Math [redacted] 5 SN

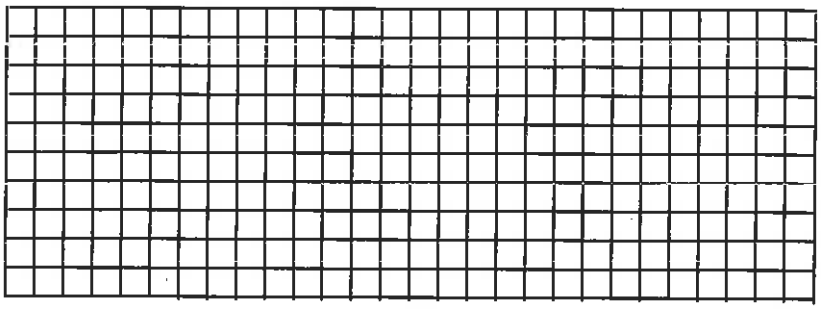
Name:_____

Sinusoidal Word Problems

Chapter 6 Trig

1. In Canada's wonderland there is a roller coaster that is a continuous series of identical hills that are 18m high from the ground. The platform to get on the ride is on top of the first hill. It takes 3 seconds for the coaster to reach the bottom of the hill 2m off the ground

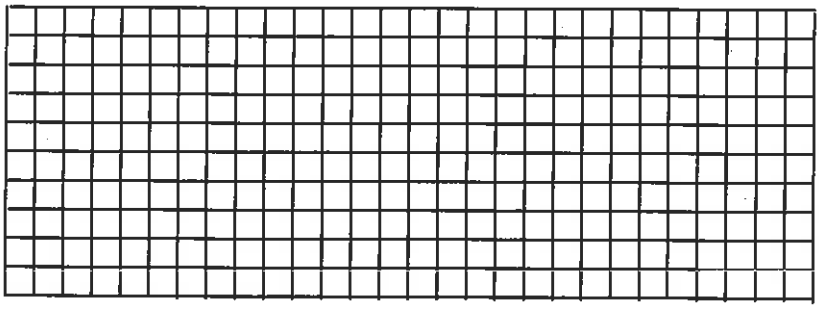
(a) Sketch a graph below which expresses the path of the roller coaster.

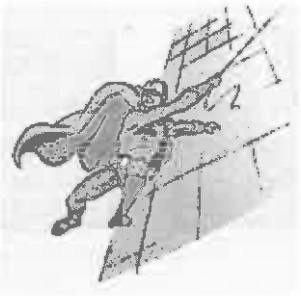


(a) What is the sinusoidal equation (sine and cosine) that best reflects this roller coaster's motion?

2. Mr. Keeping, disguised as Mathman, a costumed crime fighter, is swinging back and forth in front of the window to Ms. Gibbons's math class. At t = 3s, he is at one end of his swing and 4m from the window. At t = 7s, he is at the other end of his swing and 20m from the window.

(a) Sketch the curve. Use the distance from the window on the vertical axis and the time in seconds along the horizontal axis.





(b) What is the equation (in terms of sine and cosine), which represents Mathman's motion?

2 (c) How far is he from the window at $t = 10s$?

(evaluate using sine + cosine)

2 (d) In the first 30 seconds, when is he 8 m from the window?

(evaluate using sine + cosine)

Math [redacted] 5 5w

Key

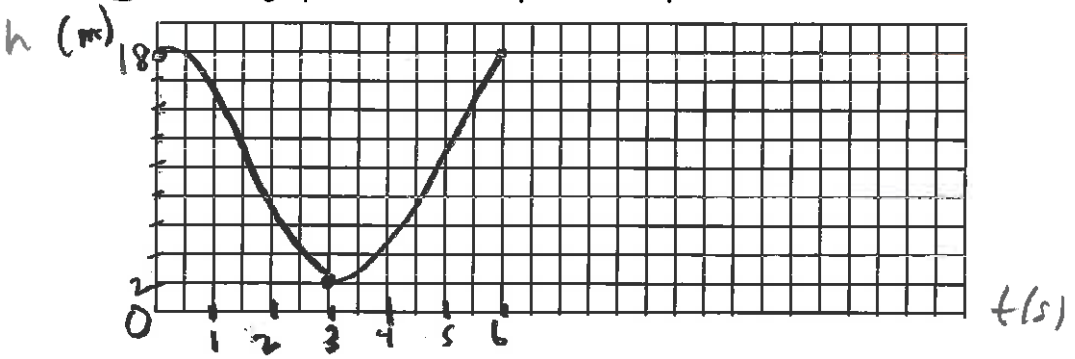
Name: _____

Sinusoidal Word Problems

Chapter [redacted] TMP

1. In Canada's wonderland there is a roller coaster that is a continuous series of identical hills that are 18m high from the ground. The platform to get on the ride is on top of the first hill. It takes 3 seconds for the coaster to reach the bottom of the hill 2m off the ground

(a) Sketch a graph below which expresses the path of the roller coaster.



