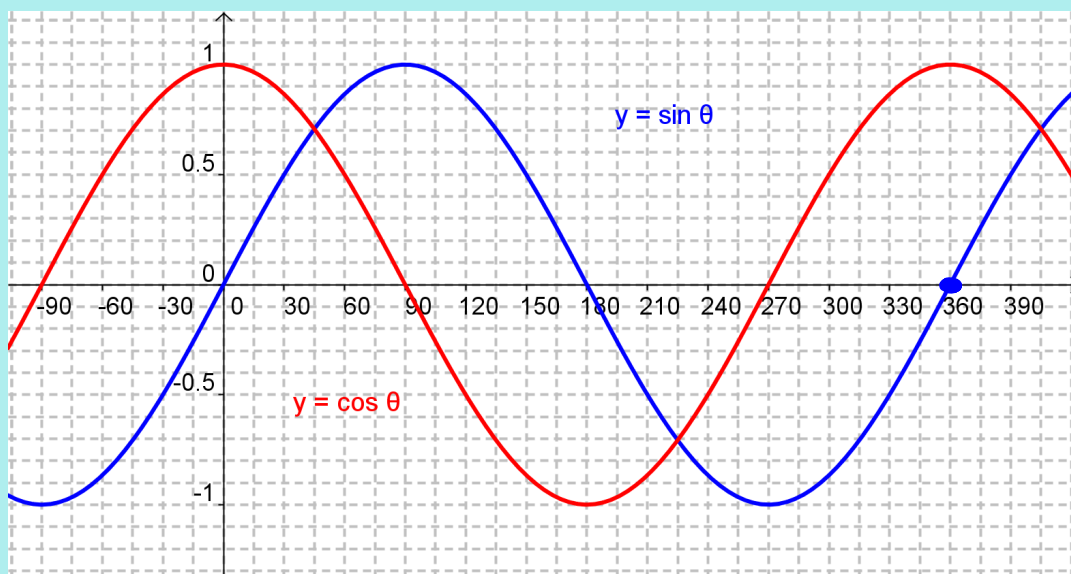


Graphing Trigonometric Functions from Key Properties

Recall: parent functions for sine and cosine



May 21-8:27 PM

Graphing Trigonometric Functions from Key Properties

Given:

$$y = a \sin [k(x - p)] + q$$

or

$$y = a \cos [k(x - p)] + q$$

a gives vertical reflection and scaling
 k gives horizontal reflection and scaling
 p gives horizontal translation or shift
 q gives vertical translation or shift

$$(x, y) \rightarrow (x, ay) \rightarrow \left(\frac{x}{k}, ay\right) \rightarrow \left(\frac{x}{k} + p, ay\right) \rightarrow \left(\frac{x}{k} + p, ay + q\right)$$

May 17-9:17 AM

Graphing Trigonometric Functions from Key Properties

Dec 5/2019

The standard transformations (a, k, p, q) can be expressed in terms of key properties for periodic functions and used to graph the function.

a: vertical scaling, determines the amplitude

k: horizontal scaling, determines the period

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

p: horizontal shift, also known as phase shift, determines the starting position of the graph

q: vertical shift, determines the axis of the curve

May 17-9:17 AM

To graph using key features:

- (1) Draw the axis of the curve (q-value)
- (2) Draw an 'envelope' for the amplitude (a-value)
- (3) Determine the period (k-value) and choose a scale that allows both the parent (if necessary) and transformed function. Divide into 4 equal sections.
- (4) Use the phase shift to determine the starting point for the graph.
- (5) Choose direction to draw (up/down and left/right) by considering any vertical or horizontal reflections.

May 23-11:32 AM

Ex.1 Determine transformations & key properties,
then graph $y = -2\sin[3(x-30^\circ)]+1$

transformations

- ① v. reflect
- ② v. stretch by 2
- ③ h. compress by 3
- ④ h. shift right 30°
- ⑤ v. shift up 1

key properties

$$\text{amplitude} = 2 = |a|$$

$$\begin{aligned} \text{period} &= \frac{360^\circ}{k} \\ &= \frac{360^\circ}{3} \\ &= 120^\circ \end{aligned}$$

