AP Precalc

Write your questions and thoughts here!

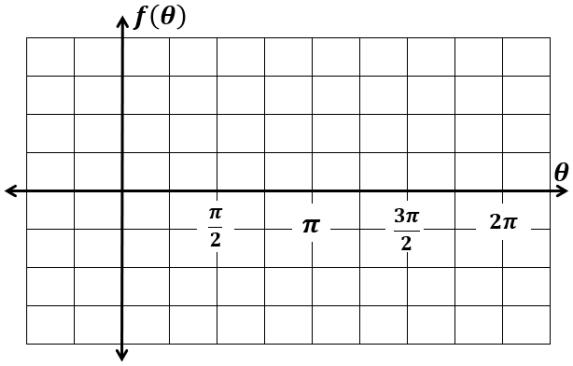
3.5 Sinusoidal Functions

3.5 Notes

Any function that is an additive or multiplicative transformation of $f(\theta) = \sin\theta$ is called a _____ function.

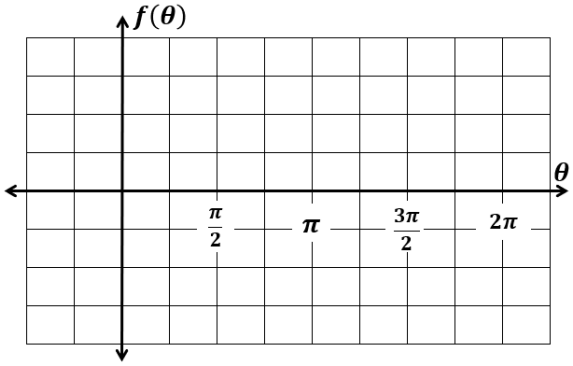
Parent Function Graphs of Sinusoids

$f(\theta) = \cos\theta$



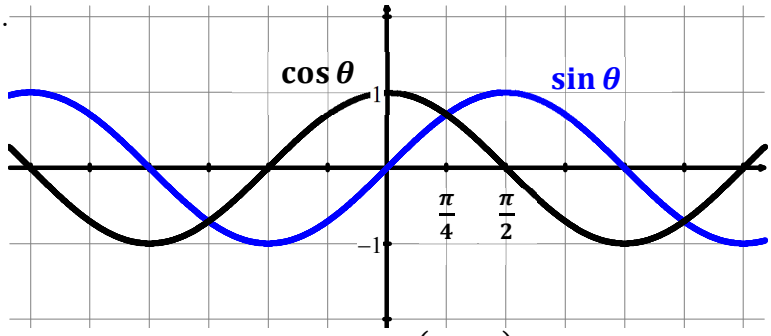
$f(\theta) = \cos\theta$ is an _____ function. It has reflective symmetry over the _____.

$f(\theta) = \sin\theta$



$f(\theta) = \sin\theta$ is an _____ function. It has rotational symmetry about the _____.

$\cos\theta$ is a transformation of $\sin\theta$. If you look at the graphs, we can shift $\sin\theta$ by $\frac{\pi}{2}$ to the left, and it will match up with $\cos\theta$.



$$\cos\theta = \sin\left(\theta + \frac{\pi}{2}\right)$$

Standard equations: $y = a\cos\theta$ $y = a\sin\theta$

Amplitude: ____ Half the difference between the maximum and minimum values.

Midline: A horizontal line halfway between the maximum and minimum values. It is determined by finding the average of the maximum and minimum values. The concavity of the sinusoid will change when it crosses the midline. For $y = a\cos\theta$ and $y = a\sin\theta$ the midline is _____.

Period (cycle): ____ The reciprocal of frequency. The change in θ values required for the function to complete one full cycle.

Frequency: ____ The reciprocal of period. The number of cycles the graph completes per one radian. For these functions the frequency is approximately 0.159 cycles per radian.

