5.4 -Combination of Transformations

Vertical Stretch/Compression (AMPLITUDE)

Horizontal Shift left/right (PHASE SHIFT)

In general: $y = af(k(x-d))+c$

Horizontal Stretch/Compression

Vertical Shift up/down

Perform transformations in the following order:

1) Reflections and Stretches/compressions together
2) Translations

period= $\frac{360^0}{k}$

Don't forget to factor out the coefficient of the x-term!

The amplitude is |a|

$$a = \frac{\max - \min}{2}$$

y=c is the base line/imaginary middle (axis of the curve)

$$y = \frac{\max + \min}{2}$$

Max= c + |a|
Min = c - |a|

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Ex 1 - Describe the transformations from the base function.

a) $y = -2\sin 3x$
- reflection in x-axis
- amplitude of 2
- horz. comp. of 3

b) $h(x) = 3\sin(x - 600) + 2$
- amplitude of 3
- phase shift 600° right
- Vert. shift up 2

c) $y = 2\sin(2x + 450) + 3$ $[2(x+225)]$
- amplitude of 2
- horz. comp. of 2
- phase shift left of 225°
- Vert. shift up 3

d) $y = \frac{-1}{2}\cos(4x-1800)$ $[4(x-450)]$
- reflection in x-axis
- amplitude of $\frac{1}{2}$
- horz. comp. of 4
- phase shift right 450°

Ex 2 - Sketch the graph for each, pay attention to the restrictions. State the amplitude, period, D & R, phase shift and vertical translation.

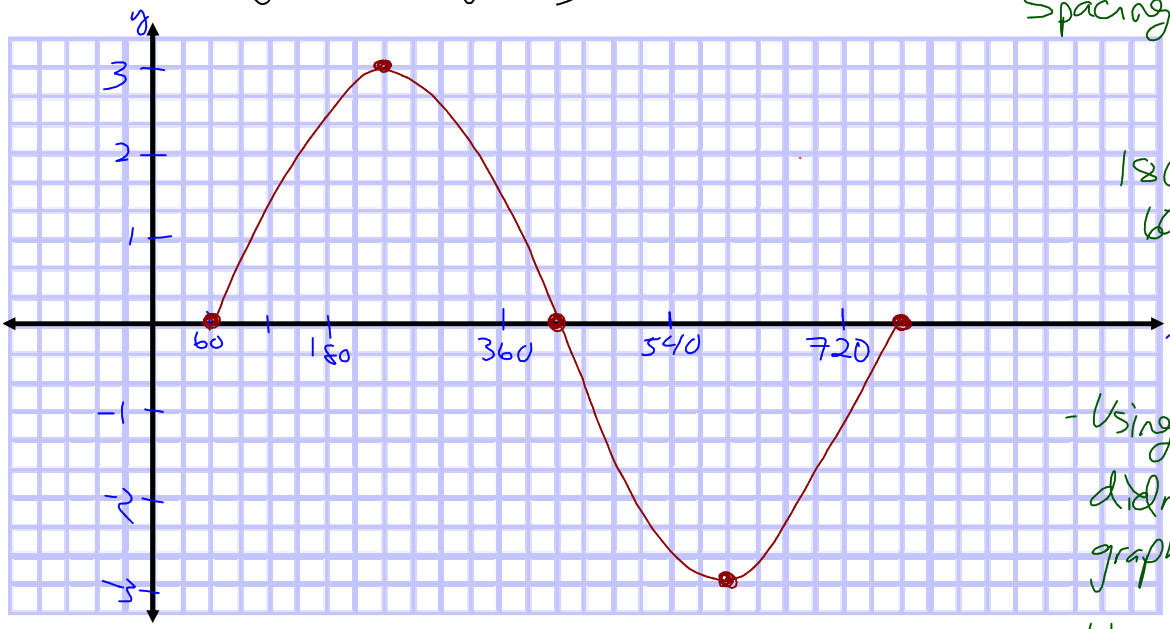
a) $y = 3\sin\left(\frac{1}{2}x - 30°\right)$ for one cycle

