

(16 marks)

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



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- (a) The probability is 0.15 that a Choc-ricot 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:

- (i) *exactly* 6 Choc-pricots will be imperfect.

(1 mark)

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

(2 marks)

Question 8 continues on page 8.

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

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

(3 marks)

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- (e) The manager chooses a new production rate for the assembly line. They claim that the production rate that they have chosen will result in the minimum probability that a randomly selected Choc-pricot is imperfect.

After running the assembly line at the new production rate for one day, a quality-control officer randomly selects 80 Choc-pricots and 6 are imperfect.

- (i) Calculate $\hat{p}$, the proportion of Choc-precicots that are imperfect in the sample of 80 Choc-precicots manufactured at the new production rate.

(1 mark)

- (ii) Assuming that a sample size of 80 is large enough for the central limit theorem to apply, determine a 90% confidence interval for the proportion of Choc-pricots that will be imperfect at the new production rate.

(2 marks)

- (iii) Using the confidence interval that you calculated in part (e)(ii), can it be concluded that the manager's claim is false with 90% confidence? Justify your answer.

(2 marks)

- (iv) Using the confidence interval that you calculated in part (e)(ii) and $p(x)$, determine with 90% confidence the upper and lower bounds of the new production rate.

(2 marks)