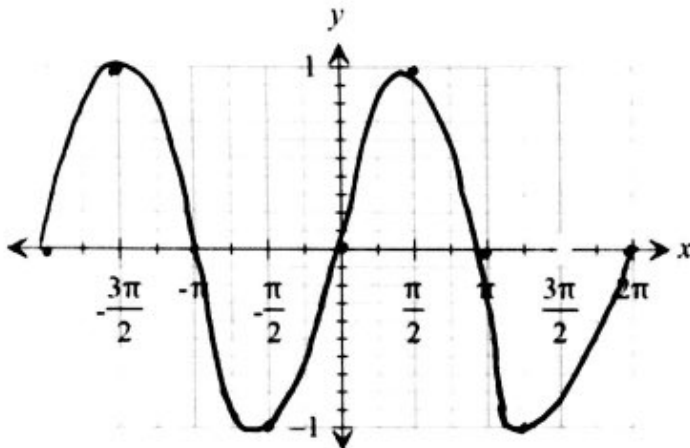


10.3N – Review graphing sine and cosine

A. Graph Sine and Cosine

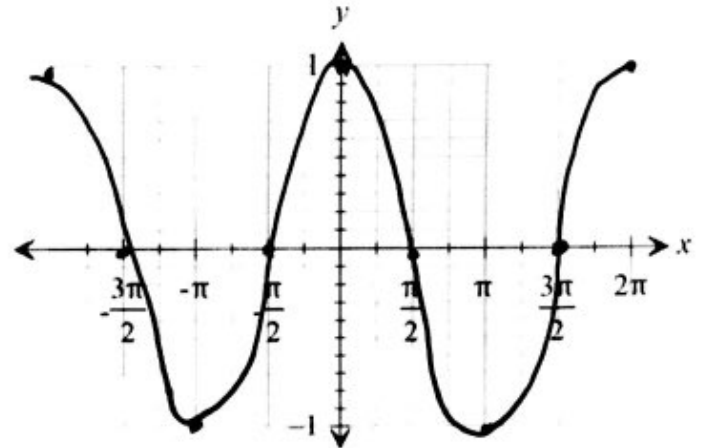
Parent sine graph $f(\theta) = \sin \theta$

Draw the graph and make a table.



Parent cosine graph $f(\theta) = \cos \theta$

Draw the graph and make a table.



| | | | | | |
|-------------------|---|---------|-------|----------|--------|
| θ | 0 | $\pi/2$ | π | $3\pi/2$ | 2π |
| $y = \sin \theta$ | 0 | 1 | 0 | -1 | 0 |

| | | | | | |
|-------------------|---|---------|-------|----------|--------|
| θ | 0 | $\pi/2$ | π | $3\pi/2$ | 2π |
| $y = \cos \theta$ | 1 | 0 | -1 | 0 | 1 |

For the parent graph of $f(\theta) = \sin \theta$

Vertical shift: 0

Amplitude: 1

b: 1

Period: 2π

Phase shift: none

Frequency: $1/2\pi$

For the parent graph of $f(\theta) = \cos \theta$

Vertical shift: 0

Amplitude: 1

b: 1

Period: 2π

Phase shift: none

Frequency: $1/2\pi$

Steps for when you do all 4 transformations in one function

1. Find all the transformations a, b, c, d
 Amp. Period P.S. V.S

2. Multiply by amplitude (a), don't forget negative

3. Add or subtract Vertical shift (d)

4. Multiply or Divide by b

5. Add or subtract Phase shift. (c)

B. Examples

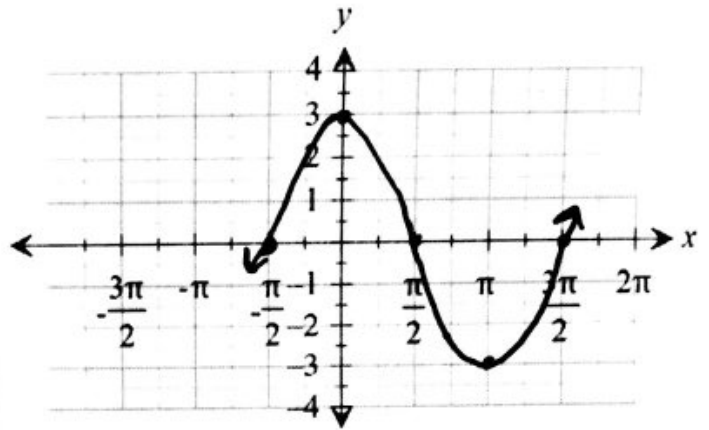
EX. 1 $f(\theta) = 3\sin(\theta + \frac{\pi}{2})$

Vertical Shift (k): none

Amplitude (a): 3

Phase Shift (h): $-\frac{\pi}{2}$ left $\frac{\pi}{2}$

Period: $\frac{2\pi}{1} = 2\pi$



| | | | | | | |
|---------------|--------------------------|------------------|-----------------|-----------------|------------------|------------------|
| | | | | | | |
| * | $-\frac{\pi}{2}$ | $-\frac{\pi}{2}$ | 0 | $\frac{\pi}{2}$ | π | $\frac{3\pi}{2}$ |
| | $\theta - \frac{\pi}{2}$ | 0 | $\frac{\pi}{2}$ | π | $\frac{3\pi}{2}$ | 2π |
| | $y = \sin \theta$ | 0 | 1 | 0 | -1 | 0 |
| * y values | $\times 3$ | 0 | 3 | 0 | -3 | 0 |