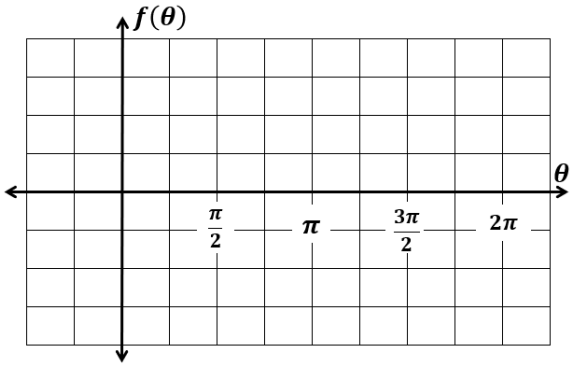
Write your questions and thoughts here!

Graph the following sinusoid functions.

1. $f(\theta) = 3\sin\theta$

Amp: _____ x-ints: _____

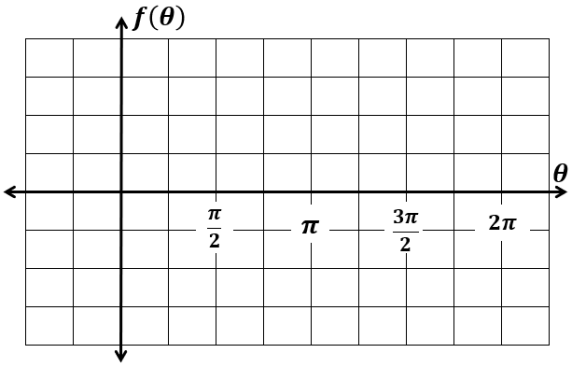
Max value: _____ Min value: _____



2. $f(\theta) = 2\cos(\theta)$

Amp: _____ x-ints: _____

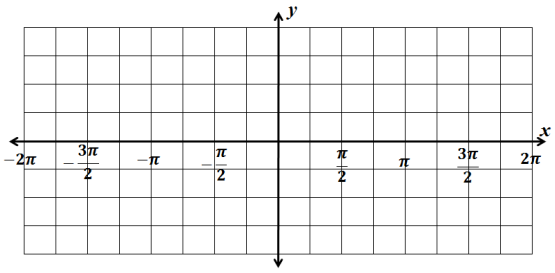
Max value: _____ Min value: _____



3. $y = -2\sin x$

Amp: _____ x-ints: _____

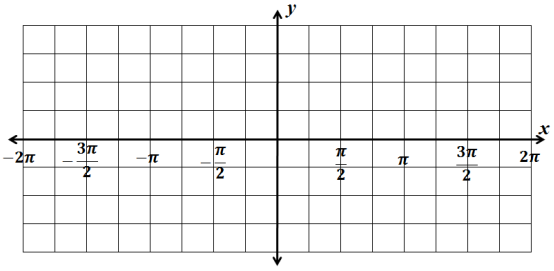
Max value: _____ Min value: _____



4. $y = -4\cos x$

Amp: _____ x-ints: _____

Max value: _____ Min value: _____



For each problem, the sinusoid has been vertically shifted and has the given maximum and minimum values. Write the equation of the midline for the sinusoid AND find the amplitude.

5. Maximum value: 100
   Minimum value: 20

6. Maximum value: 135
   Minimum value: 90

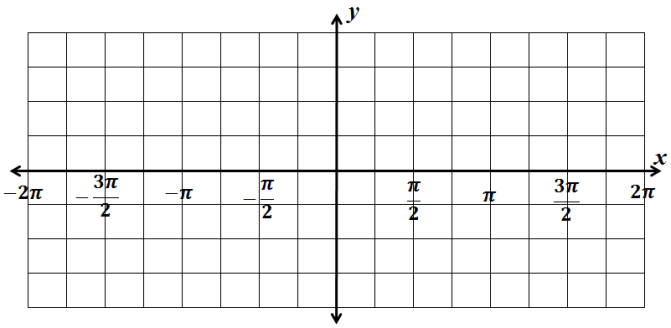
3.5 Sinusoidal Functions

AP Precalculus

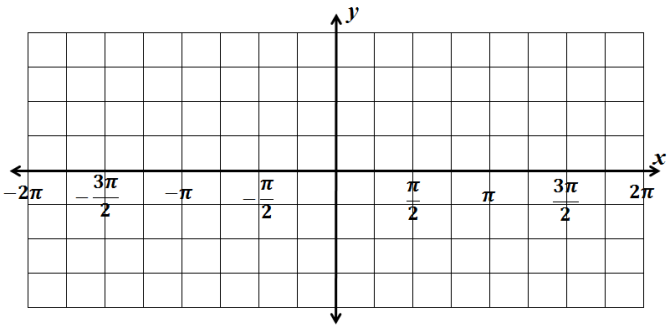
3.5 Practice

Graph the trig function.

