300 An angle, θ, is in standard position and its terminal side passes through the point $(2,-1)$. Find the *exact* value of $\sin\theta$.

301 Using the identity $\sin^2\theta+\cos^2\theta=1$, find the value of $\tan\theta$, to the *nearest hundredth*, if $\cos\theta$ is -0.7 and θ is in Quadrant II.

302 Given that $\sin^2\theta+\cos^2\theta=1$ and $\sin\theta=-\frac{\sqrt{2}}{5}$, what is a possible value of $\cos\theta$?

1 $\frac{5+\sqrt{2}}{5}$

2 $\frac{\sqrt{23}}{5}$

3 $\frac{3\sqrt{3}}{5}$

4 $\frac{\sqrt{35}}{5}$

303 Given $\cos\theta=\frac{7}{25}$, where θ is an angle in standard position terminating in quadrant IV, and $\sin^2\theta+\cos^2\theta=1$, what is the value of $\tan\theta$?

1 $-\frac{24}{25}$

2 $-\frac{24}{7}$

3 $\frac{24}{25}$

4 $\frac{24}{7}$

F.TF.C.8: SIMPLIFYING TRIGONOMETRIC IDENTITIES

304 If $\sin^2(32°)+\cos^2(M)=1$, then M equals

1 32°

2 58°

3 68°

4 72°

F.TF.B.5: MODELING TRIGONOMETRIC FUNCTIONS

305 The voltage used by most households can be modeled by a sine function. The maximum voltage is 120 volts, and there are 60 cycles *every second*. Which equation best represents the value of the voltage as it flows through the electric wires, where t is time in seconds?

1 $V=120\sin(t)$

2 $V=120\sin(60t)$

3 $V=120\sin(60\pi t)$

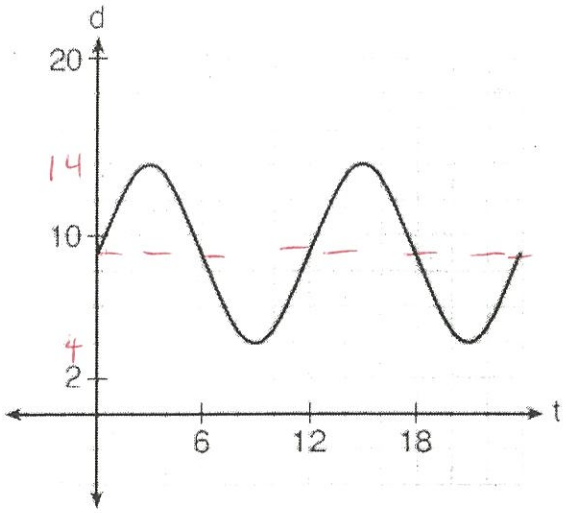
4 $V=120\sin(120\pi t)$

$F=\frac{2\pi}{P}$

$=\frac{2\pi}{\frac{1}{60}}$

$2\pi\cdot 60$

306 The depth of the water at a marker 20 feet from the shore in a bay is depicted in the graph below.



If the depth, d, is measured in feet and time, t, is measured in hours since midnight, what is an equation for the depth of the water at the marker?

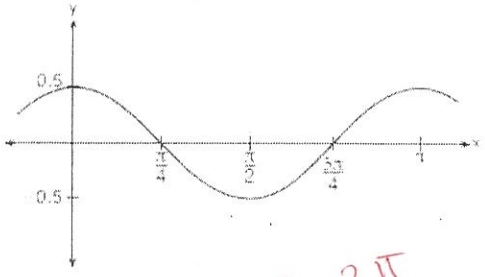
1 $d = 5\cos\left(\frac{\pi}{6}t\right) + 9$

2 $d = 9\cos\left(\frac{\pi}{6}t\right) + 5$

3 $d = 9\sin\left(\frac{\pi}{6}t\right) + 5$

4 $d = 5\sin\left(\frac{\pi}{6}t\right) + 9$

307 Which equation is represented by the graph shown below?



1 $y = \frac{1}{2}\cos 2x$

2 $y = \cos x$

3 $y = \frac{1}{2}\cos x$

4 $y = 2\cos\frac{1}{2}x$

F.IF.B.4, F.IF.C.7: GRAPHING TRIGONOMETRIC FUNCTIONS

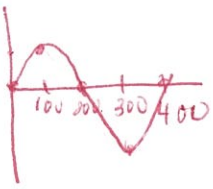
308 The Ferris wheel at the landmark Navy Pier in Chicago takes 7 minutes to make one full rotation. The height, H, in feet, above the ground of one of the six-person cars can be modeled by $H(t) = 70\sin\left(\frac{2\pi}{7}(t - 1.75)\right) + 80$, where t is time, in minutes. Using $H(t)$ for one full rotation, this car's minimum height, in feet, is