Phase shift $+30^\circ$ (to the right)

$$\text{A of C: } y = 1$$

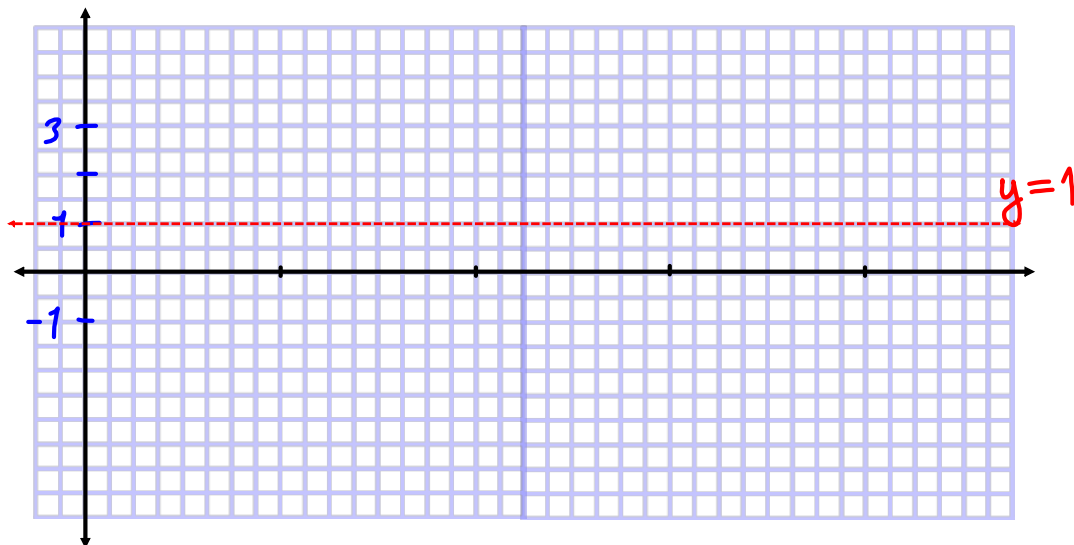
May 17-9:19 AM

Ex.1 Determine key properties and graph

$$y = -2\sin[3(x-30^\circ)]+1$$

(1) draw axis of the curve

$$\text{A of C: } y = 1$$

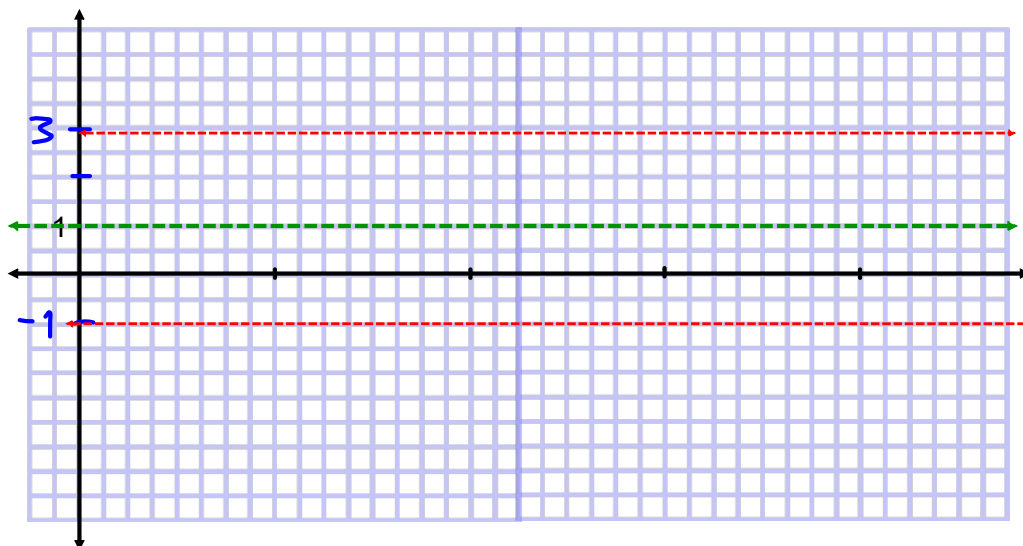


May 17-9:19 AM

Ex.1 Determine key properties and graph

$$y = -2\sin[3(x - 30^\circ)] + 1$$

(2) envelope for amplitude



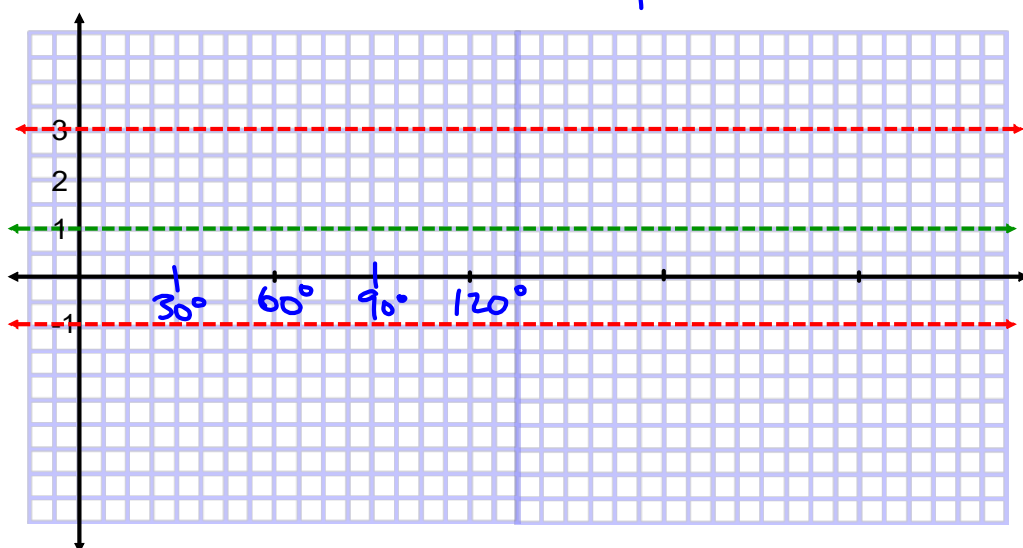
