

# 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:**

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- 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  $30^\circ$  to the horizontal (see Fig. 1).  $P$  is fired up the slope from the lowest point  $O$ , with an initial speed of  $20 \text{ m s}^{-1}$ .



Fig. 1

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

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

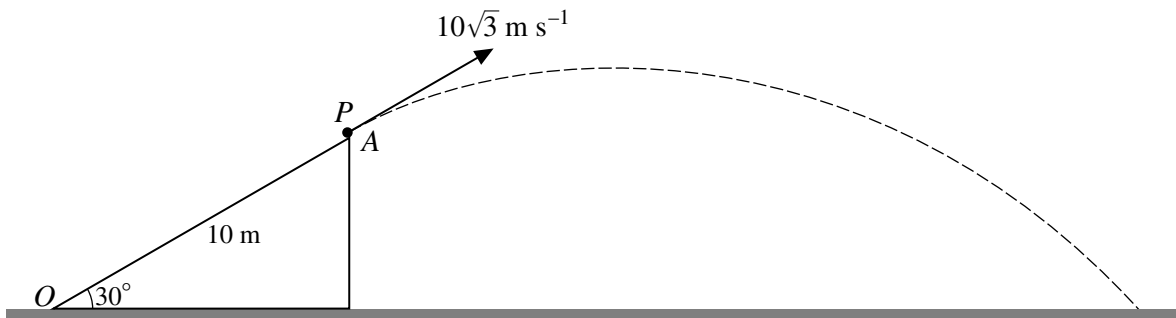


Fig. 2

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

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- 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  $\mu$  and standard deviation  $\sigma$ .
- (i) Calculate  $\mu$  and  $\sigma$ . [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  $\mu$  and  $\sigma$  found in part (i). [3]