

1.10 The Normal Distribution

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS normal distribution
• standard deviation

• -score • empirical rule • mean

Objective

Build the skills to answer exam questions on **the normal distribution**.

You must be able to:

- describe the **normal distribution** as a symmetric, bell-shaped model with mean μ and standard deviation σ
- apply the **empirical rule** (68–95–99.7)
- calculate a **z-score** z and use the standard normal distribution

1 Key knowledge and worked examples

Study these first. Each one shows the method for a question type used later.

■ The normal distribution

Symmetric and bell-shaped, fully described by its **mean** μ (center) and **standard deviation** σ (spread).

■ The empirical rule

For a normal distribution, about **68%** of values lie within 1σ , **95%** within 2σ , and **99.7%** within 3σ of the mean.

■ The z-score

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

gives how many standard deviations x is from the mean. With $\mu = 100$, $\sigma = 15$, $x = 130$: $z = 2$.

2 Practice

2.1 State the three percentages of the empirical rule. [2]

2.2 A normal distribution has $\mu = 50$, $\sigma = 5$. Find the z -score of $x = 60$. [2]

2.3 State the two parameters that define a normal distribution. [1]

3 Exam-style questions

3.1 The empirical rule says about 95% of data lie within [1]

- A 1
- B 2
- C 3
- D 4

standard deviations of the mean.

3.2 A z -score measures [1]

☐

A the mean

B how many standard deviations a value is from the mean

C the median

D the range

3.3 IQ scores are normal with $\mu = 100$ and $\sigma = 15$.

(a) Find the z -score for $x = 115$. [2]

(b) State the percentage of scores within 1 standard deviation of the mean. [1]

Solutions

Each answer shows the steps, then the **result**.

2.1

- about 68% within 1σ , 95% within 2σ , 99.7% within 3σ

2.2

- $z = \frac{60 - 50}{5} = 2$

2.3

- the mean μ and the standard deviation σ

3.1 B

- 2.

3.2 B

- how many standard deviations a value is from the mean.

3.3

(a)

- $z = \frac{115 - 100}{15} = 1$

(b)

- about 68%