Sine and Cosine Graph with Translations

In general:

$$y = a \cdot \sin(bx - c) + d$$

vertical stretch/shrink amplitude = |a|	frequency change horizontal dilation	horizontal shift	vertical shift

$$y = a \cdot \cos(bx - c) + d$$

phase shift
(determines domain of one phase)
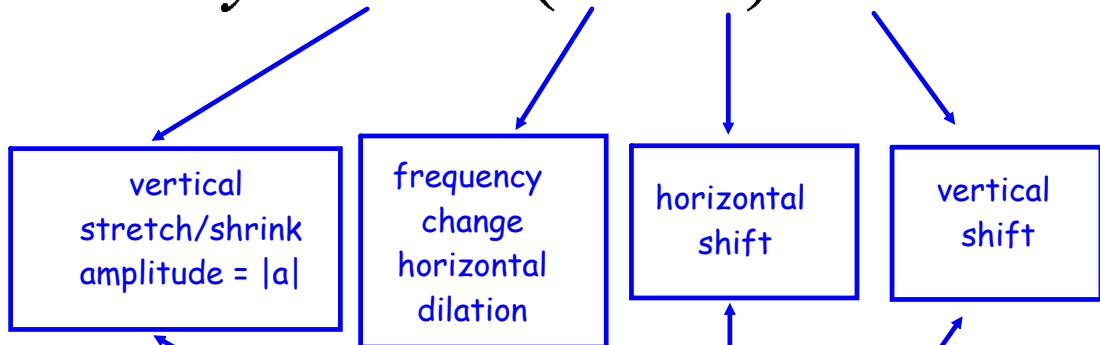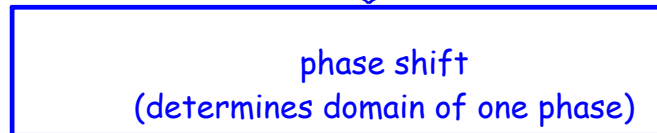
Graphing Prep and Checklist:

- amplitude: $|a|$

- period: $\dfrac{2\pi}{b}$ OR $\dfrac{360°}{b}$

- phase shift: $bx - c = 0$

- vertical shift: $\pm d$

- domain: of one phase $\begin{cases} bx - c = 0 \\ bx - c = 2\pi \text{ OR } 360° \end{cases}$

- range: amp & vertical shift

- even or odd? depends on final graph !

1) $y = -\dfrac{1}{2}\sin x + 2$ ← v.s.
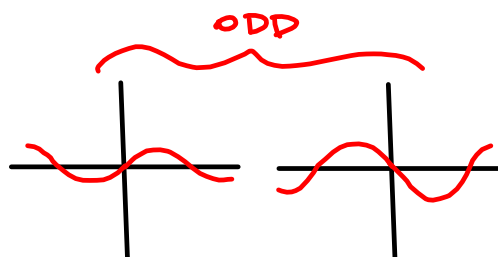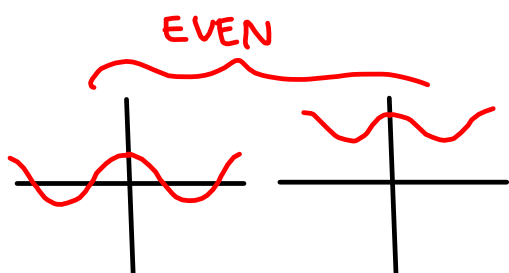
reflection
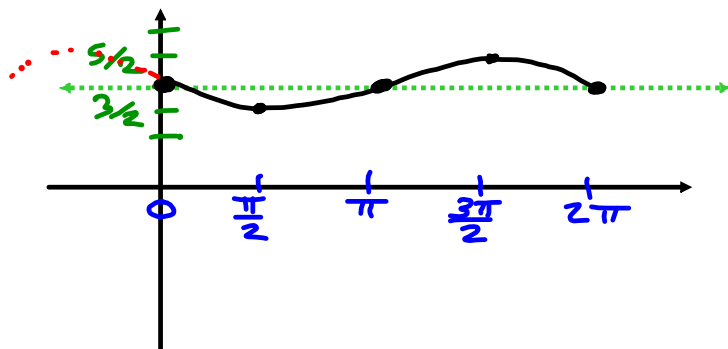
amplitude: $\dfrac{1}{2}$

