TO GRAPH SINE & COSINE with Transformations

Basic step by step walk thru

Given: $y = A \sin/\cos(k\theta \pm c) \pm h$

Meanings:

h: vertical shift:
- moves graph up and down
- tells where midline of the graph is located
- the midline is where the functions of sin & cos equal zero

A: amplitude: vertical stretch & compression
- means the distance the max & min values are from the midline
- $-A$ means max & min flip

K: period change: horizontal stretch & compression
- means the distance on the x-axis that it takes for graph to start to repeat.
- mainly changes the values of your x-axis
- period of function is $\frac{2\pi}{K}$

  or $2\pi \cdot$ reciprocal of K

C: phase shift: horizontal shift left & right
- moves graph left & right
- a phase shift can make sin look like cosine & vice versa
- phase shift is found by $\frac{C}{K}$

  $+c$ moves left, $-c$ moves right

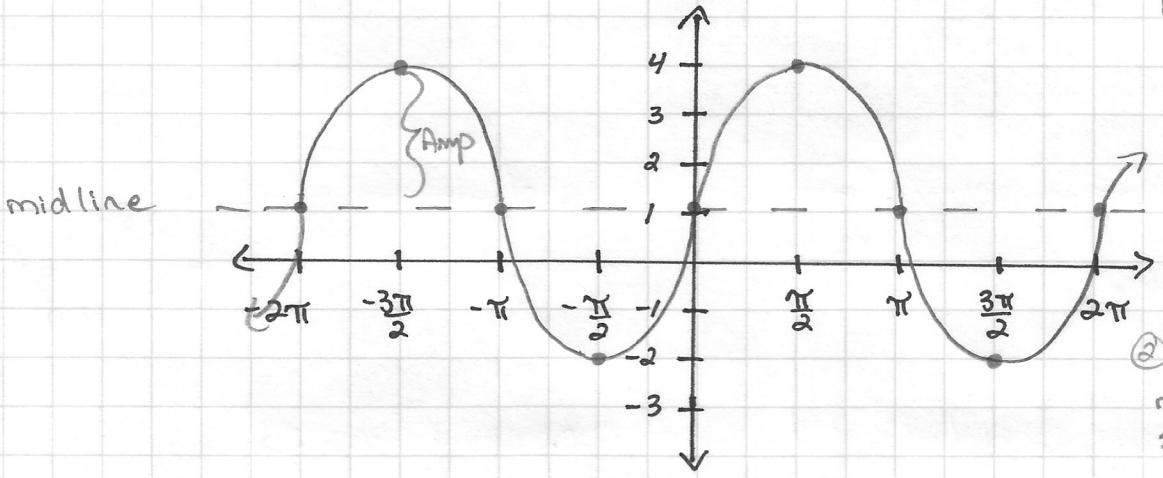
* only have to divide by K if period changes

Basic steps for graphing sine or cosine

- Given: $y = A \sin/\cos(k\theta \pm c) \pm h$

Steps:
1st: graph h → the midline
2nd: graph A → distance from midline
3rd: graph K → period change (change x-axis values)
4th: graph C → shift graph left or right

Example #1: $y = 3\sin\theta + 1$

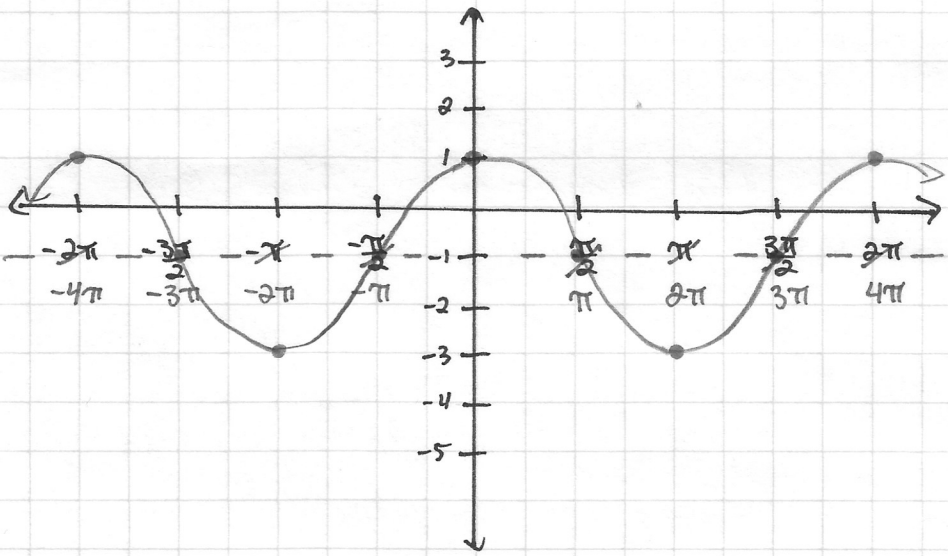


① $h = 1$ midline
for sin, zeros are at $0\pi, \pi, 2\pi$ those are the pts on midline

