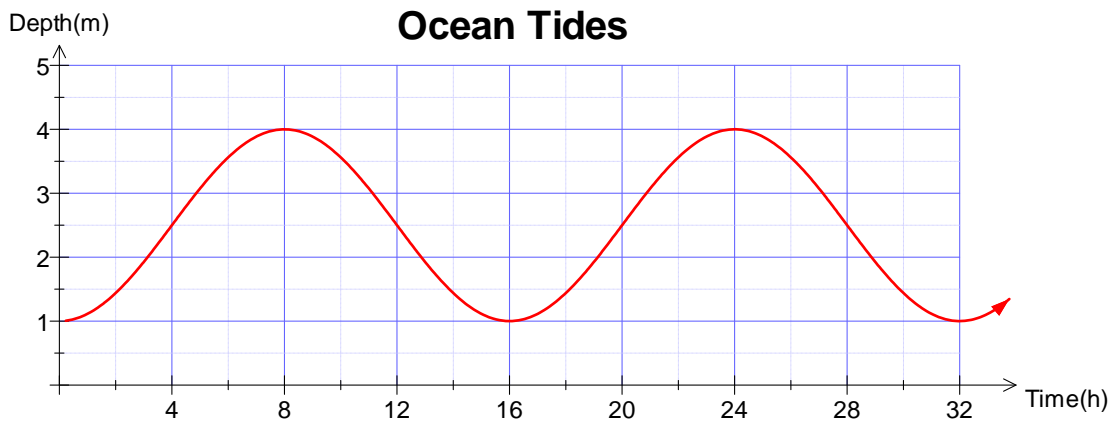


Part I Multiple Choice Questions (10 marks)

John recorded the water depth at the end of his wharf over 32 hours. The following graph shows his data. Answer questions 1 – 4 using this graph.



- What is the equation of the sinusoidal axis?
 - $x = 8$
 - $y = 1$
 - $y = 3$
 - $y = 2.5$
- What is the period of the sinusoidal function graphed above?
 - 16 h
 - 24 h
 - 32 h
 - 3 m
- What is the amplitude of the sinusoidal function graphed above?
 - 3 m
 - 1.5 m
 - 4 m
 - 2.5 m
- What is the horizontal translation for this graph for the cosine function?
 - 4
 - 8
 - 16
 - 20
- What is the mapping rule for $-\frac{1}{2}y - 3 = \sin\left[\frac{3}{4}(x + 45^\circ)\right]$?
 - $x, y \rightarrow \left(\frac{4}{3}x - 45^\circ, -2y + 3\right)$
 - $x, y \rightarrow \left(\frac{4}{3}x + 45^\circ, -2y - 3\right)$
 - $x, y \rightarrow \left(\frac{4}{3}x - 45^\circ, 2y - 3\right)$
 - $x, y \rightarrow \left(-2x - 45^\circ, -\frac{4}{3}y + 3\right)$
- A graph which is a transformation of $y = \sin x$ has a period of 270° . What is the horizontal stretch factor?
 - $\frac{3}{4}$
 - $1.3\bar{3}$
 - 3
 - $\frac{4}{3}$
- What is the amplitude of $\frac{1}{3}y - 5 = \sin\left[\frac{3}{5}(x + 65^\circ)\right]$?
 - 5
 - 3
 - 1.7
 - $\frac{1}{3}$

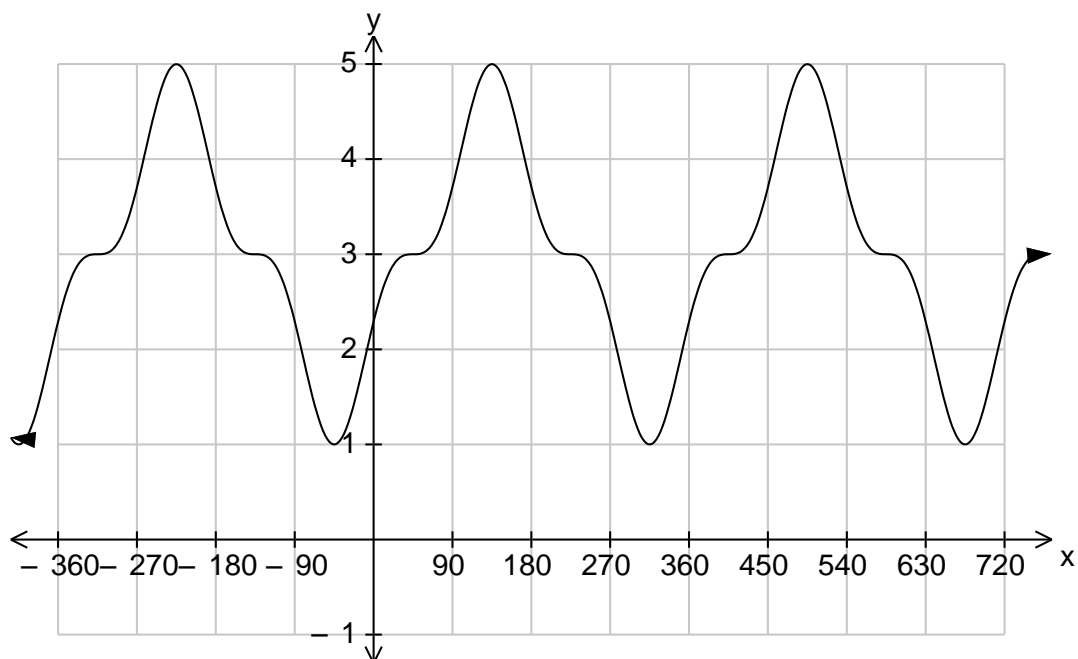
8. The graph of $y = \cos x$ is equivalent to the graph of which equation below?