1 150
2 70
3 10
4 0

309 A sine function increasing through the origin can be used to model light waves. Violet light has a wavelength of 400 nanometers. Over which interval is the height of the wave *decreasing*, only?

1 (0,200)
2 (100,300)
3 (200,400)
4 (300,400)

Period



310 Relative to the graph of $y = 3\sin x$, what is the shift of the graph of $y = 3\sin\left(x + \frac{\pi}{3}\right)$?

1 $\frac{\pi}{3}$ right
2 $\frac{\pi}{3}$ left
3 $\frac{\pi}{3}$ up
4 $\frac{\pi}{3}$ down

311 Given the parent function $p(x) = \cos x$, which phrase best describes the transformation used to obtain the graph of $g(x) = \cos(x + a) - b$, if a and b are positive constants?

1 right a units, up b units
2 right a units, down b units
3 left a units, up b units
4 left a units, down b units

312 As x increases from 0 to $\frac{\pi}{2}$, the graph of the equation $y = 2\tan x$ will

1 increase from 0 to 2
2 decrease from 0 to −2
3 increase without limit
4 decrease without limit

313 Based on climate data that have been collected in Bar Harbor, Maine, the average monthly temperature, in degrees F, can be modeled by the equation $B(x) = 23.914\sin(0.508x - 2.116) + 55.300$. The same governmental agency collected average monthly temperature data for Phoenix, Arizona, and found the temperatures could be modeled by the equation $P(x) = 20.238\sin(0.525x - 2.148) + 86.729$. Which statement can *not* be concluded based on the average monthly temperature models x months after starting data collection?

1 The average monthly temperature variation is more in Bar Harbor than in Phoenix.
2 The midline average monthly temperature for Bar Harbor is lower than the midline temperature for Phoenix.
3 The maximum average monthly temperature for Bar Harbor is 79° F, to the nearest degree.
4 The minimum average monthly temperature for Phoenix is 20° F, to the nearest degree.

min = 86.729 − 20.238
= 66.491

314 The height, $h(t)$ in cm, of a piston, is given by the equation $h(t) = 12\cos\left(\frac{\pi}{3}t\right) + 8$, where t represents the number of seconds since the measurements began. Determine the average rate of change, in cm/sec, of the piston's height on the interval $1 \le t \le 2$. At what value(s) of t, to the *nearest tenth of a second*, does $h(t) = 0$ in the interval $1 \le t \le 5$? Justify your answer.

a) (1, 14) (2, 2)

$\frac{2-14}{2-1} = \frac{-12}{1} = -12$ cm/sec

b) Graph, 2nd Trace #2 zero
t = 2.2 t = 3.8

315 Which function's graph has a period of 8 and reaches a maximum height of 1 if at least one full period is graphed?

1 $y = -4\cos\left(\frac{\pi}{4}x\right) - 3$

2 $y = -4\cos\left(\frac{\pi}{4}x\right) + 5$

3 $y = -4\cos(8x) - 3$

4 $y = -4\cos(8x) + 5$

max: $-3+4=1$
$P = \frac{2\pi}{\frac{\pi}{4}} = 2\pi \cdot \frac{4}{\pi} = 8$
max: $5+4=9$
max: $-3+4=1$
$P = \frac{2\pi}{8} = \frac{\pi}{4}$
max: $5+4=9$

316 Which statement is *incorrect* for the graph of the function $y = -3\cos\left[\frac{\pi}{3}(x-4)\right] + 7$?

1 The period is 6.
2 The amplitude is 3.
3 The range is [4,10].
4 The midline is $y = -4$.

317 The height above ground for a person riding a Ferris wheel after t seconds is modeled by $h(t) = 150\sin\left(\frac{\pi}{45}t + 67.5\right) + 160$ feet. How many seconds does it take to go from the bottom of the wheel to the top of the wheel?

