

Exercise walk-through

The Normal Distribution, Revisited ■ 5.2

eXercise

You must be able to

- calculate a **z-score** $z = \frac{x - \mu}{\sigma}$
- use the **standard normal** 标准正态 distribution to find proportions and percentiles

Method — The z-score

$$z = \frac{x - \mu}{\sigma}$$

gives how many standard deviations x is from the mean. Positive is above the mean; negative is below.

Method — The standard normal

The **standard normal** distribution has mean 0 and standard deviation 1. Converting to a z-score lets you look up **proportions** and **percentiles**. For $\mu = 70$, $\sigma = 10$, $x = 85$: $z = 1.5$.

Practice 2.1 ■ 1 mark

Write the z-score formula.

Solution 2.1

Worked steps

$$z = \frac{x - \mu}{\sigma} \quad \text{B1}.$$

Practice 2.2 ■ 2 marks

For $\mu = 60$, $\sigma = 8$, find the z-score of $x = 76$.

Solution 2.2

Worked steps

$$z = \frac{76 - 60}{8} = 2 \quad \text{M1} \quad \text{A1}.$$

Practice 2.3 ■ 1 mark

State what a z-score of 0 means.

Solution 2.3

Worked steps

the value equals the mean **B1**.

Exam-style 3.1 ■ 1 mark

A z-score of 2 means a value is

- A** at the mean
- B** 2 standard deviations above the mean
- C** 2 below the mean
- D** impossible

Solution 3.1

- A at the mean
- B 2 standard deviations above the mean** 
- C 2 below the mean
- D impossible

Worked steps

B.

Exam-style 3.2 ■ 1 mark

The standard normal distribution has mean and standard deviation

A 0 and 1

B 1 and 0

C 100 and 15

D any values

Solution 3.2

Method: The standard normal

A 0 and 1



B 1 and 0

C 100 and 15

D any values

Worked steps

A.

Exam-style 3.3 ■ 2 marks

Test scores are normal with $\mu = 500$ and $\sigma = 100$.

- (a) Find the z-score for a score of 650.
- (b) State whether 650 is above or below average.

Solution 3.3

Method: The z-score

Worked steps

$$(a) z = \frac{650 - 500}{100} = 1.5 \quad \text{M1 A1. (b) above average B1.}$$