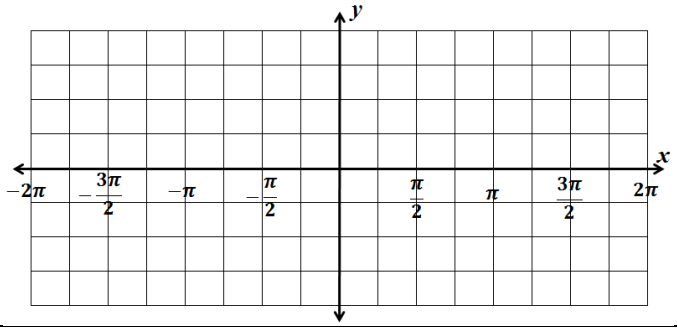
1. $f(\theta) = 3\sin\theta$



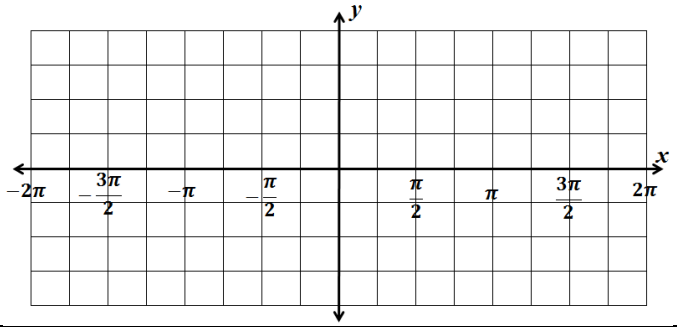
2. $y = -\sin x$



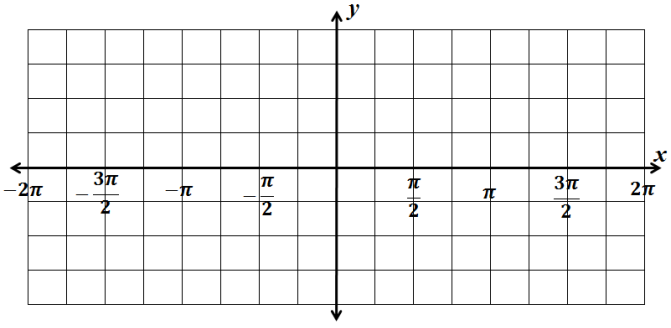
3. $f(\theta) = -2\cos\theta$



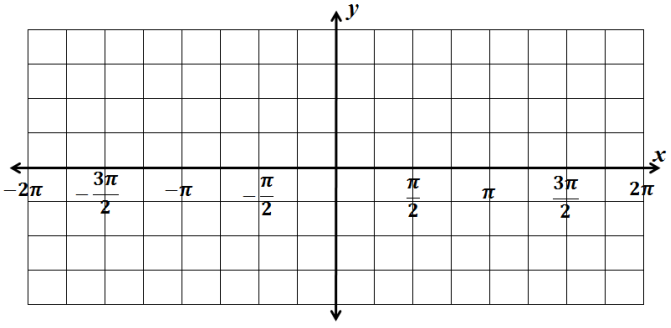
4. $y = -\cos x$



5. $f(\theta) = -2\sin\theta$

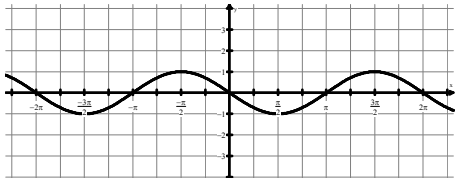


6. $f(t) = 4\cos t$



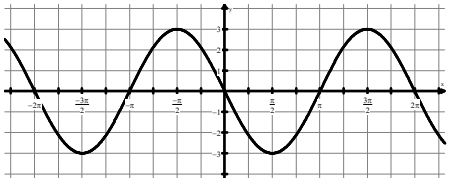
Write the equation of the following *sine* curves.