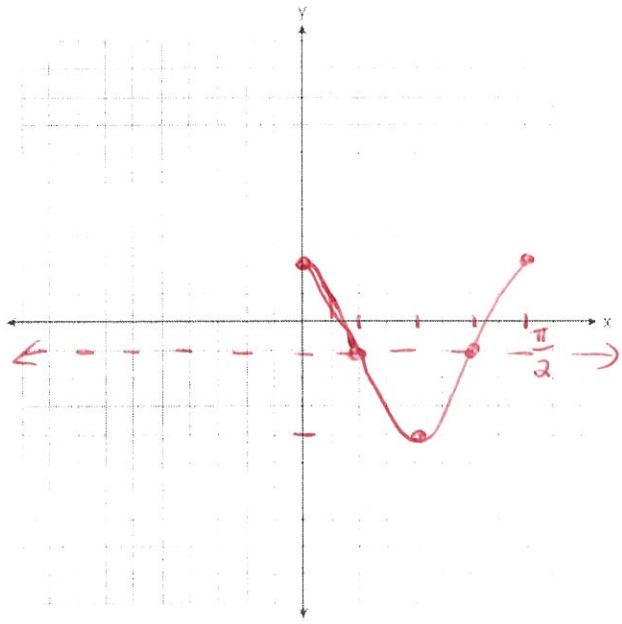
1 10
2 45
3 90
4 150

min → max
$\frac{1}{2}$ Period

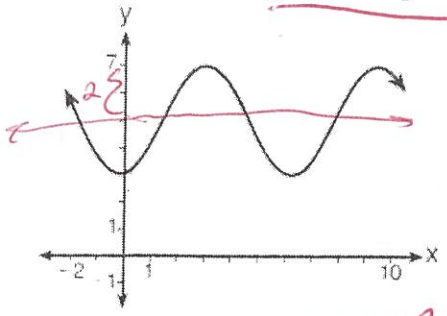
$P = \frac{2\pi}{\frac{\pi}{45}} = 2\pi \cdot \frac{45}{\pi} = 90$
$\frac{1}{2}(90) = 45$

318 The volume of air in a person's lungs, as the person breathes in and out, can be modeled by a sine graph. A scientist is studying the differences in this volume for people at rest compared to people told to take a deep breath. When examining the graphs, should the scientist focus on the amplitude, period, or midline? Explain your choice.

319 On the axes below, graph *one* cycle of a cosine function with amplitude 3, period $\frac{\pi}{2}$, midline $y = -1$, and passing through the point (0,2).



320 Which sinusoid has the greatest amplitude?



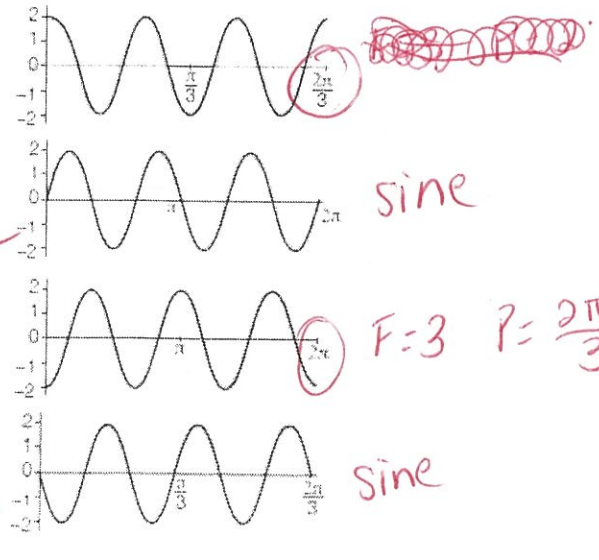
1

2 $y = 3\sin(\theta - 3) + 5$

3

4 $y = -5\sin(\theta - 1) - 3$

321 Which graph represents a cosine function with no horizontal shift, an amplitude of 2, and a period of $\frac{2\pi}{3}$?