- A) $y = \sin(x - 60^\circ)$ B) $y = \sin(x + 90^\circ)$
 C) $y = -\sin x$ D) $y = \sin x$

9. What is the period of the graph represented by $\frac{1}{3}y + 3 = \sin\left[\frac{1}{2}x - 90^\circ\right]$?

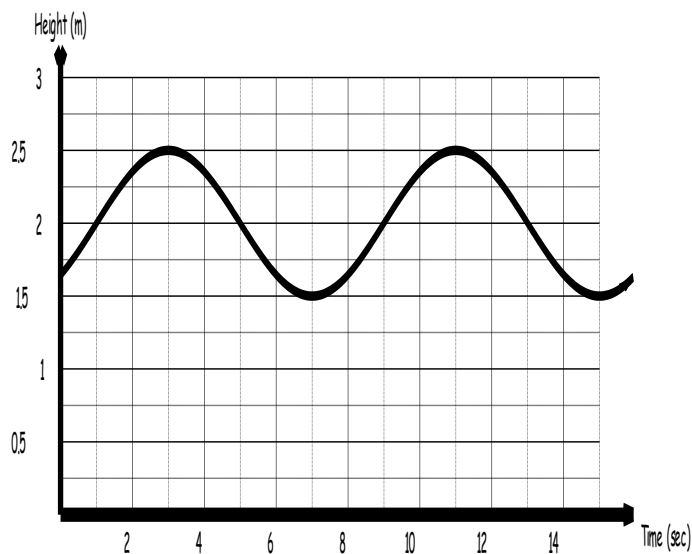
- A) 90° B) 180° C) 360° D) 720°

10. Which of the following statements describes the curve below?



- A) sinusoidal B) both periodic & sinusoidal
 C) neither periodic nor sinusoidal D) Periodic

John is relaxing on an inner tube in the wave pool at the Magic Mountain water park. The following graph shows the relationship between his height above the bottom of the pool with respect to time. Use the graph to help answer the first four questions.



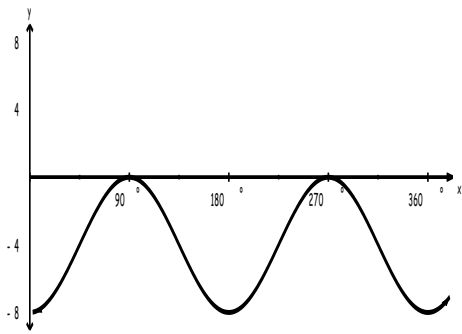
11. What is the equation of the sinusoidal axis?

- A) $t = 2$ B) $h = 2$ C) $h = 2.5$ D) $t = 1.5$

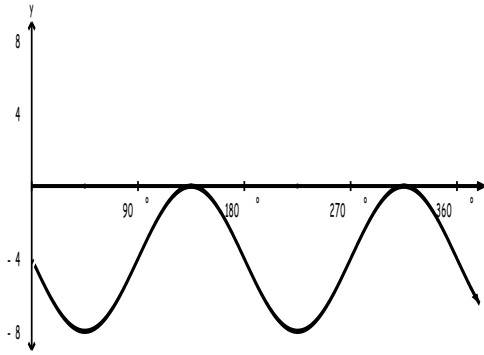
12. What is the period of the sinusoidal function graphed above?
 A) 16 sec B) 12 sec C) 8 sec D) 4 sec
13. What vertical stretch factored would we apply to $y = \sin(x)$ to obtain the above graph?
 A) 0.25 B) 0.5 C) 1.5 D) 2
14. What is the horizontal translation for this graph with respect to the cosine function?
 A) 1 B) 2 C) 3 D) 7
15. What mapping would we use to transform $y = \sin(x)$ to $-4y = \sin\left[\frac{2}{5}x + 30^\circ\right]$?
 A) $x, y \rightarrow \left(\frac{5}{2}x - 30^\circ, -4y\right)$ B) $x, y \rightarrow \left(\frac{5}{2}x - 30^\circ, -\frac{1}{4}y\right)$
 C) $x, y \rightarrow \left(\frac{2}{5}x + 30^\circ, 4y\right)$ D) $x, y \rightarrow \left(-\frac{1}{4}y, \frac{5}{2}x - 30^\circ\right)$
16. The graph of a sinusoidal function has a period of 4 units. As compared to the base graph of $y = \cos(x)$, what horizontal stretch factor would result in this value for the period?
 A) 90 B) 45 C) $\frac{1}{4}$ D) $\frac{1}{90}$
17. What is the amplitude of $y = 4 \cos[45x - 8] + 2$?
 A) 4 B) 45 C) -8 D) 2
18. The graph of $y = \sin x$ is equivalent to the graph of which equation below?
 A) $y = \cos(x - 90^\circ)$ B) $y = \cos(x + 90^\circ)$
 C) $y = -\sin x$ D) $y = -\cos x$
19. Which statement below is true?
 A) All periodic graphs are sinusoidal
 B) No periodic graphs are sinusoidal
 C) If a graph is sinusoidal then it has to be periodic
 D) If a graph is periodic then it has to be sinusoidal