$y = 3\sin\left[\frac{1}{2}(x - 60°)\right]$

- amp. 3
- period: $\frac{360}{\frac{1}{2}} = 720°$
- phase shift 60° right

$D: \{x \in \mathbb{R} \mid 60° \le x \le 780°\}$

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



Spacing: $\frac{720}{4} = 180$

180° / 60° CF = 60°

- Using 60° units didn't fill graph.
- Use 30° units

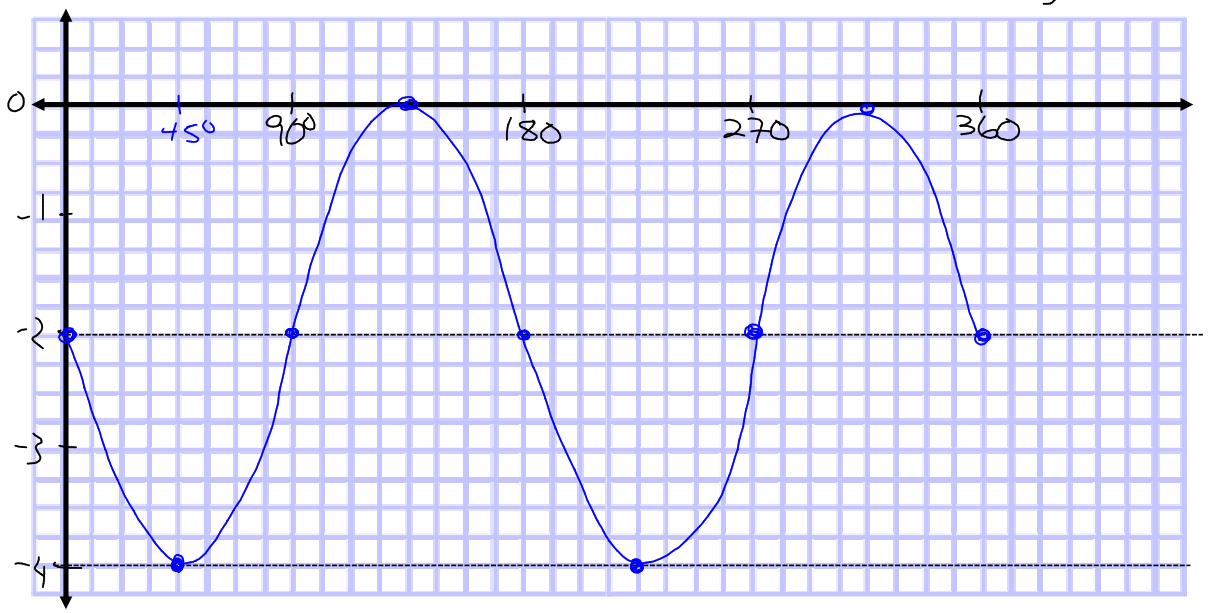
b) $y = -2\cos(2x - 90^\circ) - 2$, $0 \le x \le 360^\circ$

$y = -2\cos[2(x-45)] - 2$

Period: $\frac{360^\circ}{2} = 180^\circ$

Spacing: $\frac{180}{4} = 45^\circ$

- Reflection in x-axis $(-1, 0, 1, 0, -1)$
- Amp. of 2
- Horz. comp of 2
- Shifted down 2
- Phase shift right 45°



$D: \{x \in \mathbb{R} \mid 0^\circ \le x \le 360^\circ\}$

$R: \{y \in \mathbb{R} \mid -4 \le y \le 0\}$

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c) $y = \frac{1}{2}\cos(3x - 90°) + 1$ $0 \le x \le 360^o$

$y = \frac{1}{2}\cos[3(x - 30°)] + 1$

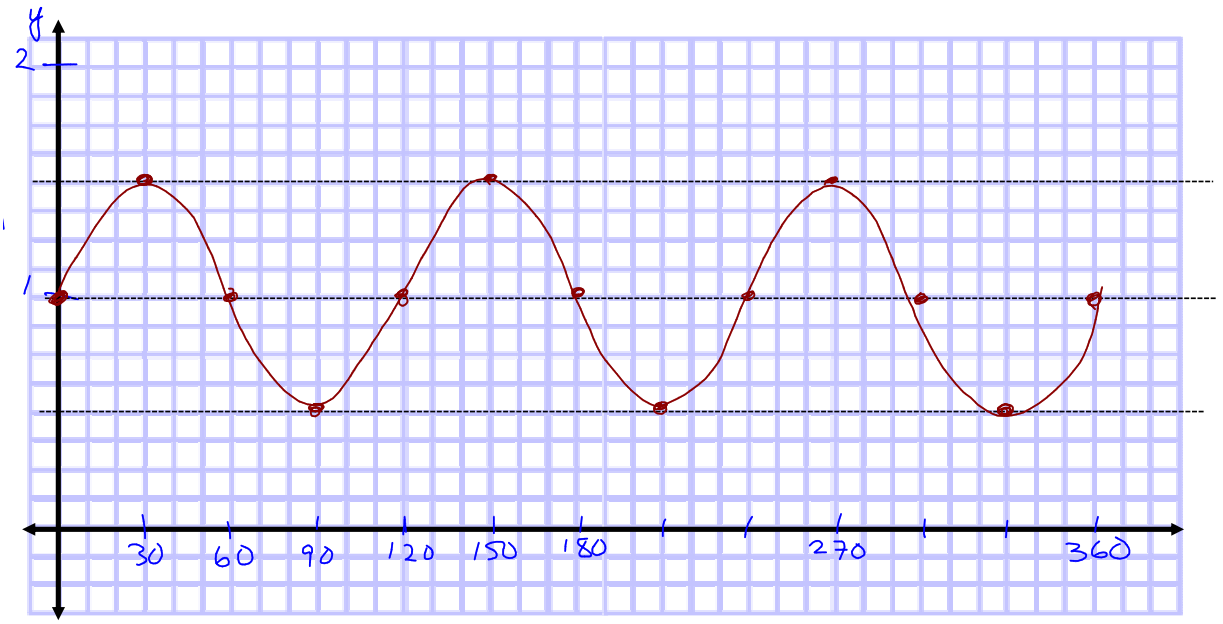
$a = \frac{1}{2}$

Period $= \frac{360}{3} = 120$

Spacing $= \frac{120}{4} = 30$

max: $1 + \frac{1}{2} = 1.5$

min: $1 - \frac{1}{2} = 0.5$



D: $\{x \in R \mid 0° \le x \le 360°\}$

R: $\{y \in R \mid 0.5 \le y \le 1.5\}$

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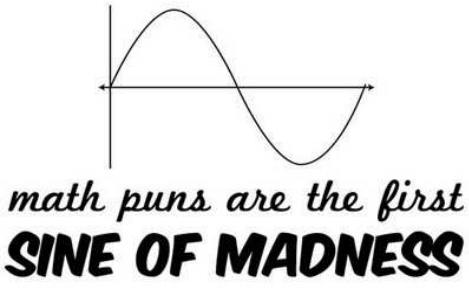
1-11, 21-23
note π radians = 180°

(or go to website to see Unit 5 Text handout with degrees)



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