Question 8 (16 marks)

A company produces a type of fruit-filled chocolate called Choc-pricots. They are produced on an automated assembly line that can result in imperfect Choc-pricots.

(a) The probability is 0.15 that a Choc-pricot randomly selected off the assembly line is imperfect.

Use the binomial distribution to determine the probability that, in a random sample of 80 Choc-pricots:





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(1 mark)

(ii) more than 20 Choc-pricots will be imperfect.

(2 marks)

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The manager of the assembly line can adjust the rate of production of Choc-pricots, resulting in a change in the probability that a randomly selected Choc-pricot is imperfect. This probability can be modelled by the function

$$p(x) = \sin(0.00392x^2) + e^{-x}$$
, for $0 < x \le 20$,

where p(x) represents the probability that a randomly selected Choc-pricot is imperfect, and x represents the rate of production measured in Choc-pricots per second.

(b) On the axes in Figure 8, sketch the graph of y = p(x).



(c) Using the function p(x), determine the possible rate(s) of production that resulted in the given probability of 0.15 stated in part (a).

(2 marks)

(3 marks)

(d) The minimum probability that a randomly selected Choc-pricot is imperfect, according to the function p(x), is 0.0781 (correct to three significant figures).

State the corresponding rate of production that would result in this probability.