

# Linear combinations for random variables

## Question Paper 1

<b>Level</b>	International A Level
<b>Subject</b>	Maths
<b>Exam Board</b>	CIE
<b>Topic</b>	Linear combinations for random variables
<b>Sub Topic</b>	
<b>Booklet</b>	Question Paper 1

**Time Allowed:** 64 minutes

**Score:** /53

**Percentage:** /100

**Grade Boundaries:**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

- 1 The masses, in grams, of potatoes of types  $A$  and  $B$  have the distributions  $N(175, 60^2)$  and  $N(105, 28^2)$  respectively. Find the probability that a randomly chosen potato of type  $A$  has a mass that is at least twice the mass of a randomly chosen potato of type  $B$ . [5]
- 2 The masses, in grams, of tomatoes of type  $A$  and type  $B$  have the distributions  $N(125, 30^2)$  and  $N(130, 32^2)$  respectively.
- (i) Find the probability that the total mass of 4 randomly chosen tomatoes of type  $A$  and 6 randomly chosen tomatoes of type  $B$  is less than 1.5 kg. [5]
- (ii) Find the probability that a randomly chosen tomato of type  $A$  has a mass that is at least 90% of the mass of a randomly chosen tomato of type  $B$ . [5]
- 3 The number of radioactive particles emitted per 150-minute period by some material has a Poisson distribution with mean 0.7.
- (i) Find the probability that at most 2 particles will be emitted during a randomly chosen 10-hour period. [3]
- (ii) Find, in minutes, the longest time period for which the probability that no particles are emitted is at least 0.99. [5]
- 4 Kieran and Andreas are long-jumpers. They model the lengths, in metres, that they jump by the independent random variables  $K \sim N(5.64, 0.0576)$  and  $A \sim N(4.97, 0.0441)$  respectively. They each make a jump and measure the length. Find the probability that
- (i) the sum of the lengths of their jumps is less than 11 m, [4]
- (ii) Kieran jumps more than 1.2 times as far as Andreas. [6]

- 5 The lifetimes, in hours, of Longlive light bulbs and Enerlow light bulbs have the independent distributions  $N(1020, 45^2)$  and  $N(2800, 52^2)$  respectively.
- (i) Find the probability that the total of the lifetimes of 5 randomly chosen Longlive bulbs is less than 5200 hours. [4]
- (ii) Find the probability that the lifetime of a randomly chosen Enerlow bulb is at least 3 times that of a randomly chosen Longlive bulb. [6]
- 6 The lengths of logs are normally distributed with mean 3.5 m and standard deviation 0.12 m. Describe fully the distribution of the total length of 8 randomly chosen logs. [3]
- 7 The masses of a certain variety of potato are normally distributed with mean 180 g and variance  $1550 \text{ g}^2$ . Two potatoes of this variety are chosen at random. Find the probability that the mass of one of these potatoes is at least twice the mass of the other. [7]