20. Which graph best represents the equation $\frac{1}{4}y + 4 = \cos[2x - 90^\circ]$?

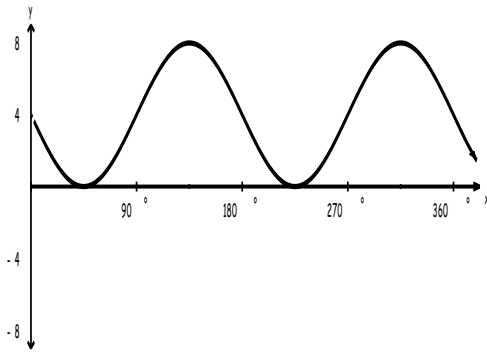
A)



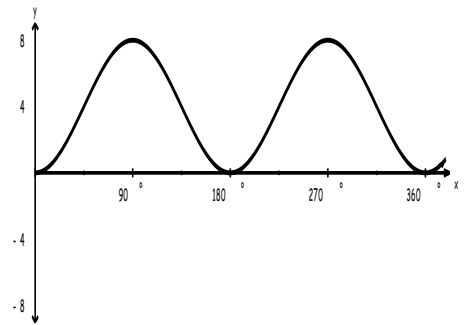
B)



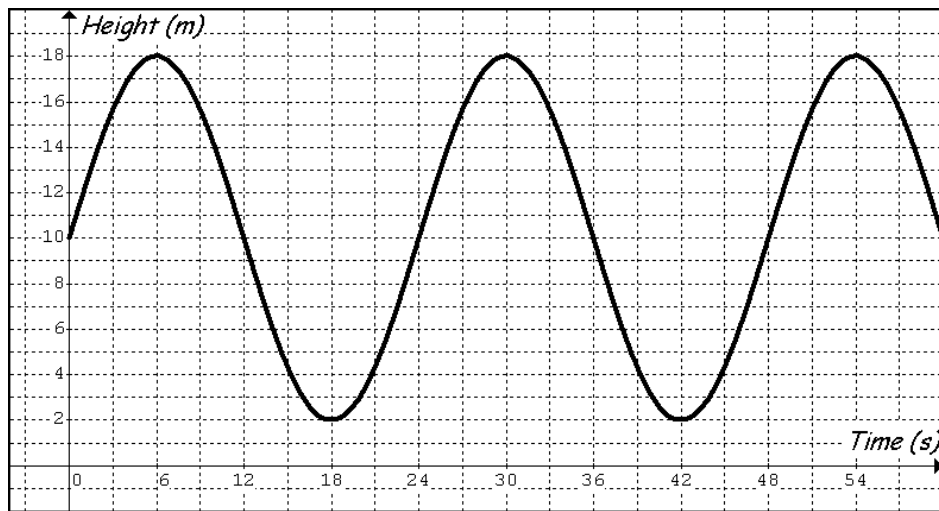
C)



D)



A red flag is attached to one of the propellers on a windmill and its height above the ground is recorded on the graph below. Use the graph to answer questions 1 to 3 below.