(b) What is the sinusoidal equation (sine and cosine) that best reflects this roller coaster's motion?

cosine: $|2a| = 16$; $a = 8$; $p = 6$; $h = 0$; $k + a = 18$; $(h, k+a) = (0, 18)$ $b = \frac{2\pi}{6} = \frac{\pi}{3}$

$k + 8 = 18$ $k = 10$

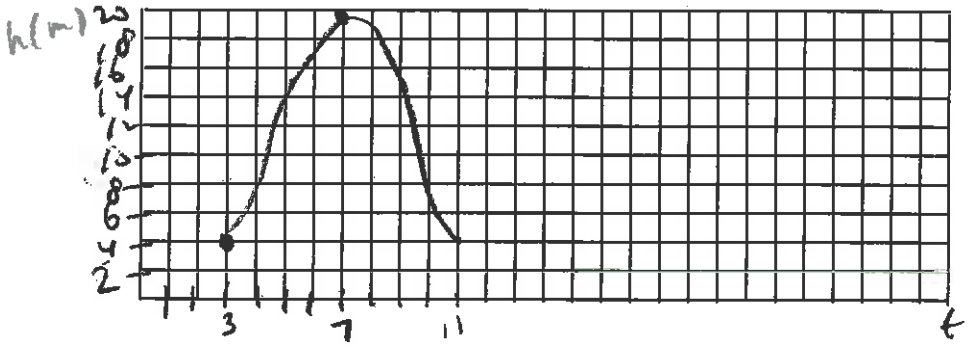
$$y = 8\cos\tfrac{\pi}{3}(x) + 10$$

sine: $h = 1.5$; $k = 10$; $a = -8$; $p = 6$; $b = \frac{2\pi}{6} = \frac{\pi}{3}$

$$y = -8\sin\tfrac{\pi}{3}(x - 1.5) + 10$$

2. Mr. Keeping, disguised as Mathman, a costumed crime fighter, is swinging back and forth in front of the window to Ms. Gibbons's math class. At t = 3s, he is at one end of his swing and 4m from the window. At t = 7s, he is at the other end of his swing and 20m from the window.

(a) Sketch the curve. Use the distance from the window on the vertical axis and the time in seconds along the horizontal axis.



(b) What is the equation (in terms of sine and cosine), which represents Mathman's motion?

Cosine: $|2a| = 16$; $a = -8$; p 8; $b = \frac{2\pi}{8} = \frac{\pi}{4}$; $h = 3$; $k + a = 4$

$k - 8 = 4 \rightarrow k = 12$.

$$y = -8\cos\tfrac{\pi}{4}(x - 3) + 12$$

Sine: $a = 8$; $h = 5$; $k = 12$; $p = 8$; $b = \frac{2\pi}{8} = \frac{\pi}{4}$

$$y = 8\sin\tfrac{\pi}{4}(x - 5) + 12$$

(c) $y = 8\sin\frac{\pi}{4}(10-5)+12$

$= 8\sin\frac{5\pi}{4}+12$

$= 8\left(-\frac{\sqrt{2}}{2}\right)+12 \approx 6.34\text{m}$ ✓

$y = -8\cos\frac{\pi}{4}(10-1)+12$

$y = -8\cos\frac{7\pi}{4}+12$

$= -8\left(\frac{\sqrt{2}}{2}\right)+12$

$\approx 6.34\text{m}$ ✓

(d) $8 = 8\sin\frac{\pi}{4}(x-5)+12$

$-\frac{1}{2} = \sin\frac{\pi}{4}(x-5)$

$\frac{4}{\pi}\frac{\pi}{4}(x-5) = \frac{7\pi}{6}\frac{4}{\pi}$

$x-5 = \frac{14}{3}$

$\boxed{x = \frac{29}{3}}$ ✓

$\frac{4}{\pi}\frac{\pi}{4}(x-5) = \frac{11\pi}{6}\frac{4}{\pi}$

$x-5 = \frac{22}{3}$

$\boxed{x = \frac{37}{3}}$ ✓

$\{\frac{29}{3}, \frac{53}{3}, \frac{77}{3}, \cancel{\frac{101}{3}}\ldots\}$

$\{\frac{13}{3}, \frac{37}{3}, \frac{61}{3}, \frac{85}{3}, \cancel{\frac{109}{3}}\ldots\}$

SOLUTION:

$\{\frac{13}{3}, \frac{29}{3}, \frac{37}{3}, \frac{53}{3}, \frac{61}{3}, \frac{77}{3}, \frac{85}{3}\}$ seconds

$8 = -8\cos\frac{\pi}{4}(x-3)+12$

$\frac{1}{2} = \cos\frac{\pi}{4}(x-3)$

$\frac{4}{\pi}\frac{\pi}{4}(x-3) = \frac{\pi}{3}\frac{4}{\pi}$

$x-3 = \frac{4}{3}$

$\boxed{x = \frac{13}{3}}$ ✓

$\frac{4}{\pi}\frac{\pi}{4}(x-3) = \frac{5\pi}{3}\frac{4}{\pi}$

$x-3 = \frac{20}{3}$

$\boxed{x = \frac{29}{3}}$ ✓

$\{\frac{13}{3}, \frac{37}{3}, \frac{61}{3}, \frac{85}{3}, \cancel{\frac{109}{3}}\ldots\}$

$\{\frac{29}{3}, \frac{53}{3}, \frac{77}{3}, \cancel{\frac{101}{3}}\ldots\}$

SOLUTION:

$\{\frac{13}{3}, \frac{29}{3}, \frac{37}{3}, \frac{53}{3}, \frac{61}{3}, \frac{77}{3}, \frac{85}{3}\}$ seconds.