period: 2π

phase shift: 0

vertical shift: $+2$

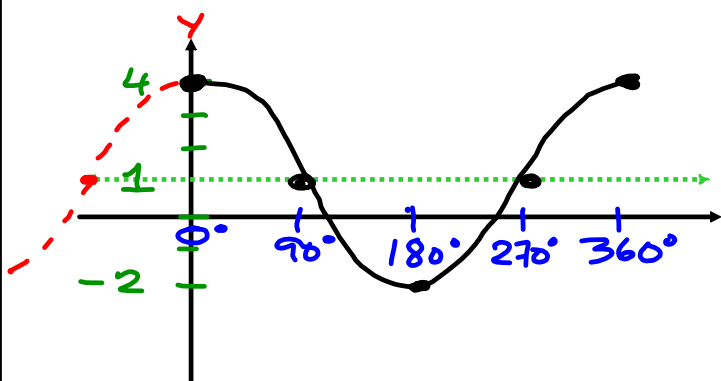domain: $[0, 2\pi]$

range: $[1.5, 2.5]$

~~even or odd?~~ neither

EVEN

ODD

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

v.s.
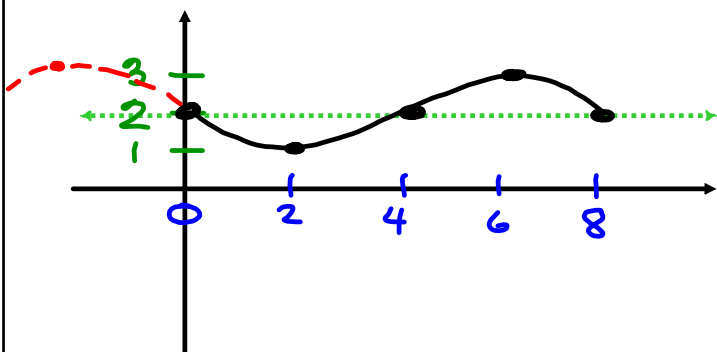
amplitude: 3

period: $360°$

phase shift: 0

vertical shift: 1

domain: $[0°, 360°]$

range: $[-2, 4]$

even or odd?

3) $y = 2 - \sin\left(\dfrac{\pi x}{4}\right) = -\sin\left(\dfrac{\pi}{4}x\right) + 2$

reflection

amplitude: 1

period: $\dfrac{2\pi}{\pi/4} = 8$

* phase shift: 0

vertical shift: 2

* domain: $[0, 8]$

range: $[1, 3]$

~~even or odd?~~ neither

* $\dfrac{\pi}{4}x = 0$ $\dfrac{\pi}{4}x = 2\pi$

$x = 0$ $x = 8$

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4) $y = 2\sin(3\theta - 270°) - 4$
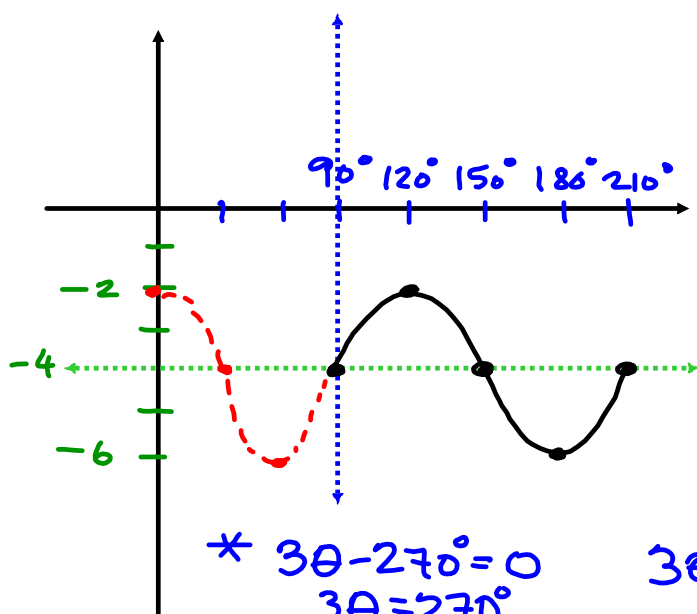
amplitude: 2

period: $\dfrac{360°}{3} = 120°$

* phase shift: $90°$

vertical shift: -4

* domain: $[90°, 210°]$

range: $[-6, -2]$

even or odd?

$90°$ $120°$ $150°$ $180°$ $210°$

* $3\theta - 270° = 0$ $3\theta - 270° = 360°$
$3\theta = 270°$ $3\theta = 630°$
$\theta = 90°$ $\theta = 210°$

5) $y = 3\cos\left(x + \dfrac{\pi}{4}\right)$

amplitude: 3

period: 2π

*phase shift: $-\dfrac{\pi}{4}$

vertical shift: 0

*domain: $\left[-\dfrac{\pi}{4}, \dfrac{7\pi}{4}\right]$

range: $[-3, 3]$

~~even or odd?~~ neither

Space evenly! but only label 5!

3

-3

$-\dfrac{\pi}{4}$ $\dfrac{\pi}{4}$ $\dfrac{3\pi}{4}$ $\dfrac{5\pi}{4}$ $\dfrac{7\pi}{4}$

2π

* $x + \dfrac{\pi}{4} = 0$ $x + \dfrac{\pi}{4} = \dfrac{8\pi}{4}$

$x = -\dfrac{\pi}{4}$ $x = \dfrac{7\pi}{4}$