May 17-9:19 AM

Ex.1 Determine key properties and graph

$$y = -2\sin[3(x - 30^\circ)] + 1$$

(3) period and scale

period = 120°



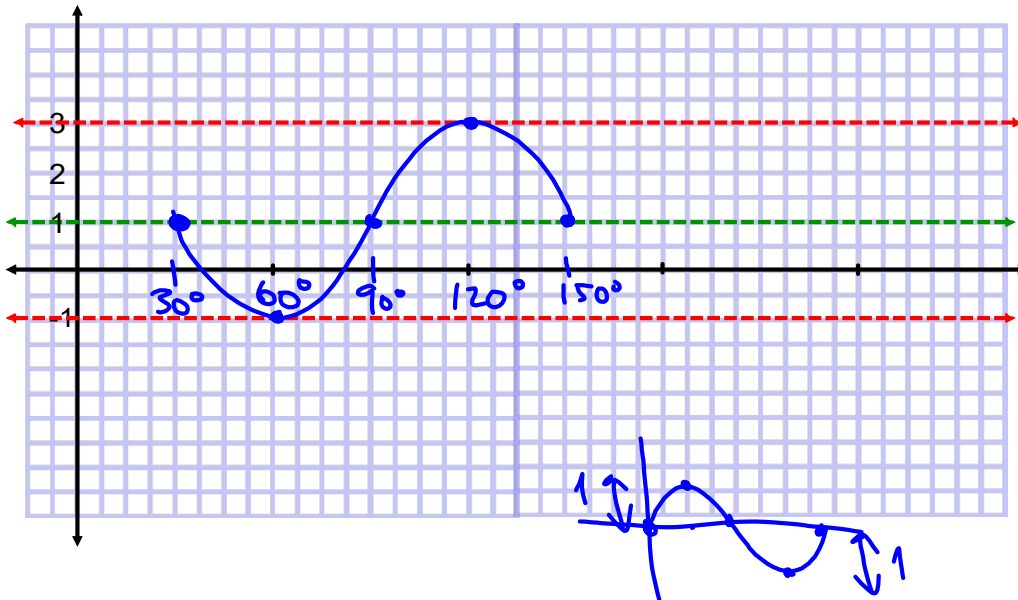
May 17-9:19 AM

Ex.1 Determine key properties and graph

$$y = -2 \sin [3(x - 30^\circ)] + 1$$

(4) phase shift to starting point

$$p = 30^\circ$$



May 17-9:19 AM

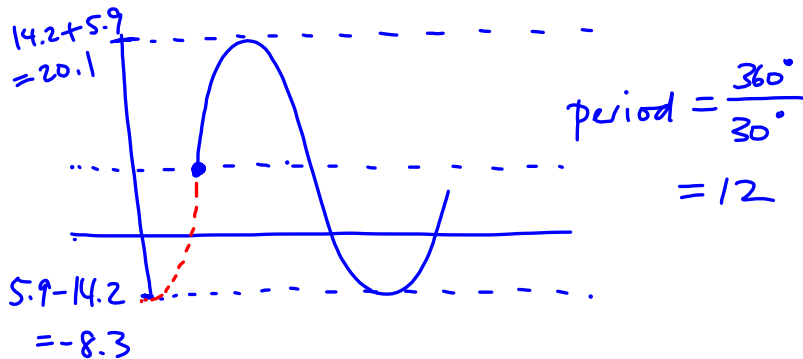
Assigned Work:

p.383 # 2, 5, 6, 9, 10, 13

p.372 # (10, 11, 12)(bcd)

