

STEP II, 2013, Q5 MS

Question 5.

Simple applications of the chain rule lead to relationships that will allow the three cases of zero gradients to be identified in part (i).

In part (ii) the relationships follow easily from substitution and therefore the three stationary points identified in part (i) must all exist. By considering the denominator there are clearly two vertical asymptotes and the numerator is clearly always positive. Additionally, the numerator is much larger than the denominator for large values of x . Given this information there is only one possible shape for the graph.

In part (iii) the solutions of the first equation will already have been discovered when the coordinates of the stationary points in part (ii) were calculated. The range of values satisfying the first inequality should therefore be straightforward. One of the solutions of the second equation should be easy to spot, and consideration of the graph shows that there must be a total of six roots. Applying the two relationships about the values of f will allow these other roots to be found. The solution set for the inequality then follows easily from consideration of the graph.



NextStepMaths.com

To view mark schemes, fully worked solutions and examiner's comments, and for more details about tutoring and other services offered, go to [NextStepMaths.com](https://www.NextStepMaths.com)