The Normal Distribution

Question Paper

Level	Pre U
Subject	Maths
Exam Board	Cambridge International Examinations
Topic	Statistics- The Normal Distribution
Booklet	Question Paper

Time Allowed: **60 minutes**

Score: **/50**

Percentage: **/100**

Grade Boundaries:

1 A machine is being used to manufacture ball bearings. The diameters of the ball bearings are normally distributed with mean 8.3 mm and standard deviation 0.20 mm.

(i) Find the probability that the diameter of a randomly chosen ball bearing lies between 8.1 mm and 8.5 mm. [5]

(ii) Following an overhaul of the machine, it is now found that the diameters of 88% of ball bearings are less than 8.5 mm while 10% are less than 8.1 mm. Estimate the new mean and standard deviation of the diameters. [6]

2 A tomato grower grows just one variety of tomatoes. The weights of these tomatoes are found to be normally distributed with a mean of 85.1 grams and a standard deviation of 3.4 grams.

(i) Find the probability that a randomly chosen tomato of this variety weighs less than 80 grams. [3]

(ii) The grower puts the tomatoes in packs of 6. Find the probability that, in a randomly chosen pack of 6, at most one tomato weighs less than 80 grams. [4]

(iii) The grower supplies consignments of 250 packs of these tomatoes to a retailer. For a randomly chosen consignment, find the expected number of packs having **more** than one tomato weighing less than 80 grams. [3]

3 The lengths of snakes on a tropical island were measured and found to be normally distributed with a mean of 160 cm and a standard deviation of 6 cm. Find the probability that a randomly selected snake has a length of less than 170 cm. [4]

4 A particle P of mass 2 kg can move along a line of greatest slope on the smooth surface of a wedge which is fixed to the ground. The sloping face OA of the wedge has length 10 metres and is inclined at 30° to the horizontal (see Fig. 1). P is fired up the slope from the lowest point O, with an initial speed of 20 m s^{-1}.

Fig. 1

(i) Find the time taken for P to reach A and show that the speed of P at A is $10\sqrt{3}$ m s^{-1}. [6]

After P has reached A it becomes a projectile (see Fig. 2).

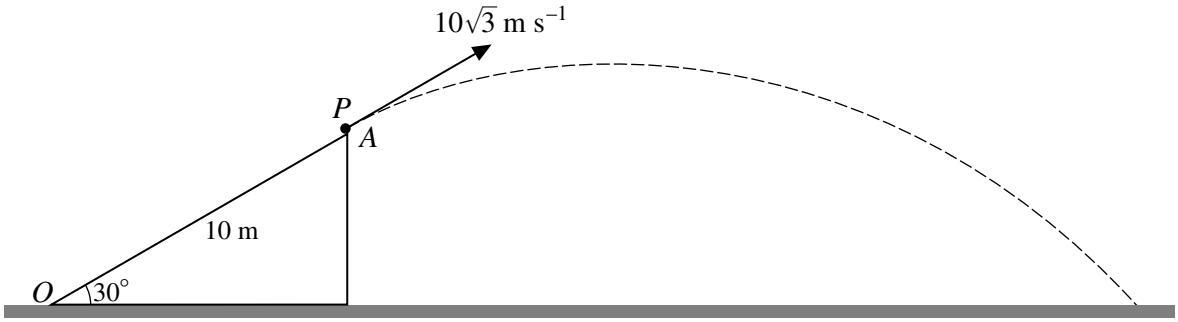

Fig. 2

(ii) Find the total horizontal distance travelled by P from O when it hits the ground. [7]

5 A manufacturer produces components designed with length L mm such that $12 < L < 15$. The Quality Control department finds that 15% of the components sampled are longer than 15 mm while 8% are shorter than 12 mm. Assume that L is normally distributed with mean μ and standard deviation σ.

(i) Calculate μ and σ. [6]

(ii) The shortest 5% of components are rejected. Find the minimum length which a component may have before it is rejected. [3]

(iii) It was found in a random sample that 10% of components were longer than 16 mm. Determine whether this finding is consistent with the assumption that L is normally distributed with the μ and σ found in part **(i)**. [3]