Name: Key

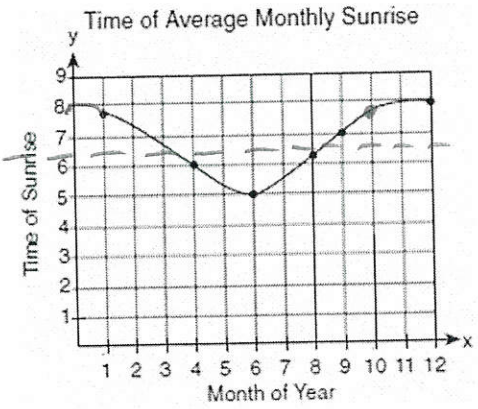
PHASE SHIFTS: Applications of Trig Functions

1) The path traveled by a roller coaster is modeled by the equation $y = 27\sin 13x + 30$. What is the maximum altitude of the roller coaster?

a=27 shift 30↑

1) 13 2) 27 3) 30 4) 57

2) The times of average monthly sunrise, as shown in the accompanying diagram, over the course of a 12-month interval can be modeled by the equation $y = A\cos(Bx) + D$. Determine the values of *A*, *B*, and *D*, and explain how you arrived at your values.



$A = amp = \frac{1}{2}|8-5| = \frac{3}{2}$

$B = freq = \frac{2\pi}{12} = \frac{\pi}{6}$

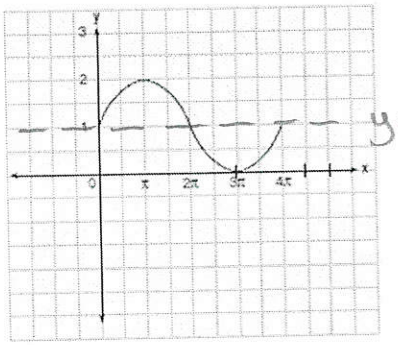
D = vert. shift = 6.5

3) In physics class, Eva noticed the pattern shown in the accompanying diagram on an oscilloscope.

amp = 1

$freq = \frac{2\pi}{per} = \frac{2\pi}{4\pi} = \frac{1}{2}$

VS = 1



y=1 midline

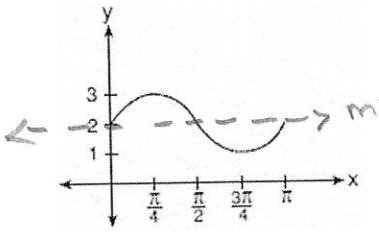
Which equation best represents the pattern shown on this oscilloscope?

1) $y = \sin\left(\frac{1}{2}x\right) + 1$ 2) $y = \sin x + 1$ 3) $y = 2\sin x + 1$ 4) $y = 2\sin\left(-\frac{1}{2}x\right) + 1$

DOUBLE SIDED!

4) The accompanying graph represents a portion of a sound wave.

VS = 2
a = 1
freq = $\frac{2\pi}{\pi} = 2$



midline y=2

y = sin 2x + 2

Which equation best represents this graph?

1) $y = 2\sin\frac{1}{2}x$ 2) $y = \sin\frac{1}{2}x + 2$ 3) $y = \sin 2x$ 4) $y = 2\sin x + 2$

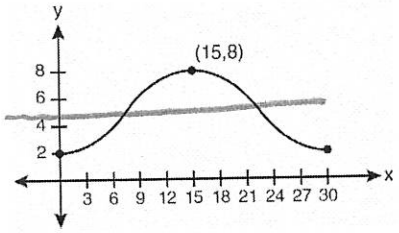
5) Which equation is graphed in the diagram below?

$a = \frac{1}{2}|8-2| = 3$

freq = $\frac{2\pi}{30} = \frac{\pi}{15}$

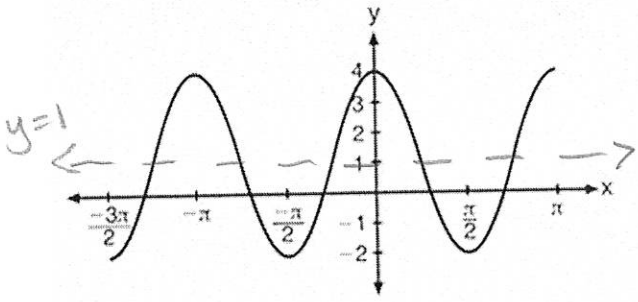
VS = 5

$-3\cos\left(\frac{\pi}{15}\right) + 5$ y=5



1) $y = 3\cos\left(\frac{\pi}{30}x\right) + 8$ 2) $y = 3\cos\left(\frac{\pi}{15}x\right) + 5$ 3) $y = -3\cos\left(\frac{\pi}{30}x\right) + 8$ 4) $y = -3\cos\left(\frac{\pi}{15}x\right) + 5$

6) The periodic graph below can be represented by the trig equation $y = a\cos bx + c$ where *a*, *b*, and *c* are real numbers. State the values for *a*, *b*, and *c*.



