

Pre-Calculus 12 Trigonometric Applications...again

1. Due to the tidal variations, the depth of water in a harbor is given by the formula

$$D = 6 + 4 \cos\left(32t + \frac{3\pi}{5}\right)$$

$$D = 4 \cos\left(32t + \frac{3\pi}{5}\right) + 6$$

where D is the depth of water in metres and t is the time in hours after midnight on Monday night.

- a) What were the greatest and least depths of water in the harbor?

$$\begin{aligned} \max &= D + A \\ &= 6 + 4 \\ &= 10\text{m} \\ &\quad \uparrow \\ &\quad \text{greatest} \end{aligned}$$

$$\begin{aligned} \min &= D - A \\ &= 6 - 4 \\ &= 2\text{m} \\ &\quad \uparrow \\ &\quad \text{least} \end{aligned}$$

- b) A boat needs at least 4 metres of water to leave the harbor. Can the boat leave the harbor at 3:00 p.m. Tuesday? Justify your answer.

$$\begin{aligned} D &= 4 \cos\left(32(15) + \frac{3\pi}{5}\right) + 6 \\ &= 4.630\text{m} \end{aligned}$$

3:00 p.m.
15 hrs
after
midnight
Mon

\therefore Yes, the boat can leave the harbour.

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2. On a typical day at an ocean port the water has a maximum depth of 20 metres at 8:00 am. The minimum depth of 8 metres occurs 6.2 hours later. Assume the relationship between the depth of the water and the time is a sinusoidal function.

a) What is the period?

$$12.4 \text{ hrs}$$

$$\text{max} \rightarrow \text{min} \rightarrow \text{max}$$

$$6.2 \text{ hrs} \quad 6.2 \text{ h}$$

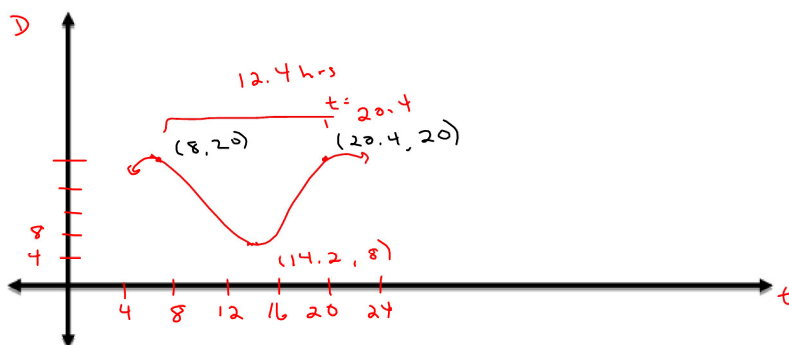
b) Write the cosine equation for the depth of the water at any time t hours.

$$A = \frac{20-8}{2} \quad D = \frac{20+8}{2} \quad B = \frac{2\pi}{12.4} \quad C = 8$$

$$= 6 \quad = 14 \quad = \frac{\pi}{6.2}$$

$$D = 6 \cos\left(\frac{\pi}{6.2}(t-8)\right) + 14$$

c) Sketch a graph



d) Calculate the depth of the water at 10:00 am.

$$D = 6 \cos\left(\frac{\pi}{6.2}(10-8)\right) + 14$$

$$= 17.174 \text{ m}$$

Assignment: Pg. ~~544; CYU #1, Pg. 548; #1, 5a, 7, 8~~