0
360°	0	1

$y = cosx$

$y = sinx$
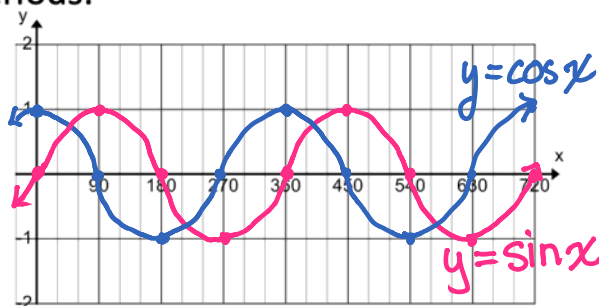
Vertical Stretch
Complete the table of values and graph both curves on the same axis.

amplitude

| x	$sinx$	$3sinx$
0°	0	0
90°	1	3
180°	0	0
270°	−1	−3
360°	0	0

$y = 3sinx$

$y = sinx$

How do the amplitudes of each graph relate to each other? A vertical stretch of 3 triples the amplitude. Amplitude equals the vertical stretch/compression factor.

$$y = asinx$$
Amplitude = $|a|$

Vertical Compression

Complete the table of values and graph both curves on the same axis.

x	$cosx$	$\frac{1}{2}cosx$
0°	1	$\frac{1}{2}$
90°	0	0
180°	-1	$-\frac{1}{2}$
270°	0	0
360°	1	$\frac{1}{2}$
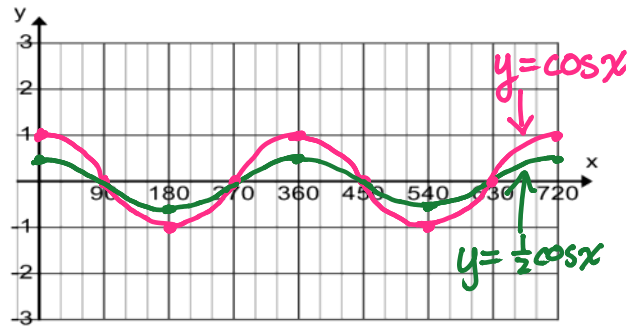
How do the amplitudes relate to each other?

$y = \cos x$ Amplitude $= 1$

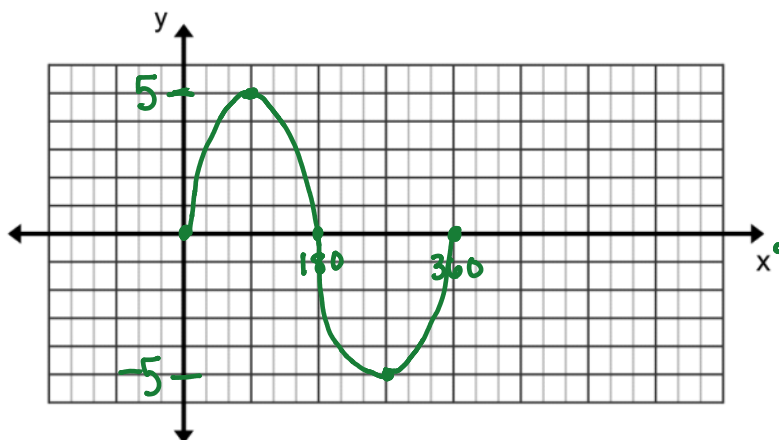$y = \frac{1}{2}\cos x$ Amplitude $= \frac{1}{2}$

In general:

Transformations that applied to f(x), also apply to trig functions:

For functions in the form $y = asinx$ or $y = a\,cosx$,

- If **a** > 1, the graphs are vertically <u>stretched</u> by a factor of **a**
- If 0 < **a** < 1, the graphs are vertically <u>compressed</u> by a factor of **a**
- *Amplitude* becomes $|a|$.(max is **a**, min is **−a**)
- *Period* is unchanged .

Example: Graph one cycle of y = 5sinx.

NOTE: NO arrows if graphing only one cycle.

U6D3 Practice: p. 374 #1, 7a, 10a, 11a