1

2

3

4

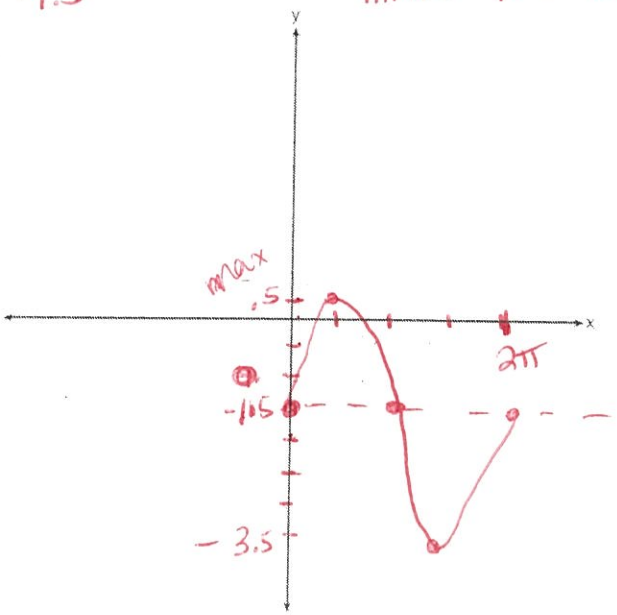
322 The ocean tides near Carter Beach follow a repeating pattern over time, with the amount of time between each low and high tide remaining relatively constant. On a certain day, low tide occurred at 8:30 a.m. and high tide occurred at 3:00 p.m. At high tide, the water level was 12 inches above the average local sea level; at low tide it was 12 inches below the average local sea level. Assume that high tide and low tide are the maximum and minimum water levels each day, respectively. Write a cosine function of the form $f(t) = A\cos(Bt)$, where A and B are real numbers, that models the water level, $f(t)$, in inches above or below the average Carter Beach sea level, as a function of the time measured in t hours since 8:30 a.m. On the grid below, graph one cycle of this function.

People who fish in Carter Beach know that a certain species of fish is most plentiful when the water level is increasing. Explain whether you would recommend fishing for this species at 7:30 p.m. or 10:30 p.m. using evidence from the given context.

323 a) On the axes below, sketch *at least one* cycle of a sine curve with an amplitude of 2, a midline at $y = -\frac{3}{2}$, and a period of 2π.

-1.5

max = -1.5+2 = .5
min = -1.5-2 = -3.5



b) Explain any differences between a sketch of $y = 2\sin\left(x - \frac{\pi}{3}\right) - \frac{3}{2}$ and the sketch from part a.

The graph has the equation $y = 2\sin x - \frac{3}{2}$, so the difference is a phase shift to the right $\pi/3$.

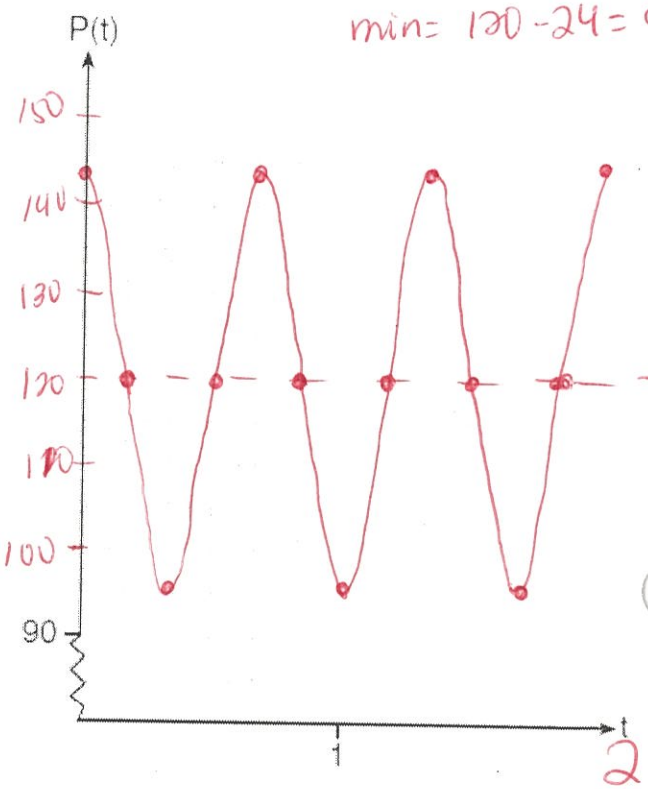
324 The resting blood pressure of an adult patient can be modeled by the function P below, where $P(t)$ is the pressure in millimeters of mercury after time t in seconds.

