STEP II, 2020, Q9 EC

This was a question that was found to be difficult.

In general, this question was not attempted well, with very few candidates progressing past the first section. Most candidates managed to pick up all the marks in the initial section of the question. However, a significant minority of students could not set up the problem correctly or knew a lot of linear acceleration (suvat) equations but could not apply them correctly (for example mistaking displacement for position) and received zero marks. Some candidates eliminated t in favour of x and could not progress to the last calculation.

Around half the candidates picked up full marks for part (i). However, many candidates tried to reason with words – almost always unsuccessfully, often believing that the particle projected from point A could not pass through the line AB.

Most of the candidates received zero marks for part (ii), failing to realise that the result follows from the height of the particle at the time of collision being non-negative. Some tried to use conservation of momentum or energy, or the equation $v^2 = u^2 + 2as$ due to the answer being suggestive of velocity squared. Candidates who were able to progress well on this part generally achieved all of the marks.

Very few candidates progressed to part (iii) and the attempts were often poor. Candidates who did know how to proceed to the result often did not justify bounds they used to obtain inequalities.

A significant number of candidates attempted the final part of the question having omitted earlier parts. In many cases candidates did not fully appreciate the requirements when asked to show a statement of the form “A if and only if B”.