STEP 2010, Paper 1 – Notes (2 pages; 8/6/18)

See separate documents for Sol'ns.

1	2	3	4	5	6	7	8
Sol'n	Sol'n	Sol'n		Sol'n	N	N	

9	10	11		12	13	14
Sol'n						

Q6 Given that methods to solve 2nd order differential equations aren't part of the C1-C4 syllabus, you can guarantee to be led through this question. The examiners themselves acknowledge that questions on unfamiliar topics often turn out to be fairly straightforward, once you get going.

Towards the end you should get $\ln|v| = -x + \ln|x-1| + C$, and there is the usual issue of what to do with the moduli signs. Sometimes (as here), the official sol'ns gloss over the complications (though sometimes they don't!)

It's definitely best to always introduce the moduli signs when integrating expressions of the form $\frac{1}{x}$. If it isn't easy to examine the different scenarios, then you can at least make some reference to restrictions on x etc, and the need to separately consider values of x outside the specified range. This could be an end-of-exam task (if you have nothing better to do).

Here we can say: $|v| = e^C|x-1|e^{-x}$ (*)

so that $v = A(x-1)e^{-x}$ if $v>0$ & $x>1$

But if v<0 and/or x<1, then we still get v = A(x-1)e^{-x} (changing the sign of A, if necessary); eg if v<0 & x<1, (*) gives –v = e^{C}(1-x)e^{-x} etc.

Q7 It is very tempting to introduce the lengths OQ etc by considering $\overrightarrow{AQ}$ to be the weighted average of $\overrightarrow{AO}$ and $\overrightarrow{AB}$, and similarly for $\overrightarrow{RO}$. (This is, after all, one of the themes of the question.) This method does work, but is very long.