

Mathematics 30-2
Chapter 8: Sinusoidal Functions Assignment
Total: ____ / 35 Marks

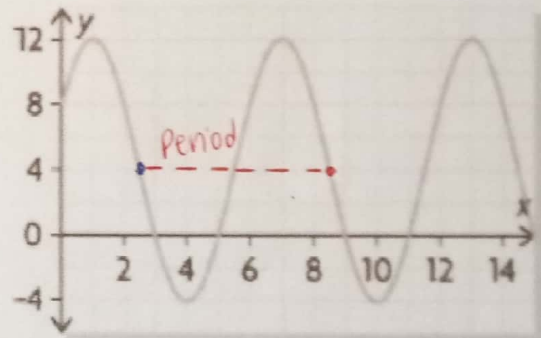
1. Identify the domain of $y = 2 \sin x - 1$. (1 mark)

The domain is:

$$(-\infty, \infty), \{x \mid x \in \mathbb{R}\}$$

2. Determine the period of the following graph. (1 mark)

The period is
6

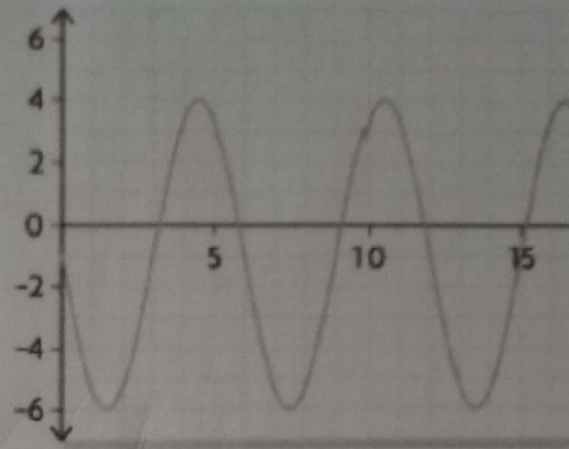


3. Determine the midline of the following graph. (1 mark)

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✓ $y = -1$

The midline is
 $y = -1$



B. $y = 4$

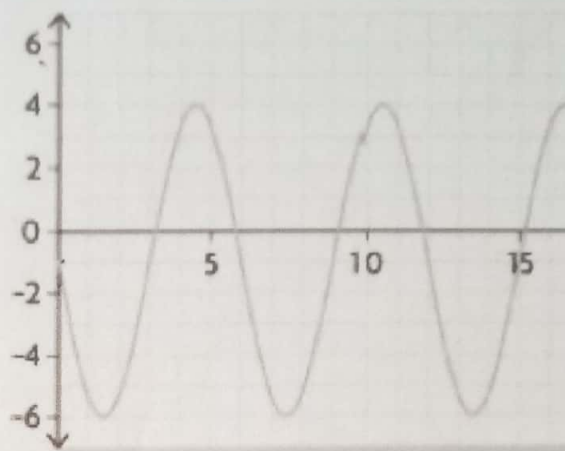
C. $y = 5$

D. $y = 6$

4. Determine the amplitude of the following graph. (1 mark)

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A. -1



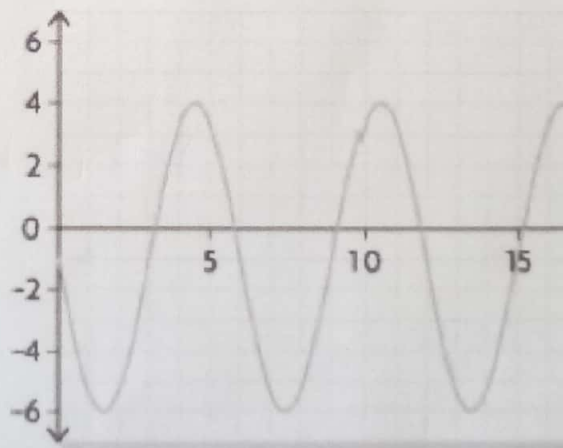
B. 4

✓ C. 5

The amplitude is 5

D. 6

5. Determine the range of the following graph. (1 mark)

A. $x \in \mathbb{R}$ 
~~B. $-6 \leq x \leq 4$~~

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C. $y \in \mathbb{R}$

✓ D. $-6 \leq y \leq 4$

The range is $-6 \leq y \leq 4$

6. A sinusoidal graph has a maximum at the point $(-40, 3)$ and a midline of $y = -12$. Determine the amplitude of the graph. (1 mark)