21. What is the equation of the sinusoidal axis?

A) $x = 5$

B) $y = 10$

C) $y = 5$

D) $y = \sin(x)$

22. What is the period of the sinusoidal function graphed above?

A) 12 s

B) 24 m

C) 24 s

D) 18 s

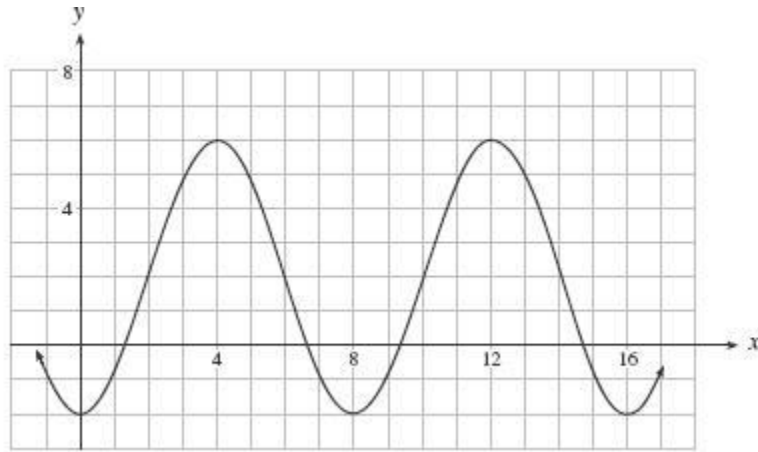
30. What is the period for the graph shown below?

A) 8

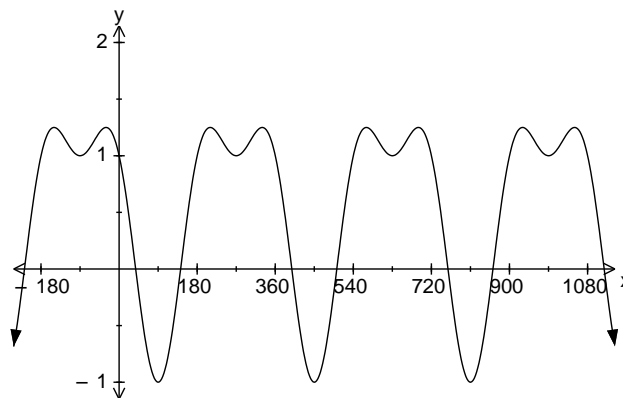
B) 4

C) 6

D) 12



31. Which of the following statements described the graph below?



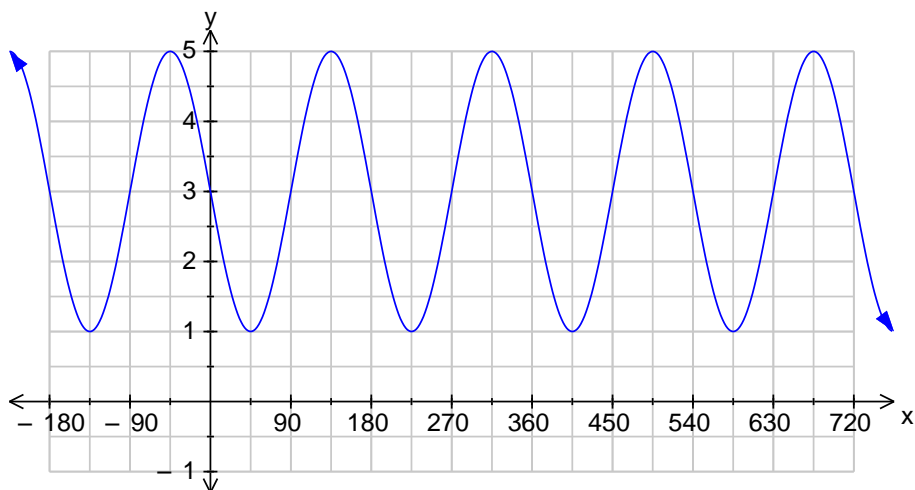
A) sinusoidal

B) periodic

C) periodic and sinusoidal

D) neither periodic nor sinusoidal

32. Which statement gives the horizontal stretch?



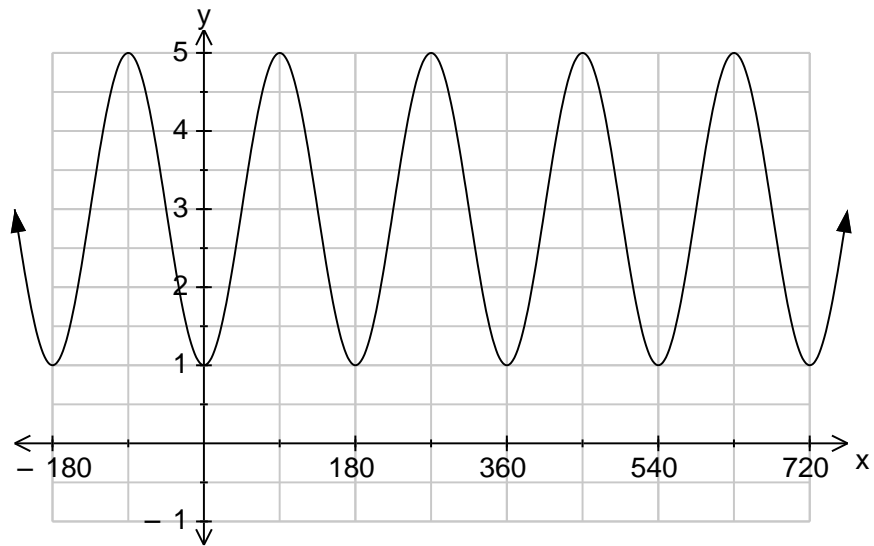
A) $\frac{\max + \min}{2} = \frac{5 + 1}{2} = \frac{6}{2} = 3$

