

- calculators permitted
- if needed, round answers to 1 decimal place

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Part A - Multiple Choice – (10 marks)

1. What is the amplitude of the following sinusoidal function? $f(x) = -4 \cos\left[3\left(x - \frac{\pi}{2}\right)\right] + 2$

- A) 2 B) 3 C) 4 D) $\frac{\pi}{2}$ E) -4 F) None of the above

2. What is the period of the following sinusoidal function? $f(x) = -4 \cos[6(x - 180^\circ)] - 1$

- A) 60° B) 360° C) 720° D) 30° E) 180° F) None of the above

3. What is the axis of the curve of a sinusoidal function with a minimum of -3 and a maximum of 5?

- A) $y = 3$ B) $y = 2$ C) $y = 1$ D) $y = -7$ E) $y = -2$ F) None of the above

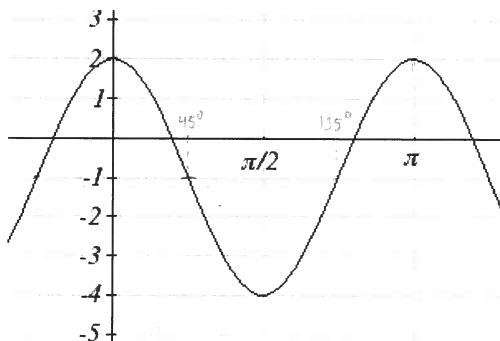
4. What is the phase shift of the following sinusoidal function? $f(x) = 10 \sin(2x - 180^\circ) - 1$

- A) $180^\circ \rightarrow$ B) $180^\circ \leftarrow$ C) $540^\circ \rightarrow$ D) $90^\circ \rightarrow$ E) $360^\circ \rightarrow$ F) None of the above

5. Which equation below could **NOT** represent the following graph?

A) $f(x) = -3 \cos(2x) - 1$ B) $f(x) = -3 \cos\left[2\left(x - \frac{\pi}{2}\right)\right] - 1$ C) $f(x) = -3 \sin\left[2\left(x - \frac{\pi}{4}\right)\right] - 1$

D) $f(x) = 3 \cos[2(x - \pi)] - 1$ E) $f(x) = 3 \sin\left[2\left(x - \frac{3\pi}{4}\right)\right] - 1$



6. What is the range of the following function? $f(x) = -10 \sin(2x - 180^\circ) - 1$

- A) $-10 \leq y \leq 0$ B) $-10 \leq y \leq 10$ C) $-10 \leq y \leq -1$ D) $-10 \leq y \leq 9$ E) $-11 \leq y \leq -1$ F) None of the above

7. What can you do (using transformations) to the graph of $y = \cos x$ to make it the same as the graph of $y = \sin x$?

- A) Horizontal translation 90° left B) Horizontal translation 90° right
 C) Horizontal translation 180° left D) Horizontal translation 180° right
 E) Reflection in the x -axis F) Reflection in the y -axis

8. Using the graph to the right, determine $f(2)$:

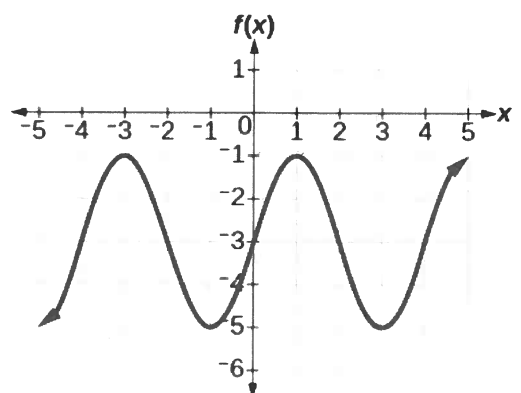
- A) -1 B) -2 C) -3 D) -4 E) -5 F) None of the above

9. Using the graph to the right, determine $f(84)$:

- A) -1 B) -2 C) -3 D) -4 E) -5 F) None of the above

10. Which statement is true?

- A) All periodic functions are sinusoidal functions
 B) All sinusoidal functions are periodic functions
 C) Periodic functions are always smooth, repetitive, oscillating waves