$$P(t) = 24\cos(3\pi t) + 120$$

$P = \frac{2\pi}{3\pi} = \frac{2}{3}$

On the set of axes below, graph $y = P(t)$ over the domain $0 \le t \le 2$.

max = 120+24 = 144
min = 120-24 = 96

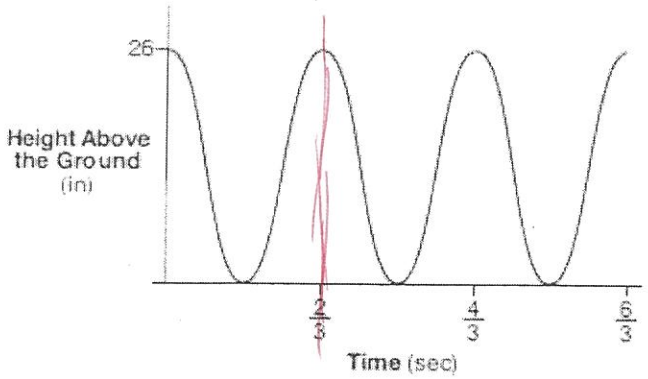


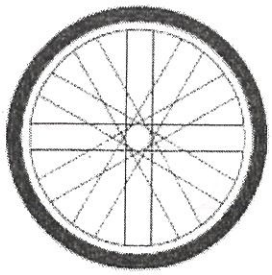
Determine the period of P. Explain what this value represents in the given context. Normal resting blood pressure for an adult is 120 over 80. This means that the blood pressure oscillates between a maximum of 120 and a minimum of 80. Adults with high blood pressure (above 140 over 90) and adults with low blood pressure (below 90 over 60) may be at risk for health disorders. Classify the given patient's blood pressure as low, normal, or high and explain your reasoning.

High = 140/90
Low 90/60

The patient has a max of 144 and a min of 96, so he has high blood pressure.

325 The graph below represents the height above the ground, h, in inches, of a point on a triathlete's bike wheel during a training ride in terms of time, t, in seconds.



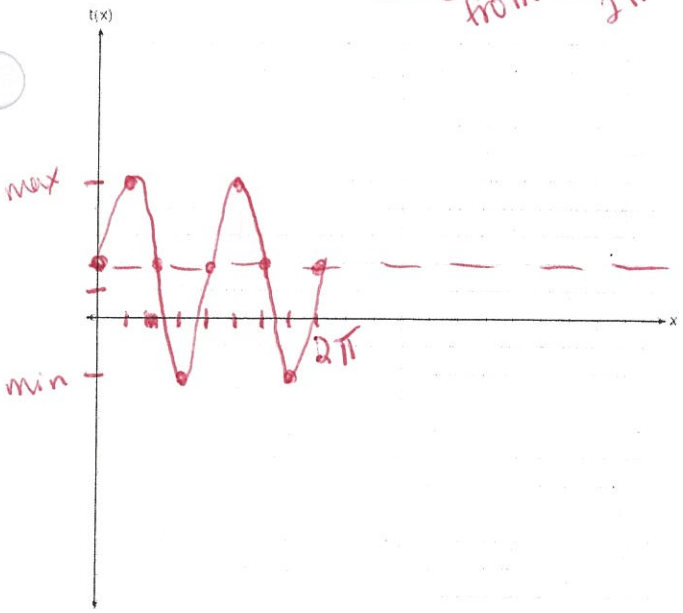


Identify the period of the graph and describe what the period represents in this context.

The period is 2/3. This represents one rotation of the wheel takes 2/3 of a second.

326 Graph $t(x) = 3\sin(2x) + 2$ over the domain $[0, 2\pi]$ on the set of axes below.

2 cycles from 0 to 2π



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

So to 2π there are 2 cycles.

CONICS

G.GPE.A.1: EQUATIONS OF CIRCLES

327 The equation $4x^2 - 24x + 4y^2 + 72y = 76$ is equivalent to

1 $4(x-3)^2 + 4(y+9)^2 = 76$
2 $4(x-3)^2 + 4(y+9)^2 = 121$
3 $4(x-3)^2 + 4(y+9)^2 = 166$
4 $4(x-3)^2 + 4(y+9)^2 = 436$