B) $\frac{\max - \min}{2} = \frac{5 - 1}{2} = \frac{4}{2} = 2$

C) $\frac{\text{period}}{360} = \frac{180}{360} = \frac{1}{2}$

D) the x value for a maximum point on the graph gives the horizontal stretch

33. Which of the following equations describes this graph?



A) $\frac{1}{3} y - 3 = \sin 3(x + 90^\circ)$

B) $\frac{1}{2} y - 3 = \sin 2(x - 45^\circ)$

C) $\frac{1}{2} y - 3 = \sin 2(x + 45^\circ)$

D) $\frac{1}{3} y + 3 = \sin 2(x - 90^\circ)$

34. What is the mapping rule for the equation: $-\frac{1}{2} y + 5 = \cos 3(x - 30^\circ)$?

A) $x, y \rightarrow \left(3x + 30, -\frac{1}{2} y - 5 \right)$

B) $x, y \rightarrow \left(3x - 30, -\frac{1}{2} y + 5 \right)$

C) $x, y \rightarrow \left(\frac{1}{3} x + 30, -2y - 5 \right)$

D) $x, y \rightarrow \left(\frac{1}{3} x - 30, -2y + 5 \right)$

35. The horizontal line halfway between the maximum and minimum points defines which of the following?

- A) period
- B) sinusoidal axis
- C) amplitude
- D) phase shift

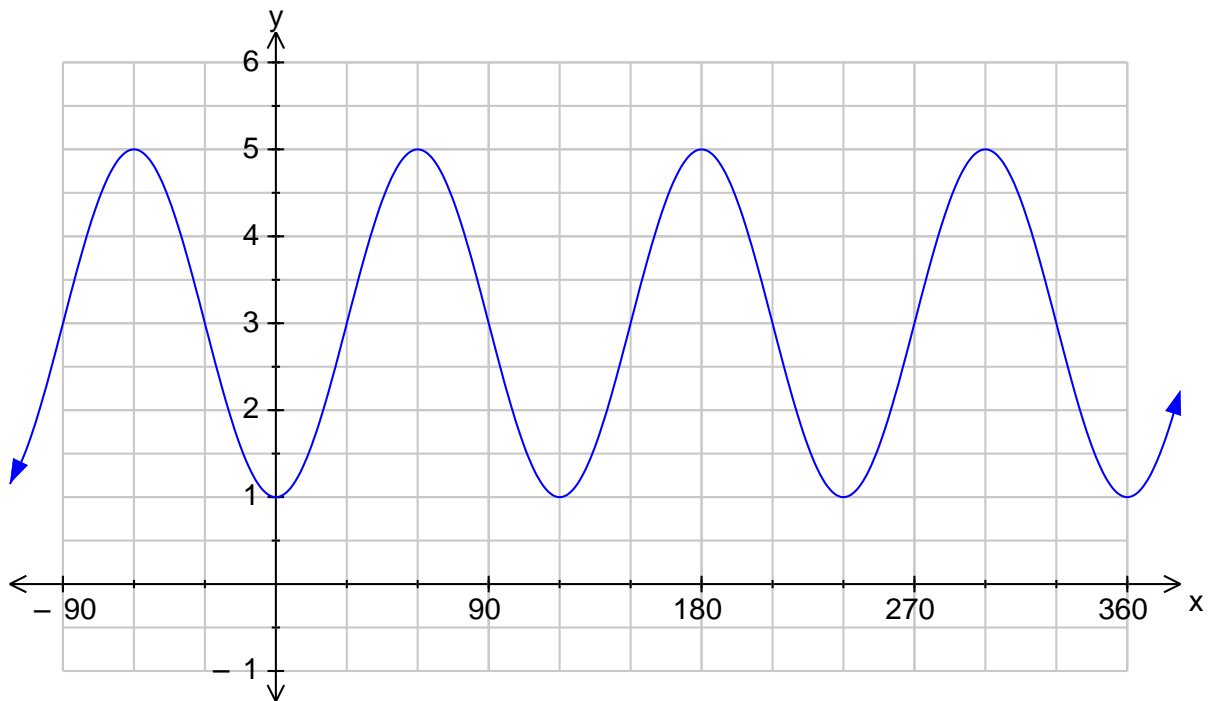
Part II: CONSTRUCTED RESPONSE

Please answer the following questions.

Be sure to read each question carefully and show ALL of your workings.