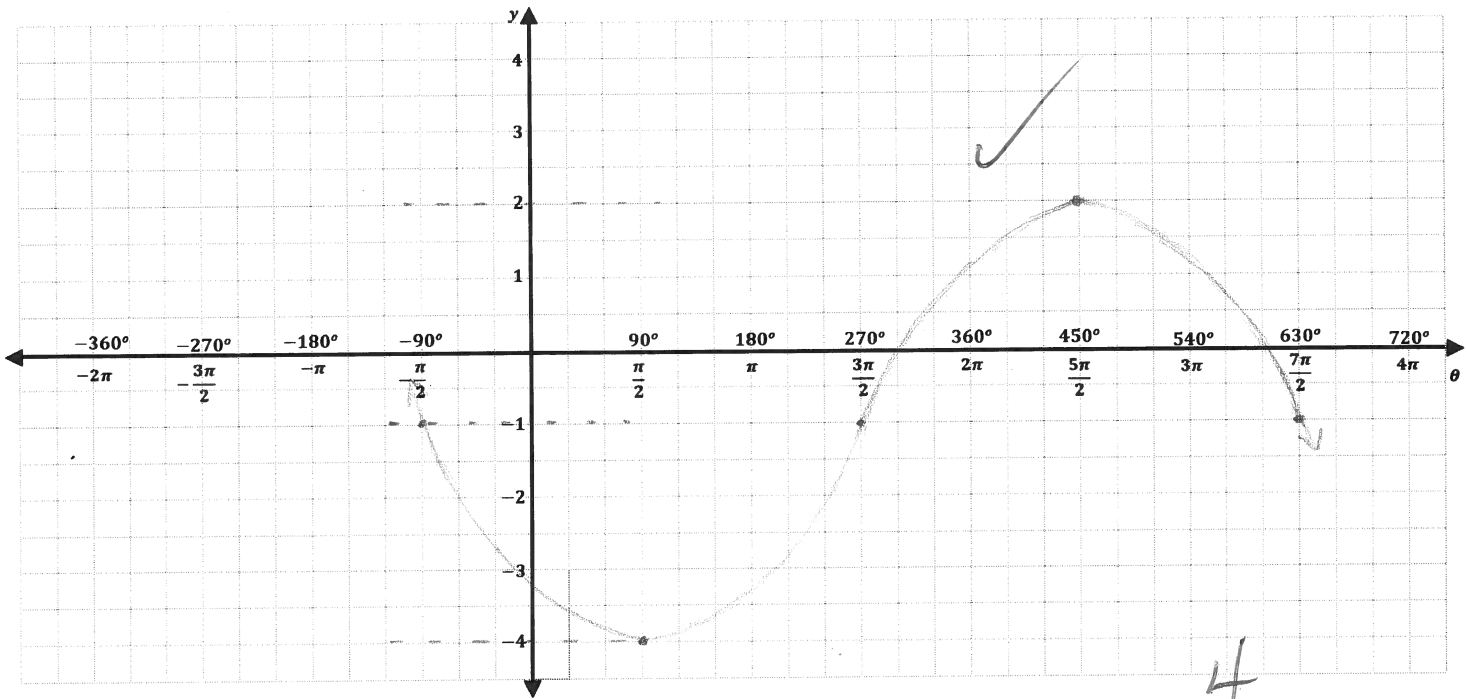


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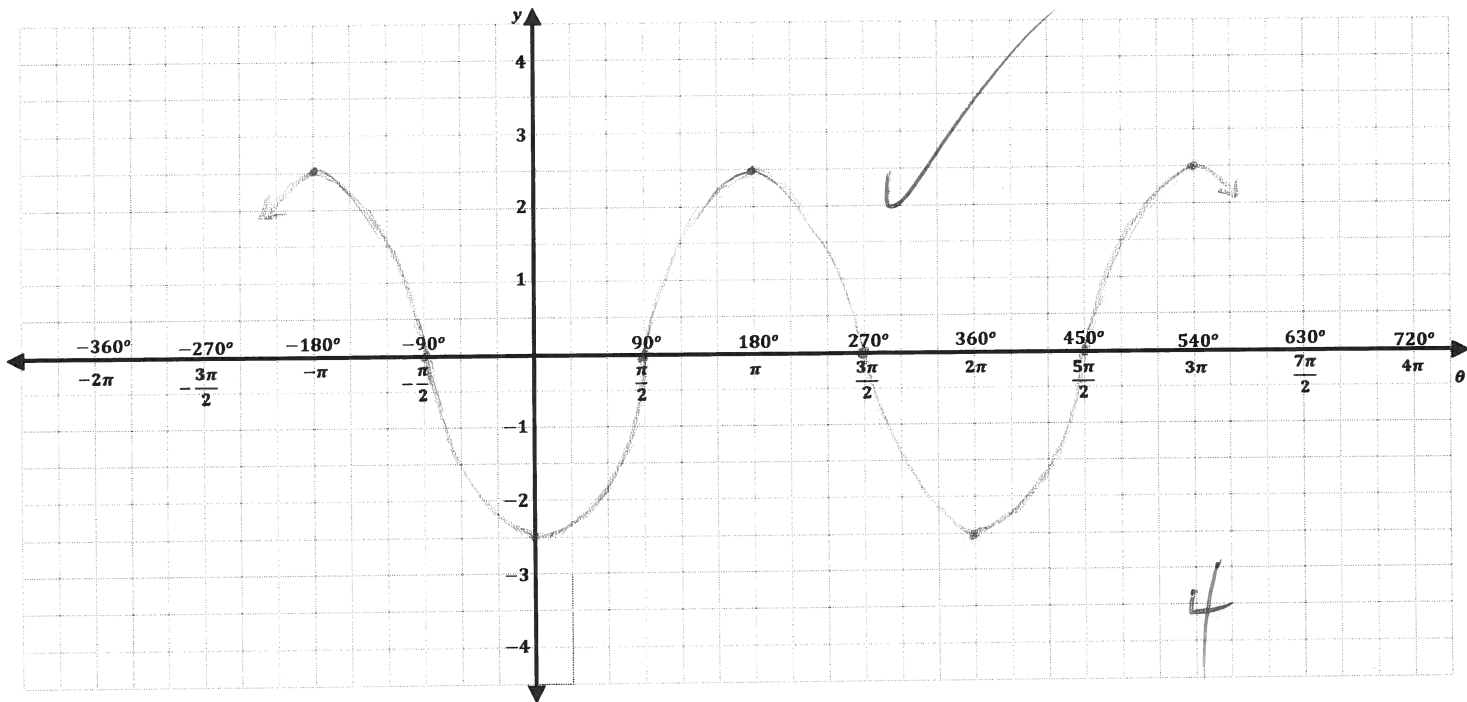
Part B – Sketching – 8 marks

6. a) $f(x) = -3 \sin \left[\frac{1}{2}(\theta + 90^\circ) \right] - 1$ * graph at least one complete cycle

period = 720°



b) $f(x) = 2.5 \cos(x + 180^\circ)$ * graph at least two complete cycles



