

### Answer on Question #54406-Math-Other

The depth ( $D$  metres) of water in a harbour at a time ( $t$  hours) after midnight on a particular day can be modelled by the function

$D = 2 \sin(0.51t - 0.4) + 5$ ,  $0 \leq t \leq 15$ ,  
where radians have been used.

Select the two options which are correct statements about the predictions based on this model.

Select one or more:

The largest depth is 7 metres.

At midnight the depth is approximately 4.2 metres.

The depth of water in the harbour falls after midnight.

The model can be used to predict the tide for up to 15 days.

The time between the two high tides is exactly 12 hours.

At midday the depth is approximately 7 metres.

The smallest depth is 5 metres.

### Solution

The largest depth is 7 metres. **True:**

$$\max D = 2 \cdot 1 + 5 = 7m.$$

At midnight the depth is approximately 4.2 metres. **True:**

$$D(0) = 2 \sin(-0.4) + 5 \approx 4.2m.$$

The depth of water in the harbour falls after midnight. **False:**

$$D' = 2 \cdot 0.51 \cos(0.51 \cdot t - 0.4).$$

$$D'(0) = 2 \cdot 0.51 \cos(0.51 \cdot 0 - 0.4) \approx 0.9 > 0.$$

The model can be used to predict the tide for up to 15 days. **False:**

The model can be used to predict the tide for up to 15 hours after midnight!

The time between the two high tides is exactly 12 hours. **False:**

$$0.51T = 2\pi \rightarrow T = \frac{2\pi}{0.51} \approx 12.3h.$$

At midday the depth is approximately 7 metres. **False:**

$$D(12) = 2 \sin(0.51 \cdot 12 - 0.4) + 5 \approx 3.9m.$$

The smallest depth is 5 metres. **False:**

$$\min D = -2 \cdot 1 + 5 = 3m.$$