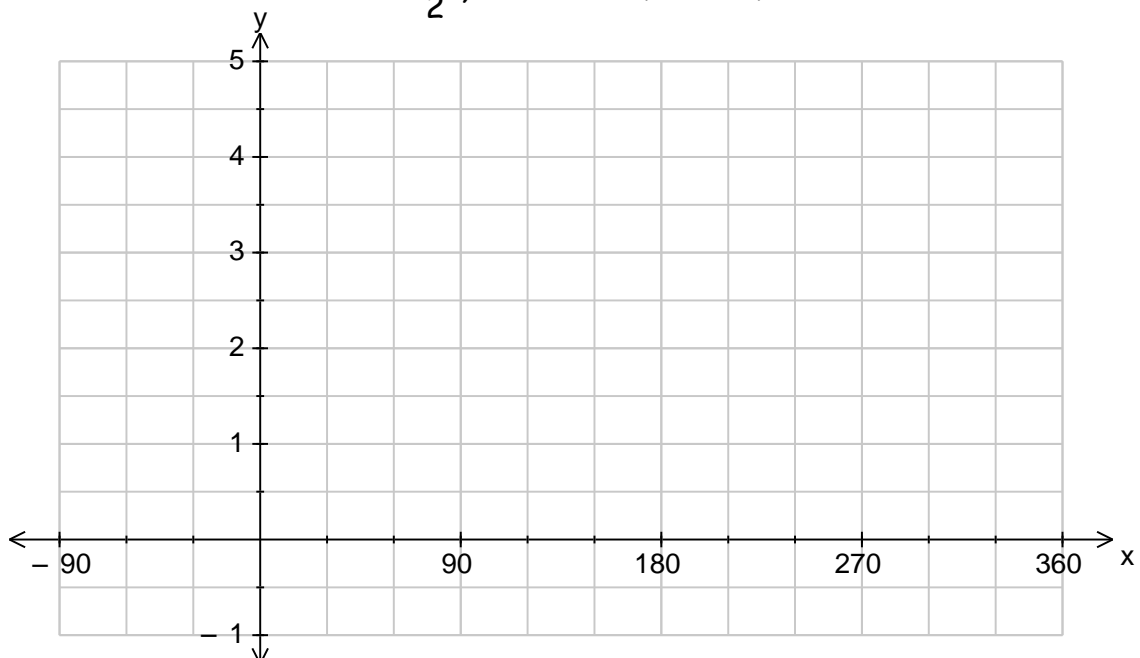
1. For the following graph determine:

- (i) The vertical translation
- (ii) The horizontal translation for sine and cosine
- (iii) The vertical stretch factor
- (iv) The horizontal stretch factor
- (v) The equation of the graph as a sine function
- (vi) The equation of the graph as a cosine function



2. For the following equation sketch the graph using the mapping rule method and state the period, sinusoidal axis, amplitude, and the maximum and minimum values:

$$\frac{1}{2}y - 1 = \sin 3(x - 90^\circ)$$



Sinusoidal Axis is:

Amplitude =

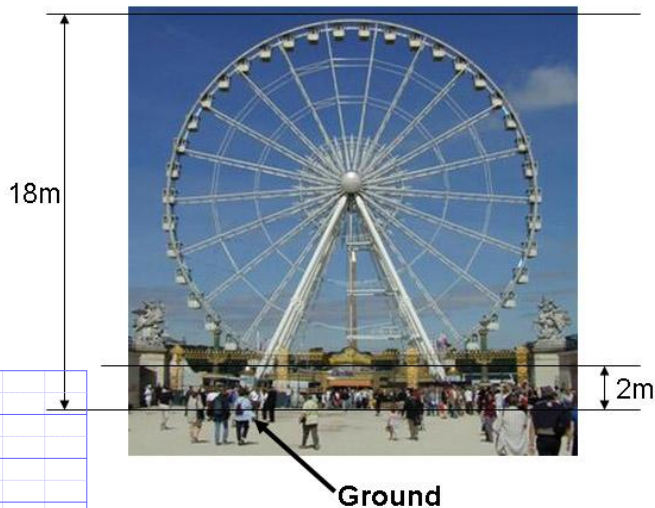
Maximum Value =

Period =

Minimum Value =

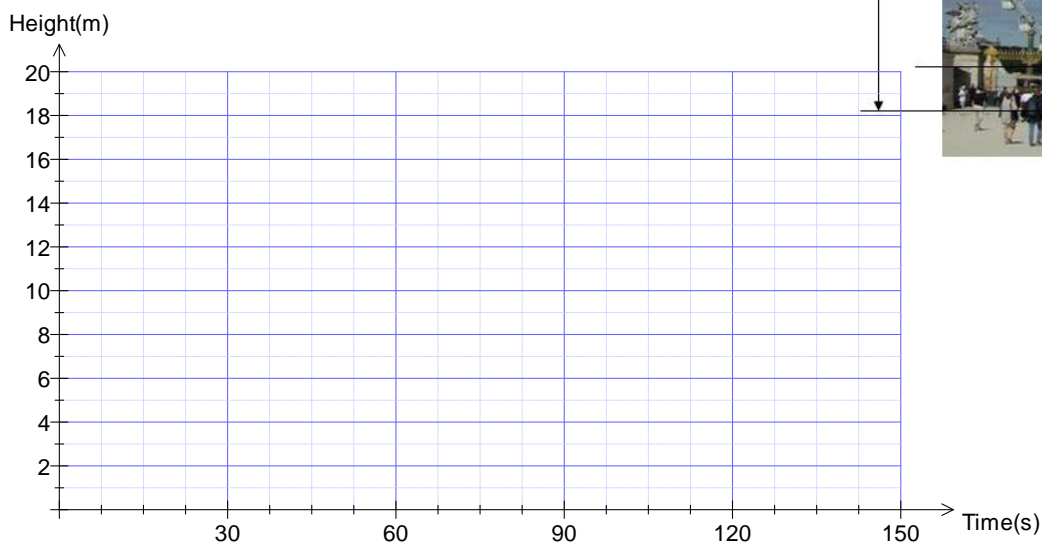
3. Glenda recently visited Bangor, Maine. While there, she rode on a Ferris Wheel which was 18m high. Glenda got on the Ferris Wheel at the lowest point which was 2m above ground. It took her 30s to reach the maximum height.

Ferris Wheel



- A) Construct a graph for the motion of the Ferris Wheel.

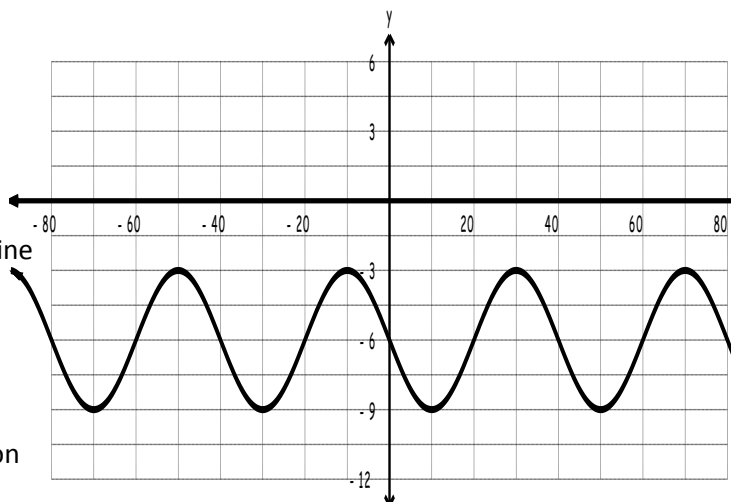
(2 points)



- B) Determine the equation of the graph in a) as a transformation of either $y = \sin x$ or $y = \cos x$.

4. For the following graph determine:

- (i) The vertical translation
- (ii) The horizontal translation for sine and cosine
- (iii) The vertical stretch factor
- (iv) The horizontal stretch factor
- (v) The equation of the graph as a sine function
- (vi) The equation of the graph as a cosine function

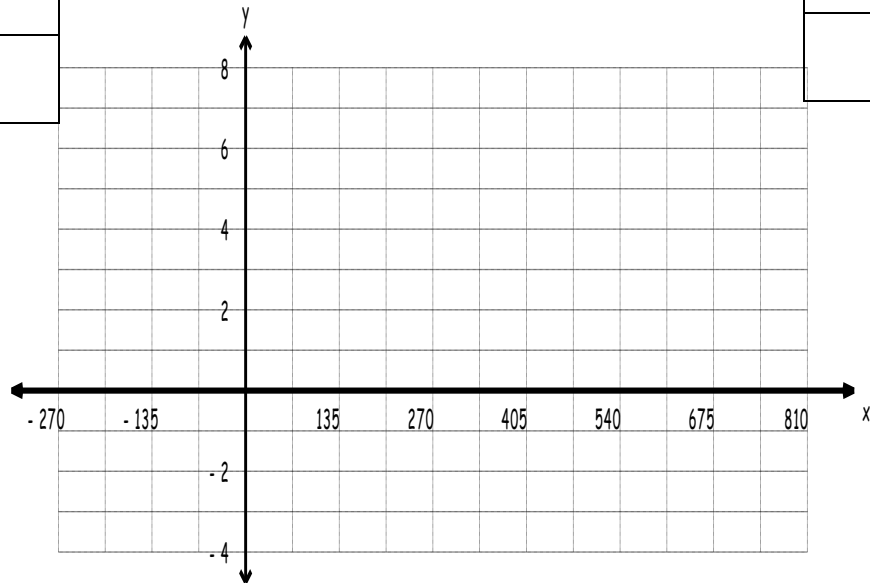


5. A) For the following equation sketch the graph using a mapping rule and the tables provided.

$$\frac{1}{3}y - 2 = \sin\left[\frac{2}{3}x - 270^\circ\right]$$

Base Function	
$y = \sin(x)$	

Transformation of $y = \sin(x)$	



B) For the graph constructed above determine the following.