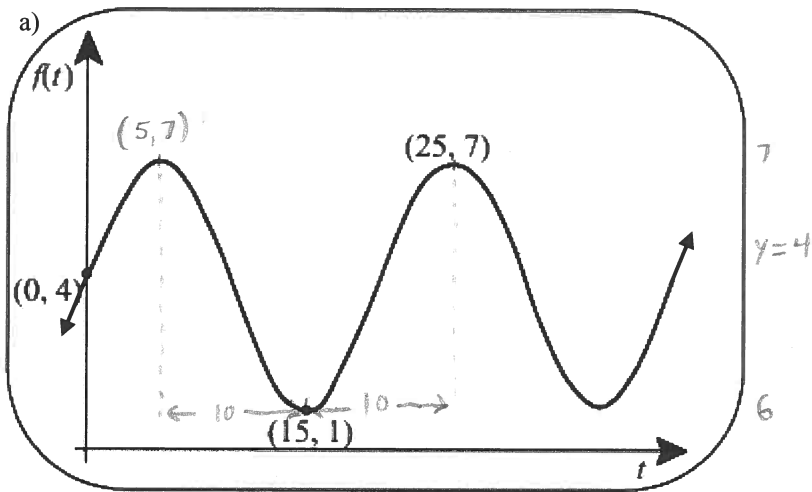
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Part C – Fill in the blanks

7. Complete the table below: (8 marks)

	Equation	Amplitude	Axis of the Curve	Phase Shift	Period
a)	$f(x) = 5\sin[3(x - 180^\circ)] - 5$	5	$y = -5$	$180^\circ \rightarrow$	120°
b)	$g(x) = -\cos(2x + 90^\circ)$	1	$y = 0$	$45^\circ \leftarrow$	180°

