U6D4_T_Horz Stretch Trig

Thursday, May 2, 2019 6:48 PM

U6D4_T_H
orz Stretc...

U6D4 MCR 3UI **Horizontal Stretches of Periodic Functions**

Recall: When a trig function was vertically stretched (or compressed), the key idea was the fact that the function's AMPLITUDE was altered. Notice that if a graph is stretched/compressed vertically, a measurement on the y-axis is changed.

So, if we stretch/compress a graph horizontally, a measurement on the x-axis is changed.

From the graph of a trig function, what is the key term measured on the x-axis? the Period

In general:

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

For functions in the form $y = sinkx \quad or \quad y = coskx$,

- If **k** > 1, the graphs are horizontally compressed by a factor of $\frac{1}{k}$
- If 0 < **k** < 1, the graphs are horizontally stretched by a factor of $\frac{1}{k}$
- *Amplitude* is unchanged
- *Period* becomes $\frac{360°}{k} \Longrightarrow k = \frac{360°}{Period}$

Graphing Horizontal stretches/compressions using the 5-Point Graphing Method

When we have a horizontal stretch/compression, the period is altered, therefore our 5 key points will also be altered. Remember that the 5 key points divided our period into quarters…therefore, divide the new period by 4 and you will have the locations of the new 5 key points (the amplitude is unchanged, so our y-values will remain the same)

horizontal compression factor $\frac{1}{3}$.

1. Graph $y = \sin x$ and $y = \sin 3x$ on the grid below.

$k = 3$

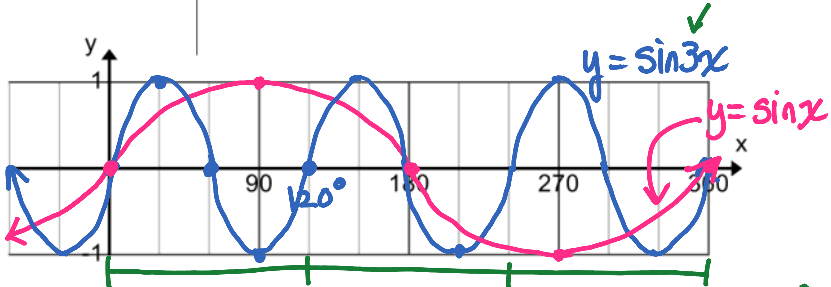
Recall the 5 Key Points of $y = \sin x$

Period of $y = \sin 3x$ is $\frac{360^\circ}{3} = 120^\circ$

Therefore, our 5 key points will occur every 30°.

x	$\sin x$
0°	0
90°	1
180°	0
270°	-1
360°	0

x	$\sin 3x$
0°	0
30°	1
60°	0
90°	-1
120°	0



note: There are 3 complete cycles in 360°

k is always the number of complete cycles in 360°.

U6D4 Practice: Page 374 #2 (all – just in degrees, not radians), 3 – 6 (b only), 8b (typo – max is at 3), 10c, 11bc, 12c

Period $= \frac{360°}{k}$, $k = \frac{1}{2}$

2. Graph $y = \cos x$ and $y = \cos \frac{1}{2} x$ on the grid below:

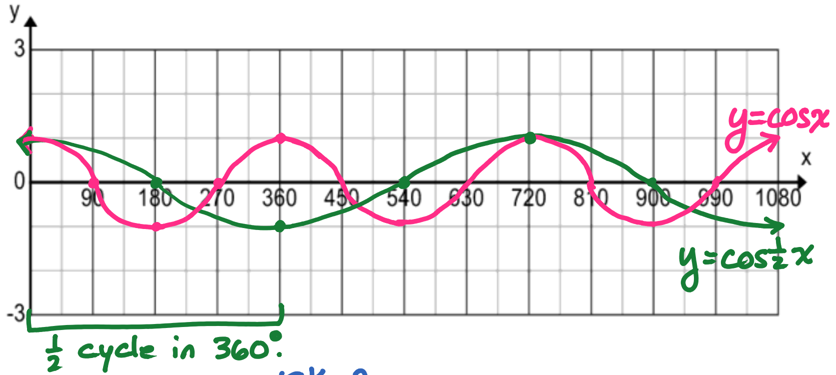
Period of $y = \cos \boxed{\frac{1}{2}} x$ is: $\underline{360° \div \frac{1}{2}}$. Key points every $\underline{\frac{720°}{4} = 180°}$.

$= 360° \times \frac{2}{1}$

$= 720°$

x	$\cos x$
0°	1
90°	0
180°	-1
270°	0
360°	1

x	$\cos \frac{1}{2} x$
0°	1
180°	0
360°	-1
540°	0
720°	1



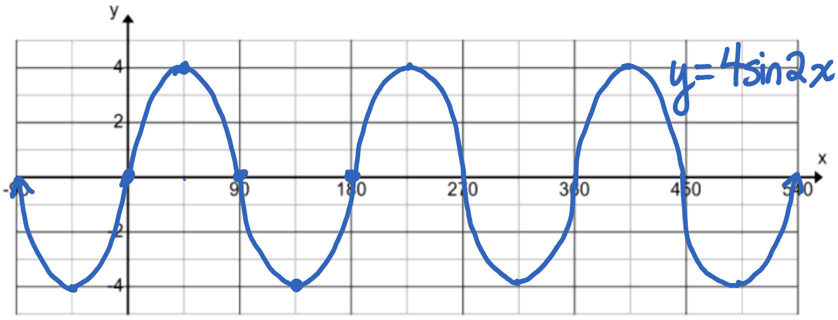
3. Graph $y = 4\sin 2x$ on the grid below $\leftarrow k=2$

~~(graph the original function as well):~~

Amplitude: $\underline{4}$. Period: $\underline{180°}$.

Key points every: $\underline{45°}$.

x	0°	45°	90°	135°	180°
$4\sin 2x$	0	4	0	-4	0



U6D4 Practice: Page 374 #2 (all – just in degrees, not radians), 3 – 6 (b only), 8b (typo – max is at 3), 10c, 11bc, 12c

$K = \frac{360°}{540°} = \frac{2}{3}$

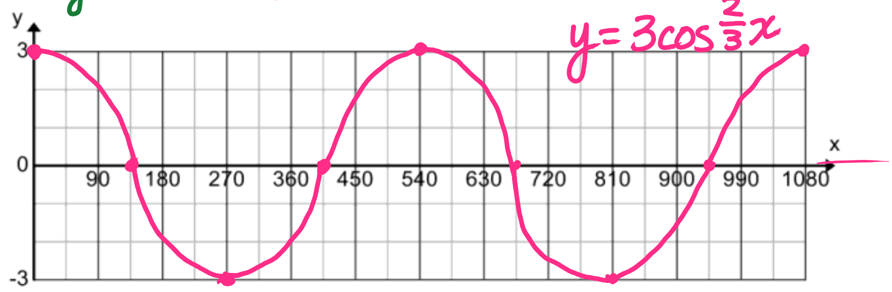
4. A cosine function has an amplitude of 3 and a period of 540°.

a) Determine the equation of the function: $y = 3\cos\frac{2}{3}x$

b) Sketch **2 cycles** of this function, beginning with a point at $x = 0$.

Key points occur every: 135°

x	0°	135°	270°	405°	540°
y	3	0	−3	0	3



U6D4 Practice: Page 374 #2 (all – just in degrees, not radians), 3 – 6 (b only), 8b (typo – max is at 3), 10c, 11bc, 12c