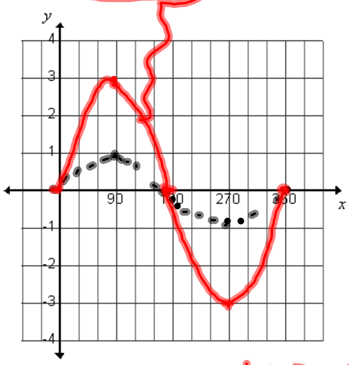
Transformations of the Sine Function

Date: May 5/11

Vertical Stretches, Compressions and Reflections: $f(x) = a \sin x$

Ex. 1: Vertical Stretches: $f(x) = a \sin x$, where $a > 1$

a) Sketch $f(x) = 3 \sin x$



Equation of the axis: $y = 0$

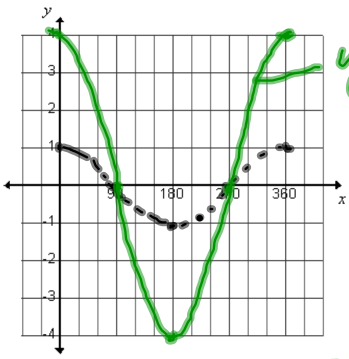
Amplitude: 3

Period: 360°

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

Range: $\{y \in \mathbb{R} \mid -3 \le y \le 3\}$

b) $f(x) = 4 \cos x$



$y = 4\cos x$

Equation of the axis: $y = 0$

Amplitude: 4

Period: 360°

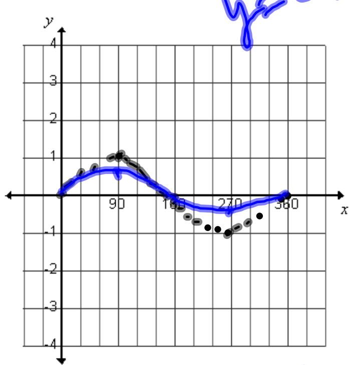
Domain: $\{x \in \mathbb{R}\}$

Range: $\{y \in \mathbb{R} \mid -4 \le y \le 4\}$

Ex. 2: Vertical Compressions: $f(x) = a \sin x$, where $0 < a < 1$

Sketch $f(x) = 0.5 \sin x$

$y = 0.5 \sin x$



Equation of the axis: $y = 0$

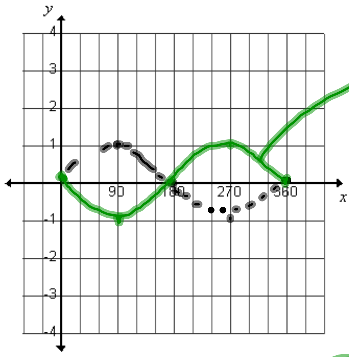
Amplitude: 0.5

Period: 360°

Range: $\{y \in \mathbb{R} \mid -0.5 \le y \le 0.5\}$

Ex. 3: Reflection: $f(x) = a \sin x$, where $a < 0$

Sketch $f(x) = -\sin x$



$y = -\sin x$

Equation of the axis: $y = 0$

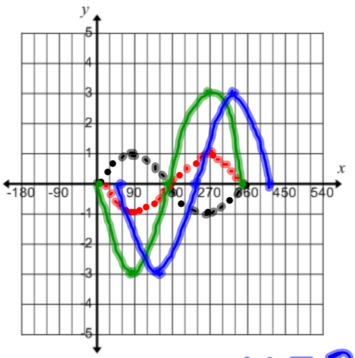
Amplitude: 1

Period: 360°

Range: $\{y \in \mathbb{R} \mid -1 \le y \le 1\}$

Ex. 4: $f(x) = a \sin(x - c) + d$ RST

a) Sketch $f(x) = -3\sin(x - 60°)$

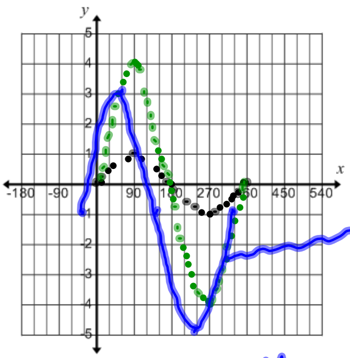


Equation of the axis: $y = 0$

Amplitude: 3

Range: $\{ \mid -3 \le y \le 3\}$

b) $f(x) = 4\sin(x + 30°) - 1$



$y = 4\sin(x + 30°) - 1$

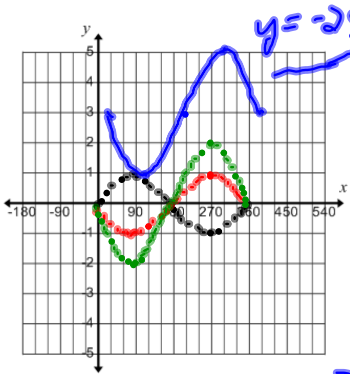
Equation of the axis: $y = -1$

Amplitude: 4

Range: $\{y \in \mathbb{R} \mid -5 \le y \le 3\}$

c) Sketch $f(x) = -2\sin(x - 30°) + 3$

$y = -2\sin(x - 30°) + 3$

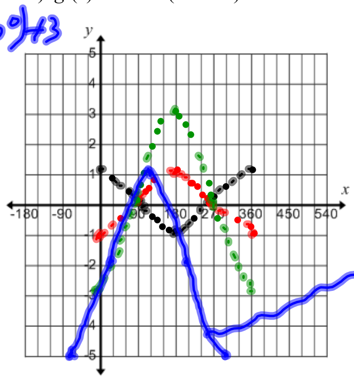