* Final Graph

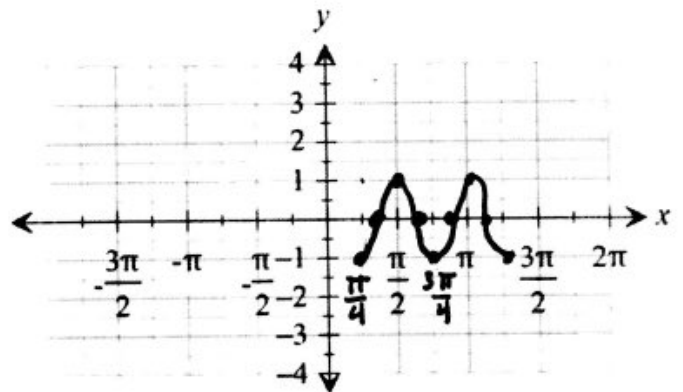
EX. 2 $f(\theta) = -\cos(4(\theta - \frac{\pi}{4}))$

Vertical Shift (k): none

Amplitude (a): 1 (Also Reflection)

Phase Shift (h): $\frac{\pi}{4}$ Right $\frac{\pi}{4}$

Period: $\frac{2\pi}{4} = \frac{\pi}{2}$



| | | | | | | |
|--------------------------|-------------------------------------|-----------------|------------------|-----------------|------------------|------------------|
| | | | | | | |
| * mult. by 1/4 and | $+\frac{\pi}{4}$ | $\frac{\pi}{4}$ | $\frac{3\pi}{8}$ | $\frac{\pi}{2}$ | $\frac{5\pi}{8}$ | $\frac{3\pi}{4}$ |
| | $\frac{1}{4}\theta + \frac{\pi}{4}$ | 0 | $\frac{\pi}{2}$ | π | $\frac{3\pi}{2}$ | 2π |
| | $y = \cos \theta$ | 1 | 0 | -1 | 0 | 1 |
| * Reflect x by -1 | | -1 | 0 | 1 | 0 | -1 |

* Final Graph

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

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

$$\frac{1}{4} \cdot \frac{3\pi}{2} + \frac{\pi}{4} = \frac{3\pi}{8} + \frac{\pi \cdot 2}{4 \cdot 2} = \frac{5\pi}{8}$$

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

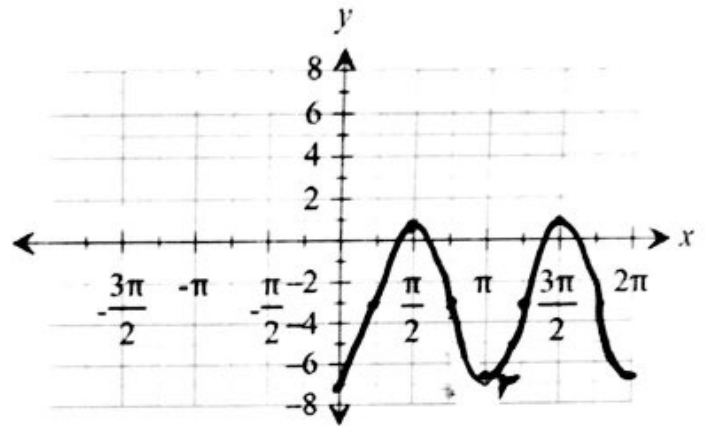
EX. 3 $f(\theta) = -4\cos 2\theta - 3$

Vertical Shift (k): ↓ 3

Amplitude (a): 4, Reflected

Phase Shift (h): none

Period: $\frac{2\pi}{2} = \pi$



| | | | | | |
|--------------------------|----|---------|---------|----------|--------|
| * mult. by $\frac{1}{2}$ | | | | | |
| π | 0 | $\pi/4$ | $\pi/2$ | $3\pi/4$ | π |
| $\frac{\theta}{2}$ | 0 | $\pi/2$ | π | $3\pi/2$ | 2π |
| $y = \cos \theta$ | 1 | 0 | -1 | 0 | 1 |
| mult. by -4 | -4 | 0 | 4 | 0 | -4 |
| * down 3 | -7 | -3 | 1 | -3 | -7 |

* Final graph

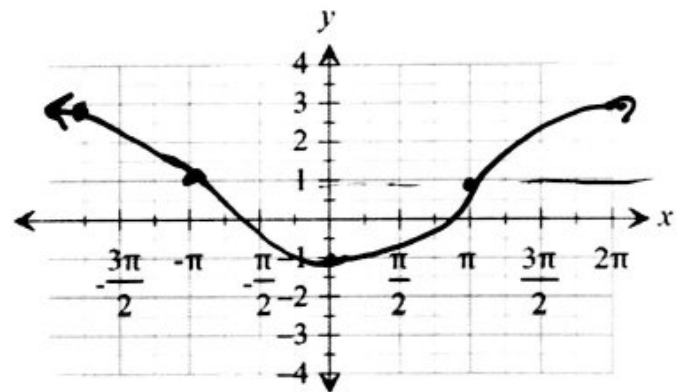
EX. 4 $f(\theta) = 2\sin \frac{1}{2}(\theta - \pi) + 1$

Vertical Shift (k): ↑ 1

Amplitude (a): 2

Phase Shift (h): $+\pi$ right

Period: $\frac{2\pi}{\frac{1}{2}} = 4\pi$



| | | | | | |
|-------------------|-------|---------|--------|----------|--------|
| * mult. by 2 | | | | | |
| add π | π | 2π | 3π | 4π | 5π |
| θ | 0 | $\pi/2$ | π | $3\pi/2$ | 2π |
| $y = \sin \theta$ | 0 | 1 | 0 | -1 | 0 |
| mult. by 2 | 0 | 2 | 0 | -2 | 0 |
| * up 1 | 1 | 3 | 1 | -1 | 1 |

Final graph

$\frac{1}{2} = 2\pi$