

# The normal distribution

## Question Paper 8

<b>Level</b>	International A Level
<b>Subject</b>	Maths
<b>Exam Board</b>	CIE
<b>Topic</b>	The normal distribution
<b>Sub Topic</b>	
<b>Booklet</b>	Question Paper 8

**Time Allowed:** 51 minutes

**Score:** / 42

**Percentage:** /100

**Grade Boundaries:**

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

- 1** The times taken to play Beethoven's Sixth Symphony can be assumed to have a normal distribution with mean 41.1 minutes and standard deviation 3.4 minutes. Three occasions on which this symphony is played are chosen at random.

(i) Find the probability that the symphony takes longer than 42 minutes to play on exactly 1 of these occasions. [4]

The times taken to play Beethoven's Fifth Symphony can also be assumed to have a normal distribution. The probability that the time is less than 26.5 minutes is 0.1, and the probability that the time is more than 34.6 minutes is 0.05.

(ii) Find the mean and standard deviation of the times to play this symphony. [5]

(iii) Assuming that the times to play the two symphonies are independent of each other, find the probability that, when both symphonies are played, both of the times are less than 34.6 minutes. [4]

- 2** The lengths, in cm, of trout in a fish farm are normally distributed. 96% of the lengths are less than 34.1 cm and 70% of the lengths are more than 26.7 cm.

(i) Find the mean and the standard deviation of the lengths of the trout. [5]

In another fish farm, the lengths of salmon,  $X$  cm, are normally distributed with mean 32.9 cm and standard deviation 2.4 cm.

(ii) Find the probability that a randomly chosen salmon is 34 cm long, correct to the nearest centimetre. [3]

(iii) Find the value of  $t$  such that  $P(31.8 < X < t) = 0.5$ . [4]

- 3 (a) The random variable  $X$  is normally distributed with mean  $\mu$  and standard deviation  $\sigma$ . It is given that  $3\mu = 7\sigma^2$  and that  $P(X > 2\mu) = 0.1016$ . Find  $\mu$  and  $\sigma$ . [4]
- (b) It is given that  $Y \sim N(33, 21)$ . Find the value of  $a$  given that  $P(33 - a < Y < 33 + a) = 0.5$ . [4]
- 4 The lengths, in centimetres, of drinking straws produced in a factory have a normal distribution with mean  $\mu$  and variance 0.64. It is given that 10% of the straws are shorter than 20 cm.
- (i) Find the value of  $\mu$ . [3]
- (ii) Find the probability that, of 4 straws chosen at random, fewer than 2 will have a length between 21.5 cm and 22.5 cm. [6]