② $A = 3$ Amplitude max & min are 3 spaces from midline

* Last draw curves

Example #2: $y = 2\cos\frac{1}{2}\theta - 1$



① $h = -1$ midline
zeros for cosine $\frac{\pi}{2}$ & $\frac{3\pi}{2}$

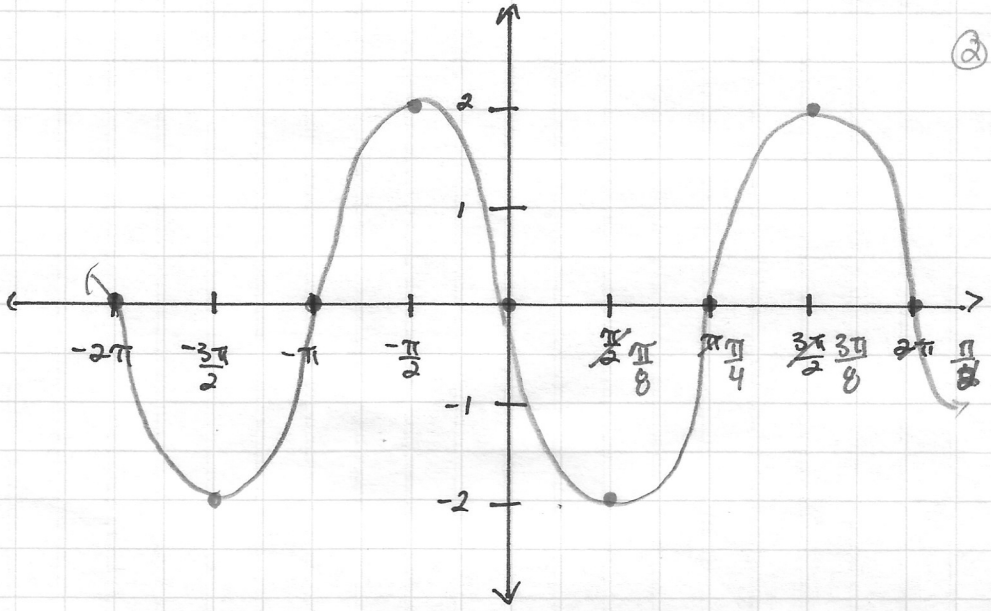
② Amp is 2

③ K = period change

$2\pi \cdot 2$ or $\frac{2\pi}{\frac{1}{2}}$ means period is 4π

* means multiply x-axis by 2

Example 3: $y = -2 \sin 4\theta$



① No h so zeros are on x-axis

② $A = 2$ max, min 2 spaces from

– flips max's, min

③ Period: $K = 4$

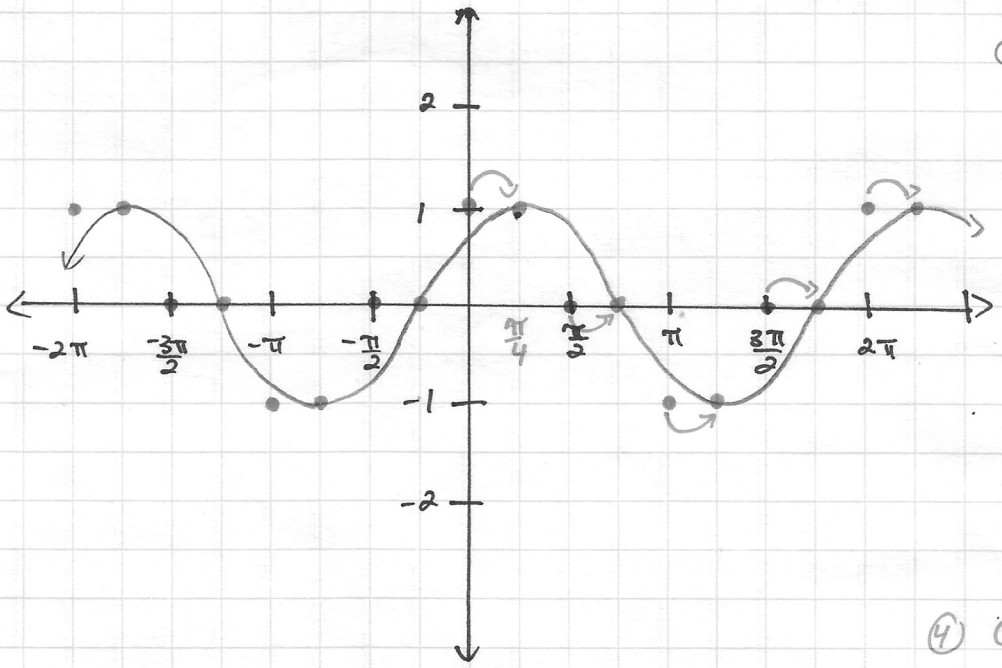
$\frac{2\pi}{4}$ or $2\pi \cdot \frac{1}{4}$ $= \frac{1}{2}\pi$ or $\frac{\pi}{2}$