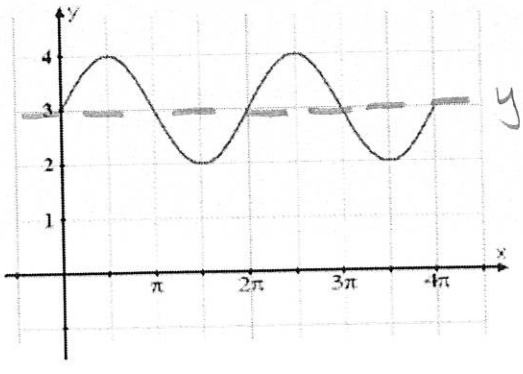
y=1

$a = \frac{1}{2}|4-2| = 3$ = amp

$b = \text{freq} = \frac{2\pi}{\text{per}} = \frac{2\pi}{\pi} = 2$

C = Vert Shift = 1

7) Write the equation of the function shown:



y = 3

VS = 3

a = 1

$b = \text{freq} = \frac{2\pi}{\text{per}} = \frac{2\pi}{2\pi} = 1$

$y = 1\sin x + 3$

)ED!

8) The temperature in an office is controlled by an electronic thermostat. The temperatures vary according to the sinusoidal function $y = 19 + 6\sin(\frac{\pi}{12}(x - 11))$ where y is the temperature in Celsius and x is the time in hours past midnight.

a.) What is the temperature in the office at 9:00 am?

$y(9) = 19 + 6\sin\left(\frac{\pi}{12}(9-11)\right)$

$= 19 + 6\left(-\frac{1}{2}\right) = 16°C$

b.) What are the maximum and minimum temperatures in the office?

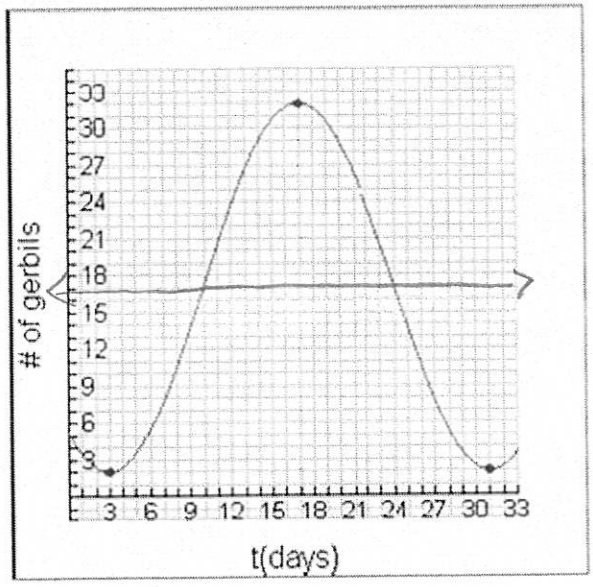
$a = 6$

$VS = 19$

max temp: 25

min temp: 13

9) A pet store clerk noticed that the population in the gerbil habitat varied sinusoidally with respect to time, in days. He carefully collected data and graphed his resulting equation. From the graph, determine the amplitude, period, horizontal shift, and vertical shift. Write the equation of the function.



$amp = a = \frac{1}{2}|32-2| = 15$

$per = 31 - 3 = 28$

HS: Right 3

VS: 17

$y = -15\cos\left(\frac{\pi}{14}x - 3\right) + 17$

$\frac{32+2}{2} = 17$

$freq = \frac{2\pi}{per} = \frac{2\pi}{28} = \frac{\pi}{14}$

DOUBLE SIDED!

10) Given the following equations, determine the amplitude, period, horizontal shift, and vertical shift of each. Determine if the two equations are equivalent.

A.) $y = 2\sin\left(\frac{\pi}{3}(x-2)\right) - 4$

amp = a = 2

per = $\frac{2\pi}{\text{freq}} = \frac{2\pi}{\pi/3} = 2\pi \cdot \frac{3}{\pi} = 6$

HS: Right 2

VS: Down 4

B.) $y = -4 + 2\cos(\frac{\pi}{3}(x-3.5))$

amp = a = 2

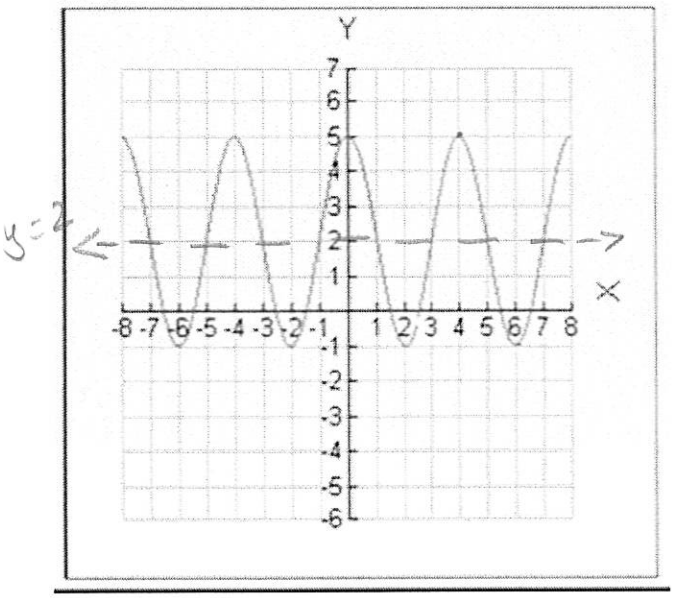
per = $\frac{2\pi}{\text{freq}} = \frac{2\pi}{\pi/3} = 6$

HS: Right 3.5

VS: down 4

Yes these functions are equivalent

11) Write both a ~~sine~~ and a cosine equation for the following function:



a = amp = $\frac{1}{2}|5 - -1| = 3$

per = 4

freq = $\frac{2\pi}{4} = \frac{\pi}{2}$

VS = 2

$y = 3\cos\left(\frac{\pi}{2}\right) + 2$

DOUBLE SIDED!