8. Determine a sine and a cosine equation of the following curves: (10 marks)

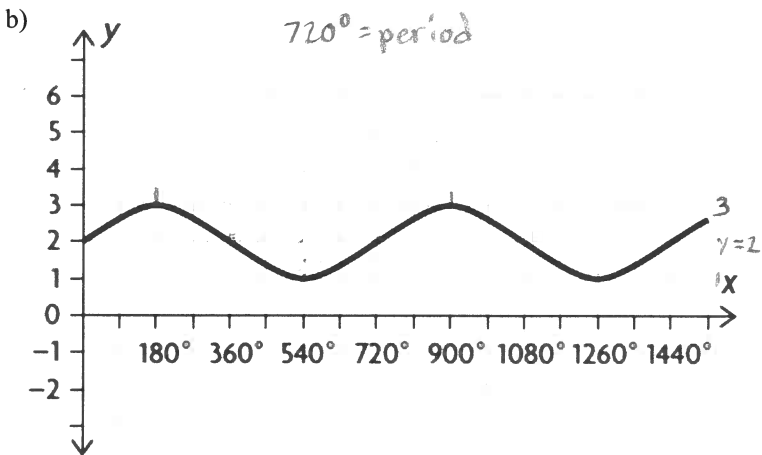


amp = 3
period = 20

$\frac{360}{20} = 18$

Sine Equation
$f(t) = 3\sin(18x) + 4$ ✓
Cosine Equation
$f(t) = -3\cos[18(x-15)] + 4$ ✓

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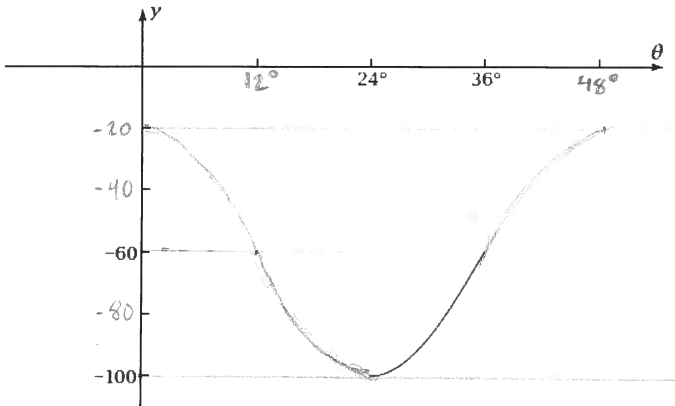


$720^\circ = \text{period}$

Sine Equation
$f(x) = \sin\left(\frac{1}{2}x\right) + 2$ ✓
Cosine Equation
$f(x) = \cos\left[\frac{1}{2}(x-180)\right] + 2$ ✓

9. The graph below shows a quarter of a cycle of a sinusoidal function with a minimum value of -100.

Determine an equation to model this wave: $f(x) = 40\cos(7.5x) - 60$ (4 marks)



$\frac{360}{48} = \frac{15}{2} = 7.5$

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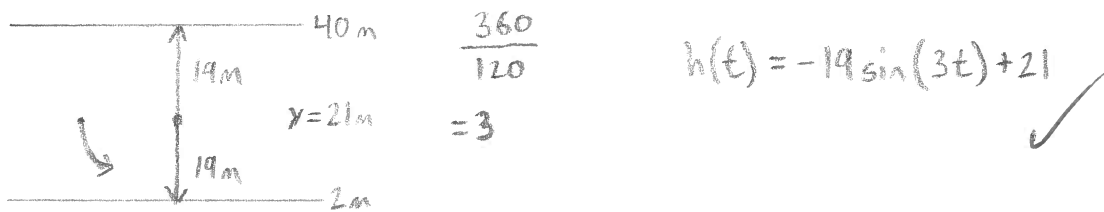
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Part D – Word Problem (round to 1 decimal place if needed)

10. A Ferris wheel at a carnival has a radius of 19 m. The top of the wheel is 40 m above the ground. One revolution of the wheel takes 2 minutes. Mr. Lenarduzzi is at the middle of the Ferris wheel heading downwards when the ride starts.

(6 marks)

a) Determine an equation representing Mr. Lenarduzzi's height, h in metres, at any time, t in seconds, from the start of the ride.



b) What is Mr. Lenarduzzi's height when the ride has been going for 95 seconds? (round to 1 decimal place)

$$h(95) = -19 \sin[3(95)] + 21$$

$$= 39.4 \text{ m}$$

c) When are the first 3 times that Mr. Lenarduzzi is 15 m above the ground? (answer in seconds rounded to 1 decimal place)

set $h(t) = 15 \text{ m}$

$$15 \text{ m} = -19 \sin[3t] + 21$$

$$\frac{6}{19} = \sin(3t)$$

$$3t \doteq 18.408^\circ$$

$$t_1 \doteq 6.1 \text{ s}$$

$$3t \doteq (180 - 18.408)$$

$$3t \doteq 161.591^\circ$$

$$t_2 \doteq 53.9 \text{ s}$$

$$t_3 = t_1 + 120$$

$$\doteq 6.1 + 120$$

$$\doteq 126.1 \text{ s}$$

First three times: 6.1 s, 53.9 s, and 126.1 s.