7.



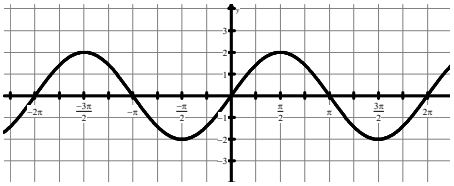
$y =$ _____

8.



$y =$ _____

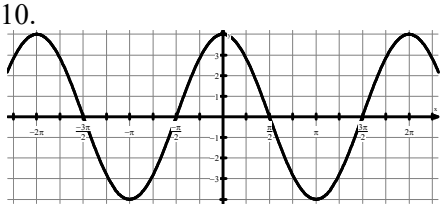
9.



$y =$ _____

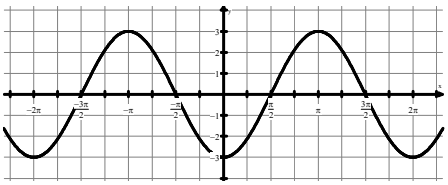
Write the equation of the following *cosine* curves.

10.



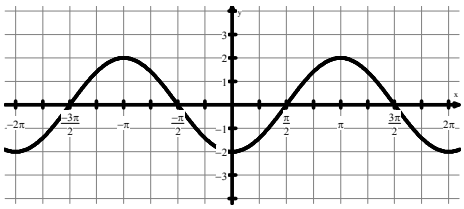
$y =$ _____

11.



$y =$ _____

12.



$y =$ _____

For each problem, the sinusoid has been vertically shifted and has the given maximum and minimum values. Write the equation of the midline for the sinusoid AND find the amplitude.

13. Max value: 40
    Min value: 28

14. Max value: 1.9
    Min value: 0.1

15. Max value: 65
    Min value: 30

16. Max value: 10
    Min value: -6

3.5 Sinusoidal Functions

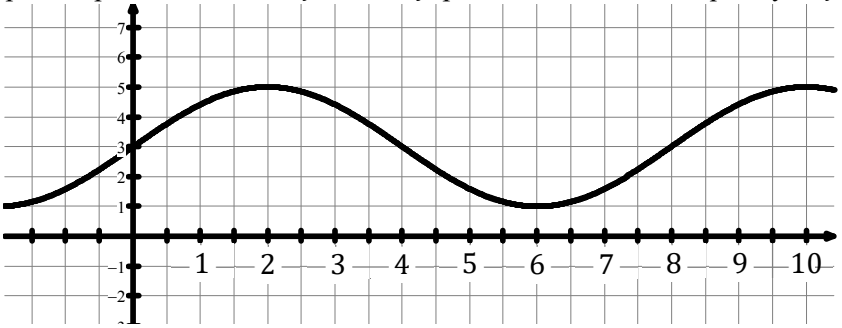
3.5 Test Prep

17. The daily low temperatures of a certain city over a period of time are modeled with a sinusoidal function the xy-plane. The minimum daily low temperature is 24°F, and the maximum daily low temperature is 52°F. Based on these temperatures, which of the following is the best value for the amplitude of the sinusoidal function?

(A) 76 (B) 38 (C) 28 (D) 14

---

18. The figure shows the graph of a periodic function f in the xy-plane. What is the frequency of f?



Graph of f

(A) $\frac{1}{8}$ (B) $\frac{\pi}{8}$ (C) $\frac{\pi}{4}$ (D) 8

19. **Calculator active.** Mr. Brust's patience with his 4th period class seems to have cycles of ups and downs. His patience can be modeled by the function $P(t) = 30\cos(0.15t) + 60$, where t is the number of minutes he has spent with his 4th period class and $P(t)$ is his patience level. A person's patience level is measured as 100 being the most patience anyone can possibly have, and 0 representing no patience. Which of the following best describes the behavior of $P(t)$ on minute 30?
hint: If you are graphing the function on a calculator, be sure your mode is set to RADIANS and not DEGREES.

(A) The amount of patience is increasing at a decreasing rate.

(B) The amount of patience is decreasing at a decreasing rate.

(C) The amount of patience is increasing at an increasing rate.

(D) The amount of patience is decreasing at an increasing rate.