Sinusoidal Axis:

Amplitude:

Maximum Value:

Minimum Value:

Period:

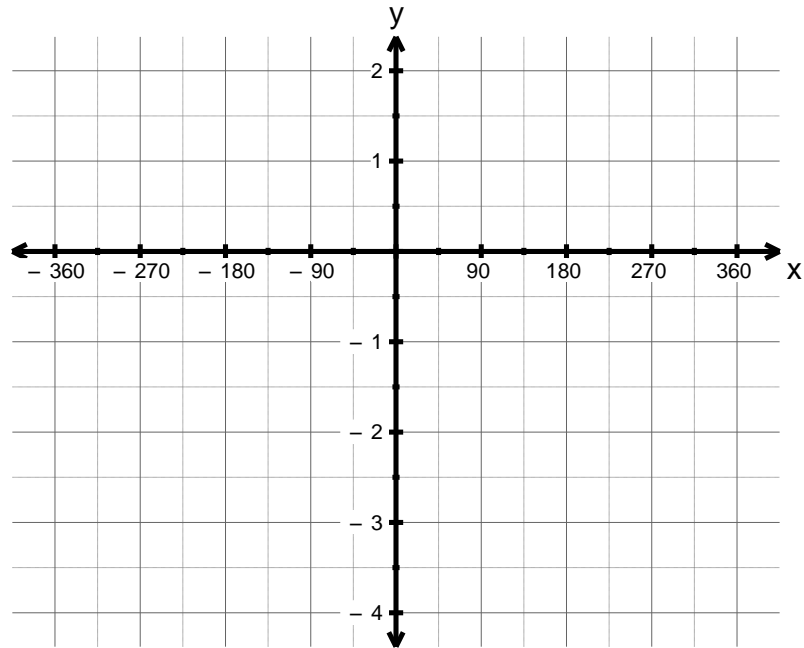
6. For the following equation: $2(y + 2) = \sin[2(x - 45^\circ)]$

a) State the vertical and horizontal stretch factors. (2 marks)

b) State the vertical and horizontal translations. (2 marks)

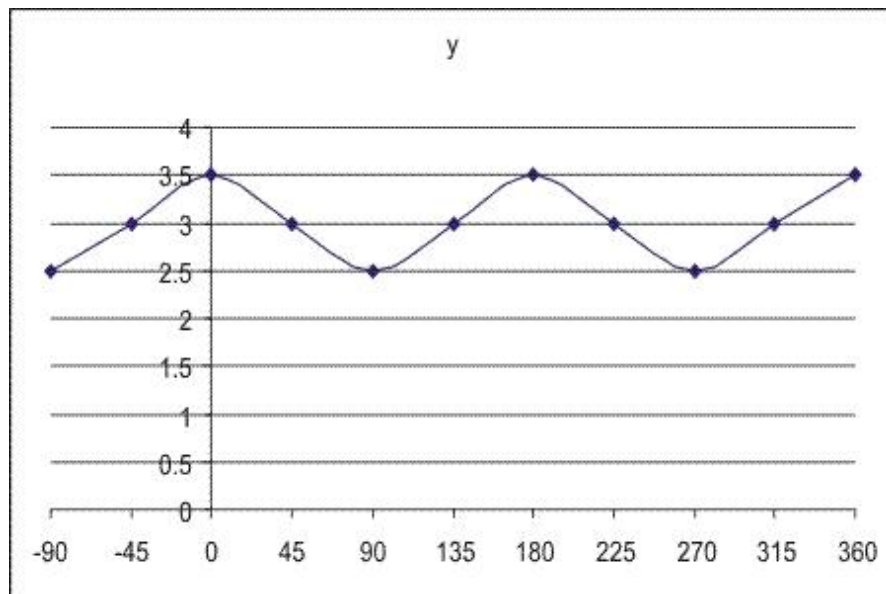
c) State the mapping rule . (1 mark)

d) Draw the graph of the above equation for at least 2 cycles. (2 marks)



7. For the graph below, determine the following:

- The equation of the sinusoidal axis
- The amplitude
- The period
- The horizontal translations (in terms of both sine and cosine)
- An equation, in transformational form, using the sine function
- An equation, in transformational form, using the cosine function



3. A pendulum of a clock constantly swings back and forth. At $t = 2$ seconds, the pendulum swings 10cm to the left (-10cm) and at $t = 4$ seconds the pendulum swings 10cm to the right (+10cm).

Draw a graph for the motion of the pendulum, with time on the horizontal axis.

Determine the equation for the graph in terms of sine **or** cosine.