* means take x-axis & multiply by 1/4

$\frac{\pi}{2} \cdot \frac{1}{4} = \frac{\pi}{8}$ $\quad \pi \cdot \frac{1}{4} = \frac{\pi}{4}$

$\frac{3\pi}{2} \cdot \frac{1}{4} = \frac{3\pi}{8}$ $\quad 2\pi \cdot \frac{\pi}{4} = \frac{\pi}{2}$

Example 4: $y = \cos\left(\theta - \frac{\pi}{4}\right)$



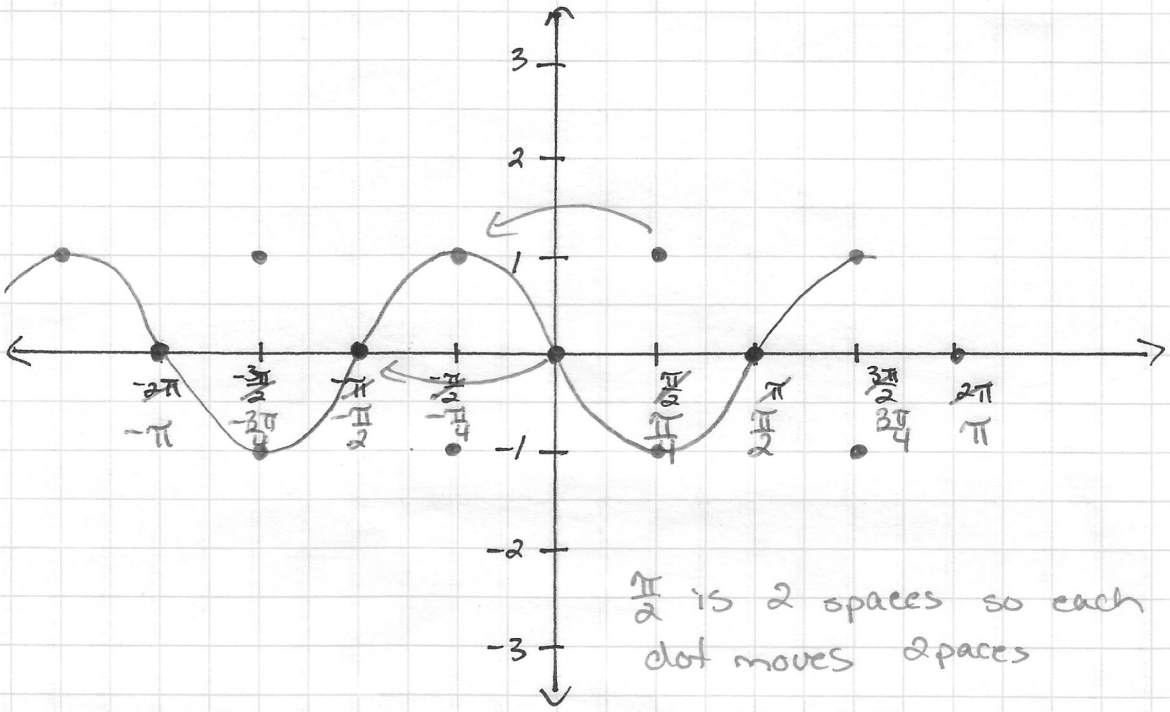
① No h so midline is x-axis

② $A = 1$ max/min 1 space from midline

③ No K show x-axis stays same

④ $C = \frac{\pi}{4}$ & is neg so each pt moves right $\frac{\pi}{4}$

Example 5: $y = \sin(2\theta + \pi)$



$\frac{\pi}{2}$ is 2 spaces so each dot moves 2 spaces

① midline is on x-axis since no h

② so zeros are at π values

② Amp is 1 so max & min are 1 space away

③ k is 2 so period changes

$2\pi \cdot \frac{1}{2} = \pi$ period is π

* multiply x-axis by 1/2 & change x-axis

④ since k is 2 & c is π

phase shift is $\pi \cdot \frac{1}{2}$ which is $\frac{\pi}{2}$
so each pt moves $\frac{\pi}{2}$ spaces to the left since it is +.