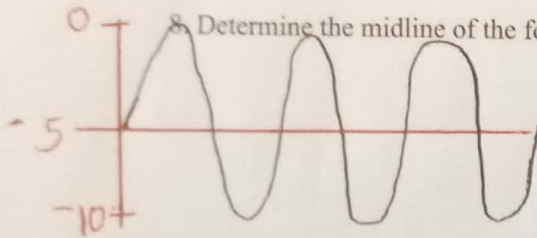
The midline $y = -12$

Therefore, amplitude, $A = 3 - (-12) = 3 + 12 = 15$
 $A = 15$

7. Determine the amplitude of the following function: $y = 10 \cos 4(x - 180^\circ) + 2$. (1 mark)

Amplitude = 10

8. Determine the midline of the following function: $y = 5 \sin 1.5(x + 60^\circ) - 5$. (1 mark)



From the graph;
 midline is $y = -5$

9. Determine the period of the following function: $y = 5 \sin 1.5(x + 60^\circ) - 5$. (1 mark)

Period = 4.7

10. Determine the range of the following function: $y = 5 \sin 1.5(x + 60^\circ) - 5$. (1 mark)

Range is $-10 \leq y \leq 0$

11. A seat's position on a Ferris wheel can be modelled by the function

$$y = 18 \cos 2.8(x + 1.2) + 21$$

where y represents the height in feet and x represents the time in minutes.

a. Determine the diameter of the Ferris wheel. (HINT: The chair will start at the bottom of the Ferris Wheel and go upto the top) (1 mark)

It is in the form $y = a \cos b(x+c) + d$

Amplitude = 18, So diameter = $18 \times 2 = \underline{\underline{36 \text{ feet}}}$.

b. Which parameter(s) of the equation change if the diameter of the Ferris wheel changes to 24 feet.

Explain your answer. (2 marks)

$2 \times \text{amplitude} = 24 \text{ ft}$

$$\text{Amplitude} = \frac{24}{2} = 12 \text{ ft}$$

$$y = 12 \cos 2.8(x + 1.2) + 21$$

If diameter change to 24 feet, then seat will move between a region of height 24 feet.

c. Determine the time that elapses between the two minimum heights. (1 mark)

$$\cos 2.8(t + 1.2) = \cos 2.8(t' + 1.2)$$

$$2.8(t + 1.2) = 2.8(t' + 1.2) + 2n\pi$$

$$2.8(t - t') = 2n\pi$$

$$(t - t') = \frac{2n\pi}{2.8}, n = 1, 2$$

Time elapses;

$$\frac{\pi}{1.4} \text{ seconds}$$

12. The following data set is sinusoidal. Determine the missing value from the table. (HINT: Use the regression equation to find the missing value) (1 mark)

x	0	2	4	6	8	10	12
y	-1	3	-1	3	-1	3	-1

Data set is sinusoidal it repeats everytime
line -1 repeat everytime and so is 3. So the
Missing value is 3.

13. Determine the equation of the sinusoidal function for the data. Round values to the nearest tenth. (1 mark)

x	3	4	5	6	7	8	9	10
y	1.2	2.1	4.3	6.1	6.2	4.7	2.5	1.3

$$y = A \cos(k\theta + c) + h$$

$$A = \frac{6.2 - 1.2}{2} = 2.5$$

$$h = \frac{6.2 + 1.2}{2} = 3.7$$

Equation is;

$$y = 2.5 \sin\left(\frac{\pi}{4}\theta + 7\right) + 3.7$$

14. The height of a mass attached to a spring can be modelled by the sinusoidal function

$$h(t) = 53.5 - 4.2 \cos 23.5t$$

where h represents the height in centimetres and t represents the time in seconds.

