

STEP II, 2013, Q1 MS

Question 1.

The gradient of a line from a general point on the curve to the origin can be calculated easily and the gradient of the curve at a general point can be found by differentiation. Setting these two things to be equal will then lead to the correct value of m . A similar consideration of gradients to the origin will establish the second result and if the line intersects the curve twice then a sketch will illustrate that there must be one intersection on each side of the point of contact found in the first case. A similar process will establish the result for part (ii).

For part (iii) the gradient of the line must be smaller than the gradient of the line through the origin which touches the curve, so the intersection with the y -axis must be at a positive value. This means that the conditions of part (ii) are met, which allows for the comparison between π^e and e^π to be made.

The condition given in part (iv) is equivalent to stating that the line is parallel to the one found at the very beginning of the question. This implies that the intersection with the y -axis is at a negative value and so an adjustment to the steps taken in part (ii) will establish the required result.



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)