\hat{a}

$$12. T(t) = 14.2 \sin [30(t - 4.2)^\circ] + 5.9$$



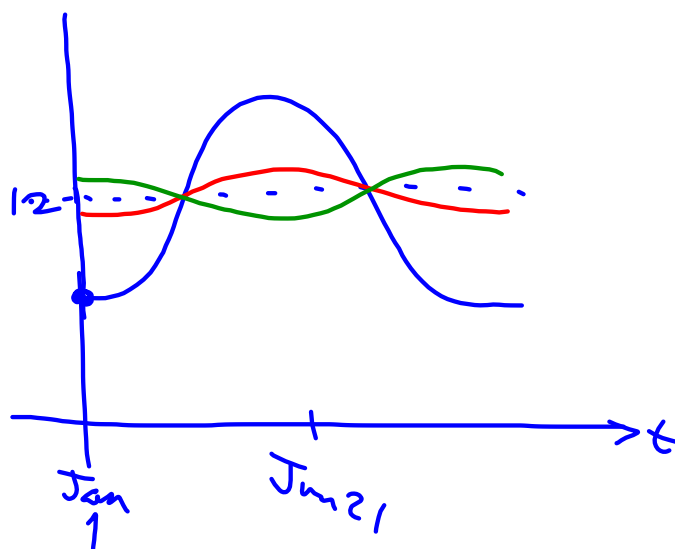
$$(c) R = \{T \in \mathbb{R} \mid -8.3 \leq T \leq 20.1\}$$

$$(d) T_{avg} = 5.9^\circ C$$

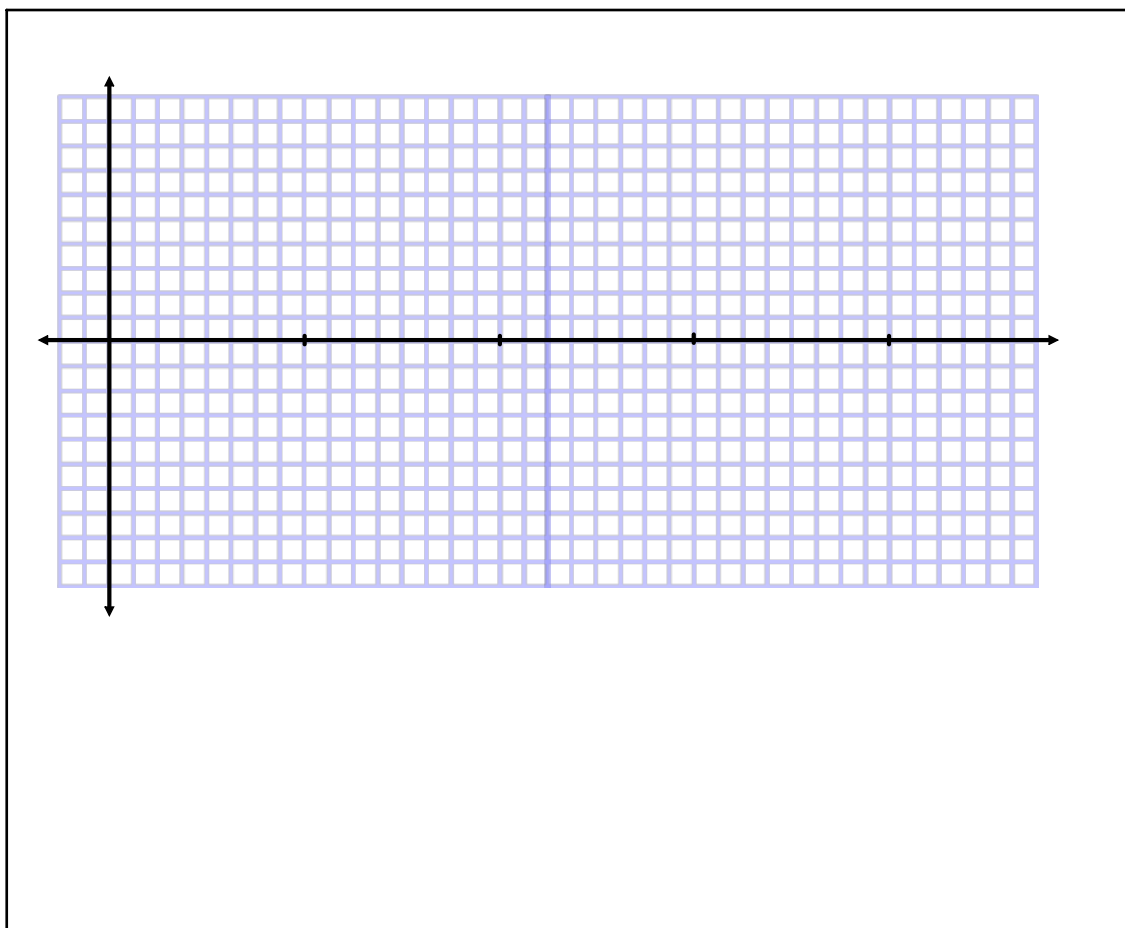
May 22-8:28 AM

p. 383 #13.

$$D(t) = 4 \sin \left[\frac{360^\circ}{365} (t - 80) \right] + 12$$



Dec 9-2:10 PM



May 16-9:08 AM