- a. What is the height of the mass, to the nearest tenth of a centimetre, after the first minute? (1 mark)

$$h(t) = 53.5 - 4.2 \cos 23.5t$$

$$= 53.5 - 4.2 \cos(23.5 \times 60)$$

$$= 53.5 - 3.6$$

$$49.9 \text{ cm}$$

- b. Calculate, to the nearest tenth of a centimetre, the height of the mass at the moment of release. (1 mark)

At moment of release, $t = 0$

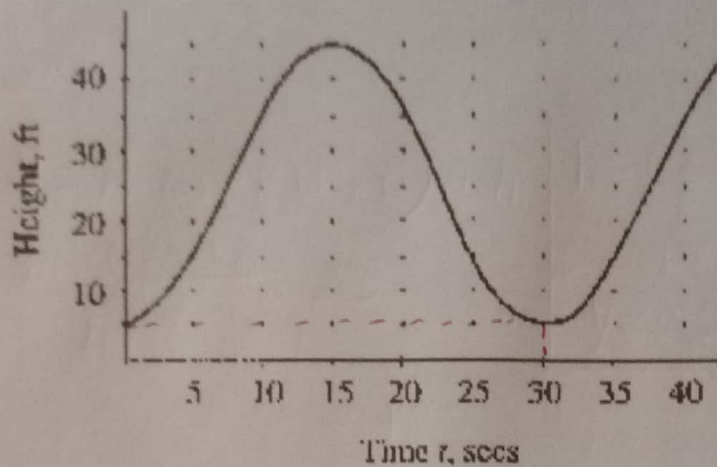
$$h(t) = 53.5 - 4.2 \cos(23.5 \times 0)$$

$$= 53.5 - (4.2 \times 1)$$

$$= 53.5 - 4.2 = 49.3 \text{ cm}$$

15. Brianna's position on a Ferris wheel can be modelled by the graph below, where h represents her height in feet and t represents the time in seconds.

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- a. How much higher is she after 30 s than at the start of the ride? Round your answer to the nearest tenth of a metre. Explain. (1 mark)

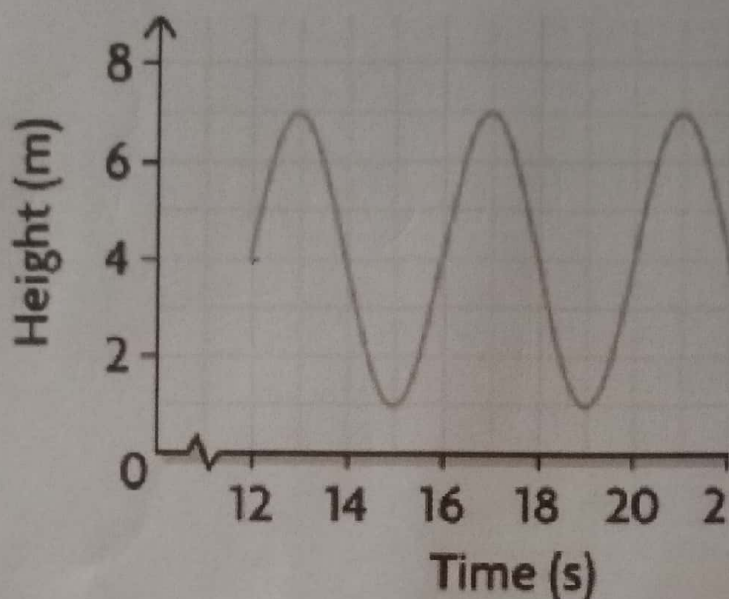
At 30th second, she is at the same height she was at the start of ride i.e 5ft. This is clearly shown in the graph.

- b. What is the maximum height of Brianna above the ground? (1 mark)

The maximum height is 45ft. This is clearly indicated on the graph.

16. Jeremy's gymnastics coach graphs one particular series of jumps. Describe Jeremy's jumps using the graph. Show your work. (2 marks)

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Amplitude: 3

This is the maximum displacement from the midline on either side of the graph.

Period: 4

This is the length of one cycle of the curve.

Midline: $y = 4$

It is the line along which the curve oscillate.

