Thu Oct 4 11:50:47 MDT 2007 /m333.fa07/333/handouts333/8asgnGRADEA04/NotesAsgnEightA04

1 First Problem part (a):

The solutions I received seemed dogged by scads of extra variables. I would prefer that the variables in the problem statement be used, while additional needed variables be described and related to the problem statement. Things to watch for:

(a) $\boldsymbol{Y \neq y,}$ so it's important to write so that the reader (dirty bifocals and not very swift, as they say) can tell which is meant.

(b) Ditto for $\boldsymbol{l \neq L}$ or $\boldsymbol{\ell \neq L.}$

(c) Common variables used but not introduced formally: $\boldsymbol{W, m, r}$ (obviated by $\boldsymbol{A}$), $\boldsymbol{\partial, \rho_L.}$

A dearth of relevant verbiage was endemic.

I have received one acceptable solution for part (a). While this paper did have a couple of extra-ish variables, they were described with brief lines of prose.

But the best feature of this paper's part-(a) solution was that, after the variables were all set up, it stated (in brief *prose*) the basic, fundamental, driving physical principle from which the part-(a) formula derives. Then it proceeded to tranform this principle into the formula.

I did receive a further acceptable part-(a) solution. A little short on expository paragraphs, but acceptable.

2 First Problem part (b):

Again, successful solutions depended on deriving the equation from a basic principle. This principle needs to be mentioned explicitly, then made over into the equation.

3 Second Problem part (a):

An algebraic approach is likely best.

The text tells us that the differential equation $y'' + \omega^2 y = 0,$ derived in the first problem, with

$$\omega = \sqrt{\frac{\rho_\ell g}{L\rho}},$$

has solutions of the form

$$y(t) = C_1 \sin(\omega t) + C_2 \cos(\omega t).$$

We know that the larger the parameter ω becomes, the faster the solution oscillates, that is, the shorter its period is.

And so, from the part-(a) picture, we conclude that cylinder number 1 is less dense than cylinder number 2. If ρ_i denotes the density of cylinder number $i,$ then we have the following string of inequality reasoning:

$$\begin{aligned} \rho_1 &< \rho_2 \\ \frac{1}{\rho_1} &> \frac{1}{\rho_2} \\ \frac{\rho_\ell g}{L\rho_1} &> \frac{\rho_\ell g}{L\rho_2} \\ \sqrt{\frac{\rho_\ell g}{L\rho_1}} &> \sqrt{\frac{\rho_\ell g}{L\rho_2}} \\ \omega_1 &> \omega_2 \end{aligned}$$

This last inequality tells us that cylinder number 1 bobs the faster.

4 Second Problem part (b):

This is the same as part (a) except that we start with $L_1 < L_2$ and $\rho_1 = \rho_2.$

5 Third Problem part (a):

From the graph of solution $y(t)$ on page 115, we can see that the period T is given by $T = 2.$ Furthermore, $y_0 = y(0) = 0.$

6 Third Problem part (b):

If the solution $y(t)$ has form

$$y(t) = C_1 \sin(\omega t) + C_2 \cos(\omega t),$$

then the frequency-period relation $\omega T = 2\pi$ tells us that $\omega = \pi.$

Furthermore, examination of the graph tells us first, that $C_2 = 0,$ because $y(0) = C_2 \cos(0).$ And further, looking at the amplitude tells us that $C_1 = 6,$ and so

$$y(t) = 6 \sin(\pi t) \qquad \text{and so} \qquad y'(t) = 6\pi \cos(\pi t),$$

so that $y'_0 = y'(0) = 6\pi \cos(0) = 6\pi.$

The cylinder dimensions are given us as a red herring...