



The Normal Distribution

Questions

Suitable for:
Pearson Edexcel International A-Level (iAL) — Statistics 1



Question 1

The random variable Z follows the standard normal distribution, $Z \sim N(0, 1)$.

Find

(a) $P(Z < 1.24)$,

(1 marks)

(b) $P(Z > 0.83)$,

(2 marks)

(c) $P(-1.5 < Z < 1.5)$.

(2 marks)

Total for question = 5 marks



Question 2

The random variable $X \sim N(50, 16)$.

Find

(a) $P(X < 54)$,

(2 marks)

(b) $P(X > 47)$,

(2 marks)

(c) $P(46 < X < 55)$.

(3 marks)

Total for question = 7 marks



Question 3

The random variable $X \sim N(30, 25)$.

Find

(a) $P(X < 26)$,

(2 marks)

(b) $P(X > 35)$,

(2 marks)

(c) $P(24 < X < 36)$.

(3 marks)

Total for question = 7 marks



Question 4

The random variable $X \sim N(20, 9)$.

Given that $P(X < a) = 0.9$, find the value of a .

(3 marks)

Total for question = 3 marks



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Question 5

The random variable $X \sim N(100, 25)$.

Given that $P(X > b) = 0.15$, find the value of b .

(3 marks)

Total for question = 3 marks



Question 6

The random variable $X \sim N(32, \sigma^2)$.

Given that $P(X < 40) = 0.975$, find the value of σ .

(3 marks)

Total for question = 3 marks



Question 7

The random variable $X \sim N(\mu, 16)$.

Given that $P(X < 25) = 0.8$, find the value of μ .

(3 marks)

Total for question = 3 marks



Question 8

The random variable $X \sim N(40, \sigma^2)$.

Given that $P(X > 46) = 0.04$, find the value of σ .

(3 marks)

Total for question = 3 marks



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Question 9

The random variable $X \sim N(\mu, \sigma^2)$.

$$P(X < 50) = 0.6 \quad P(X < 62) = 0.95$$

(a) By writing down two equations involving μ and σ , show that

$$\sigma = \frac{12}{\Phi^{-1}(0.95) - \Phi^{-1}(0.6)}$$

(3 marks)

(b) Hence find the values of μ and σ , giving your answers to 3 significant figures.

(3 marks)

Total for question = 6 marks



Question 10

The random variable $X \sim N(\mu, \sigma^2)$.

$$P(X > 30) = 0.8 \quad P(X > 45) = 0.1$$

Find the values of μ and σ , giving your answers to 3 significant figures.

(6 marks)

Total for question = 6 marks





Question 11

The weights, W grams, of apples in a large orchard are normally distributed with mean 180 g and standard deviation 20 g.

(a) Find $P(165 < W < 200)$.

(3 marks)

(b) Find the weight exceeded by 30% of apples.

(3 marks)

(c) An apple is classed as 'large' if it weighs more than 195 g. Find the probability that a randomly selected apple is large.

(2 marks)

Total for question = 8 marks



Question 12

The scores of students in an examination are normally distributed with mean 62 and standard deviation 10.

(a) The top 10% of students receive a distinction. Find the minimum score required for a distinction, giving your answer to the nearest whole number.

(3 marks)

Five students are selected at random.

(b) Find the probability that at least 2 of the 5 students receive a distinction.

(4 marks)

Total for question = 7 marks



Question 13

The time, T minutes, taken by a student to complete a mathematics problem is modelled as $T \sim N(\mu, \sigma^2)$.

$$P(T < 30) = 0.2 \quad P(T < 45) = 0.9$$

(a) Find the values of μ and σ , giving your answers to 3 significant figures.

(5 marks)

(b) Hence find $P(T > 40)$.

(2 marks)

Total for question = 7 marks





Question 14

A machine produces metal rods whose lengths, L mm, are normally distributed. A sample of rods is measured and it is found that

$$P(L < 48) = 0.05 \quad P(L < 60) = 0.85$$

- (a) Find the mean and standard deviation of L , giving your answers to 3 significant figures.

(5 marks)

A rod is classified as acceptable if its length satisfies $50 \text{ mm} < L < 65 \text{ mm}$.

- (b) Find the proportion of rods that are acceptable. Give your answer to 3 significant figures.

(3 marks)

- (c) A batch of 200 rods is produced. Find the expected number of rods in the batch that are rejected, giving your answer to the nearest integer.

(2 marks)

- (d) State one assumption made in using the normal distribution to model the lengths of the rods.

(1 marks)

Total for question = 11 marks



Question 15

The heights of male students at a university are normally distributed with mean 175 cm and standard deviation 8 cm. The heights of female students are normally distributed with mean 162 cm and standard deviation 7 cm.

(a) Find the probability that a randomly selected male student is taller than 185 cm.

(2 marks)

(b) Find the probability that a randomly selected female student is taller than 170 cm.

(2 marks)

(c) Find the height h such that 95% of male students are shorter than h .

(3 marks)

(d) Find the proportion of male students and the proportion of female students who are taller than 170 cm. Comment on your results.

(4 marks)

Total for question = 11 marks