Range: $3 \leq y \leq 7$

17. Sketch a possible graph of a sinusoidal function with the following set of characteristics. Explain your decision. (2 marks)

Domain: $\{x \mid 0 \leq x \leq 4, x \in \mathbb{R}\}$ Range: $\{y \mid 1 \leq y \leq 5, y \in \mathbb{R}\}$

Period: 8

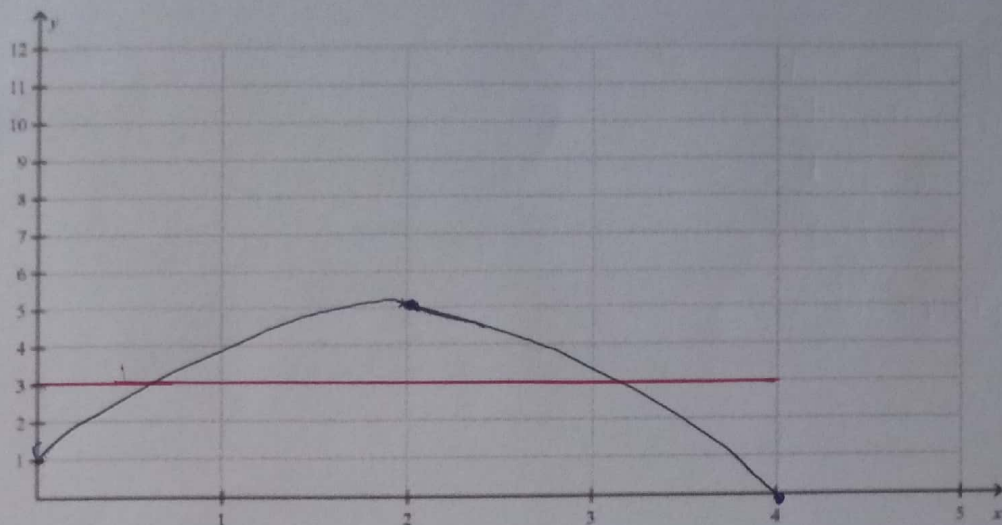
y-intercept: 1

If the domain is $0 \leq x \leq 4$ it means the graph will start at $x=0$ upto $x=4$.

If the range is $1 \leq y \leq 5$, it means the lowest value is at $y=1$ while the maximum is at $y=5$.

The period 8 means the curve covers a distance of 8 in one complete oscillation.

y-intercept of 1 means the curve will cut y-intercept at 1.



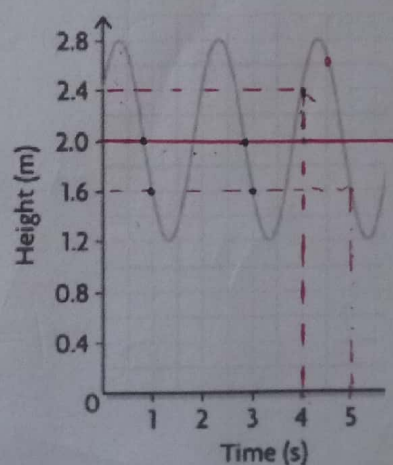
18. Kira is sitting in an inner tube in the wave pool. The depth of the water below her, in terms of time, during a series of waves can be represented by the graph shown.

a) How long does it take for one complete wave to pass?

Show your work. (1 mark) 2

It takes 2 seconds for one complete wave to take place.

2 seconds



b) What is the approximate depth of the water below Kira after 4 s? (1 mark)

After 4 seconds, the approximate depth of water is 2.4 m according to the graph.

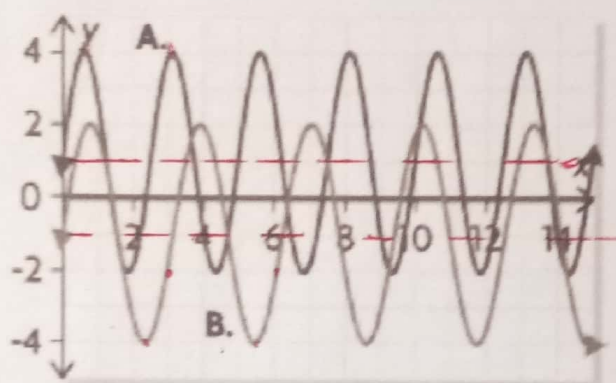
2.4 m

c) What is the depth of the water below Kira at 9 s? Assume that the waves continue at the same rate. Explain your answer. (1 mark)

1.6 m.