Equation of the axis: $y = 3$

Amplitude: 2

Range: $\{y \in \mathbb{R} \mid 1 \le y \le 5\}$

d) $g(x) = -3\cos(x + 60°) - 2$



$y = -3\cos(x + 60°) - 2$

Equation of the axis: $y = -2$

Amplitude: 3

Range: $\{y \in \mathbb{R} \mid -5 \le y \le 1\}$

Ex. 5 a) The graph of $f(x) = \sin x$ has been been stretched by a factor of 5, translated to the right 15° and up 6 units. Write the new equation.

$$f(x) = 5\sin(x - 15^\circ) + 6$$

b) The graph of $g(x) = \cos x$ has been compressed by a factor of 3, translated down 4 units and to the left 30°. Write the new equation.

$$g(x) = \frac{1}{3}\cos(x + 30^\circ) - 4$$

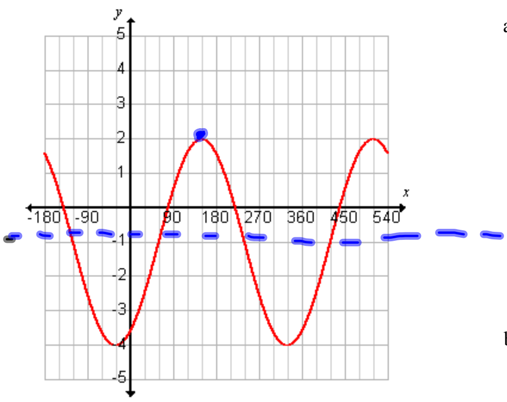
c) The graph of $g(x) = \cos x$ has been stretched by a factor of 2, reflected in the x-axis, translated up 3 units and to the left 60°. Write the new equation.

$$g(x) = -2\cos(x + 60^\circ) + 3$$

d) The graph of $f(x) = \sin x$ undergoes a horizontal translation of 15°, is reflected in the x-axis, compressed by a factor of 4, and translated down 7 units. Write the new equation.

$$f(x) = -\frac{1}{4}\sin(x - 15^\circ) - 7$$

Ex. 6 Determine four possible equations for the sketch below. Use a positive and a negative for each base curve.



a) Use $f(x) = \sin x$ as the base curve.

$$f(x) = 3\sin(x - 60^\circ) - 1$$
$$= 3\sin(x - 420^\circ) - 1$$
$$f(x) = -3\sin(x - 240^\circ) - 1$$
$$= -3\sin(x + 120^\circ) - 1$$

b) Use $g(x) = \cos x$ as the base curve.

$$g(x) = 3\cos(x - 150^\circ) - 1$$
$$g(x) = 3\cos(x - 510^\circ) - 1$$
$$g(x) = -3\cos(x - 330^\circ) - 1$$
$$g(y) = -3\cos(x + 30^\circ) - 1$$

Review the learning goals. Were we successful today?

(Inform of graphs on website.)

Homework: p. 373 # 1 – 13