I'm working in two columns to get as much as possible on one page. This is not the way to do homework. On homework, you (should) have at least two pages (Usually the computer and your paper) working at all times. The one you're reading and the one you're writing.

22. Some of the highest tides in the world occur in the Bay of Fundy on the Atlantic Coast of Canada. At Hopewell Cape the water depth at low tide is about 2.0 m and at high tide it is about 12.0 m. The natural period of oscillation is a little more than 12 hours and on June 30, 2009, high tide occurred at 6:45 AM. This helps explain the following model for the water depth D (in meters) as a function of the time t (in hours after midnight) on that day:

$$D(t) = 7 + 5\cos[0.503(t - 6.75)]$$

Lexicon (Glossary)

How fast was the tide rising (or falling) at the following times?

(a) 3:00 AM (b) 6:00 AM

(c) 9:00 AM (d) Noon

No precision specified. 3 or 4 places.

22 High tide is 12m @ 6:45am ← Not really

Low tide of 2m @ 6:45pm

Let D = Depth (height) of the tide, in meters (m), as a function of t = time, or number of hours after midnight.

$D(t) = 5\cos(.503(t-6.75)) + 7$

How fast was the tide rising (or falling) at the following times?

(we find how fast).

(a) 3 a.m. : $t = 3$

$D'(t) = -5\sin(.503(t-6.75))(.503)$

$= -5(.503)\sin(t-6.75))$

$\Rightarrow D'(3) = -5(.503)\sin(3-6.75) \approx$ $2.3909 \frac{m}{hr} \approx D'(3)$

(b) 6 a.m. $\Rightarrow D'(6) = -5(.503)\sin(6-6.75) \approx$ $.9264 \frac{m}{hr} \approx D'(6)$

(c) 9 a.m. $\Rightarrow D'(9) = -5(.503)\sin(9-6.75) \approx$ $-2.2765 \frac{m}{hr} \approx D'(9)$

(d) Noon $\Rightarrow D'(12) = -5(.503)\sin(12-6.75) \approx$ $-1.2076 \frac{m}{hr} \approx D'(12)$

1 $R(x) = -5 \cdot .503\sin(.503(x-6.75))$

2 $D(x) = 5\cdot\cos(.503(x-6.75))$

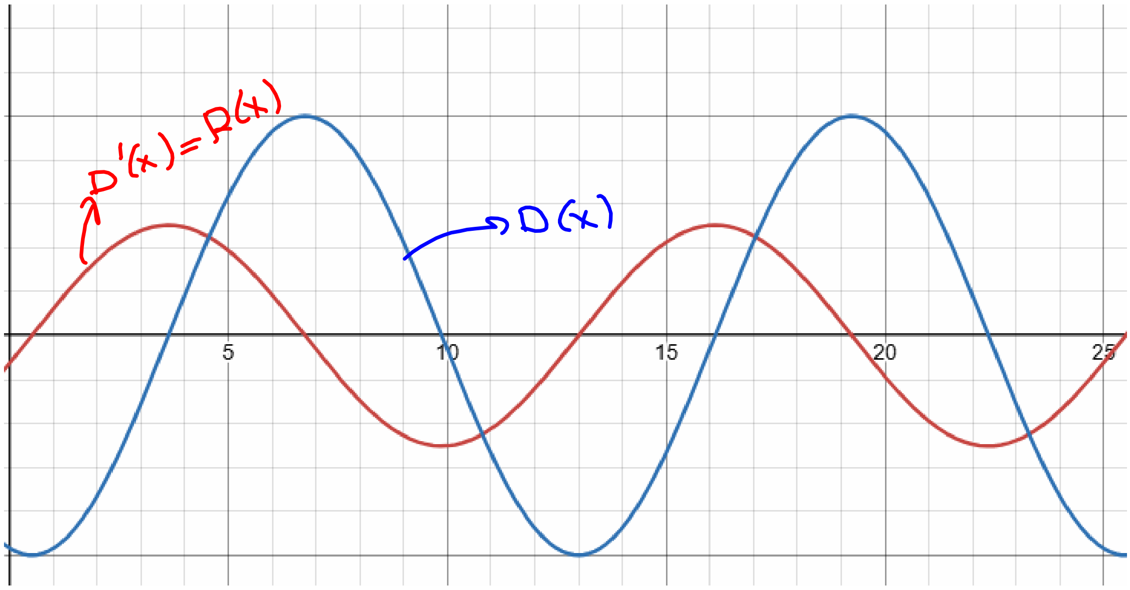
3 $R(3)$ $= 2.39089914999$

4 $R(6)$ $= 0.92643858449$

5 $R(9)$ $= -2.27647100883$

6 $R(12)$ $= -1.207614639$

D'(t) is the rate of change in D with respect to t. belongs in the lexicon.



D'(x) = R(x)
D(x)
5
10
15
20
25

This is the rabbit hole I went down when I was stuck on a 24-hour period for tides.

Note that the book's .503 would be more like .524 if it were *exactly* a 12-hour "period of oscillation." The reason it isn't is because the Moon is always trying to escape our day time hours. Slowly pulling ahead over time, because the earth's rotation lags behind it and it's not just sitting still.

Period = 24

Then

We find $a\cos(b(x-c))+d$

$a = \frac{\text{HIGH}-\text{LOW}}{2} = \frac{12-2}{2} = \frac{10}{2} = 5$ = Amplitude.

$bx = 2\pi$ when $x = 24 \Rightarrow$

$b = \frac{2\pi}{24} = \frac{\pi}{12} \approx$ 0.2617993879

24-hr model
$\boxed{\approx 5\cos(.2618(x-6.75))+7}$

↳ But it's wrong!
Not a 24-hr cycle.

Note if period is 12 hrs, as they say, then

$b = \frac{2\pi}{12} \approx$ 0.5235987758, which is a lot closer to what the book's saying

DuckDuck says: 2 high tides & 2 low tides per day.

Varies depending on geography!

Lunar Day is 24 hrs 50 min!

Far-northern latitudes apparently have the highest highs and the lowest lows.

Must diminish as you get closer to the equator?