This is because 9 second and 5 second are in the same phase.

19. Match each graph with the corresponding equation below. Explain your answers. (2 marks)



i) $y = 2 \cos 2.5(x - 0.8) - 1$

iv) $y = 3 \cos 2.5(x - 0.6) - 1$

ii) $y = 3 \cos 2(x - 0.8) + 1$

~~✓~~ $y = 3 \cos 2.5(x - 0.6) + 1$

iii) $y = 3 \cos 2(x - 0.8) - 1$

vi) $y = 2 \cos 2(x - 0.6) - 1$

Curve A = $y = 3 \cos 2.5(x - 0.6) + 1$

Curve B = $y = 3 \cos 2.5(x - 0.8) - 1$

20. Describe the graph of the function $y = \frac{1}{10} \sin(2x) + 3.5$ by stating the amplitude, equation of its midline, range, and period. Show your work. (2 marks)

Amplitude: 0.1 Midline: $y = 3.5$

Range: $[3.4, 3.6]$ Period: $\frac{2\pi}{2} = \pi$

$y = \frac{1}{10} \sin(2x + 0) + 3.5$

Thus, $a = \frac{1}{10}$, $b = 2$, $c = 0$, $d = 3.5$

$a = \frac{1}{10} = \underline{0.1}$

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

by stating the amplitude, equation of its

Range = $\left[\left(3.5 - \frac{1}{10} \right), \left(3.5 + \frac{1}{10} \right) \right]$
 $= \left[\frac{34}{10}, \frac{36}{10} \right] = [3.4, 3.6]$

The midline is where the vertical shift is ie 3.5

21. A competitive gymnast's coach analyzes one particular series of jumps. These jumps can be modelled

$$h(t) = 11.5 \sin\left(\frac{\pi}{2}t\right) + 9.8$$

by the sinusoidal function

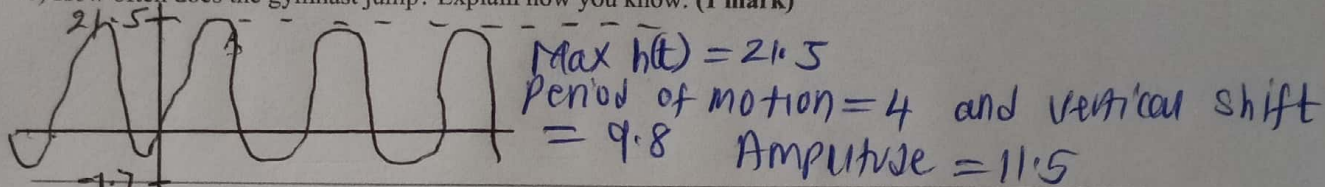
in feet and t represents the time in seconds.

, where h represents the height of the gymnast

- a) What is the maximum height of the gymnast jumps? Explain how you know. (1 mark)

For maximum height, $h'(t) = 0$ | So when $t = 1$, maximum height is given
 $h'(t) = 11.5 \times \frac{\pi}{2} \cos\left(\frac{\pi}{2}t\right) = 0$ | by $h(t) = 11.5 + 9.8 = 21.3$

- b) How often does the gymnast jump? Explain how you know. (1 mark)



22. The following table gives the population of a predator animal over a decade.

Year	1	2	3	4	5	6	7	8	9	10
Population	165	158	174	198	212	216	205	184	162	161

- a) Determine the sinusoidal equation for the data above in the form $y = a \sin(bx + c) + d$, where a , b , c , and d have been rounded to the nearest hundredth. (1 mark)

$$y = -29.5 \sin(0.8x) + 187$$

- b) Use your graph to estimate the population in the 12th year. (1 mark)

$$\Rightarrow y = -29.5 \sin(0.8x) + 187$$

$$y = -29.5 \sin(0.8 \times 12) + 187$$

$$= -29.5 \sin(9.6) + 187$$

$$= -29.5 \times (-0.174) + 187$$

$$y = 5.1426 + 187$$

$$y = 192.14$$

$$\approx 192$$