1.   An engineer measures, to the nearest cm, the lengths of metal rods.

(a)   Suggest a suitable model to represent the differences between the true lengths and the measured lengths.

(2)

(b)   Find the probability that for a randomly chosen rod the measured length will be within 0.2 cm of the true length.

(2)

Two rods are chosen at random.

(c)   Find the probability that for both rods the measured lengths will be within 0.2 cm of their true lengths.

(2)
(Total 6 marks)

2.   An athletics teacher has kept careful records over the past 20 years of results from school sports days. There are always 10 competitors in the javelin competition. Each competitor is allowed 3 attempts and the teacher has a record of the distances thrown by each competitor at each attempt. The random variable D represents the greatest distance thrown by each competitor and the random variable A represents the number of the attempt in which the competitor achieved their greatest distance.

(a)   State which of the two random variables D or A is continuous.

(1)

A new athletics coach wishes to take a random sample of the records of 36 javelin competitors.

(b)   Specify a suitable sampling frame and explain how such a sample could be taken.

(2)

The coach assumes that $P(A = 2) = \frac{1}{3}$, and is therefore surprised to find that 20 of the 36 competitors in the sample achieved their greatest distance on their second attempt.

Using a suitable approximation, and assuming that $P(A = 2) = \frac{1}{3}$,

(c)   find the probability that at least 20 of the competitors achieved their greatest distance on their second attempt.

(6)

(d)   Comment on the assumption that $P(A = 2) = \frac{1}{3}$.

(2)
(Total 11 marks)

1. (a) Continuous uniform (Rectangular) U(–0.5, 0.5)   B1 B1   2

     (b) P(error within 0. 2 cm) = $2 \times 0.2 = 0.4$ M1 A1   2

     (c) P(both within 2 cm) = $0.4^2 = 0.16$ M1 A1   2

                                                                                     [6]

2. (a) *D* is continuous   B1   1

     (b) Sampling Frame is the list of competitors or their results,   B1

         e.g. label the results 1—200 and randomly select 36 of them   B1   2

     (c) X = no. of competitors with $A = 2$ $X \sim B(36, \frac{1}{3})$

         $X \approx \sim N(12, 8)$ M1 A1

         $P(X \geq 20) \approx P\left(Z \geq \dfrac{19.5 - 12}{\sqrt{8}} \right)$ $\pm\frac{1}{2}$, 'z'   M1 M1

             $= P(Z \geq 2.65\ldots)$ A1

                $= 1 - 0.9960$ $= 0.004$ A1   6

     (d) Probability is very low, so assumption of $P(A = 2) = \frac{1}{3}$ is unlikely.   B1 B1   2

         (Suggests $P(A = 2)$ might be higher.)

                                                                                    [11]

1. The least well answered question by most candidates. Very few specified the distribution fully or gave a convincing justification for their answer in part (b). Even the best candidates struggled to gain full marks.

2. No Report available for this question.