

Exercise walk-through

1.10

The Normal Distribution

AP Statistics

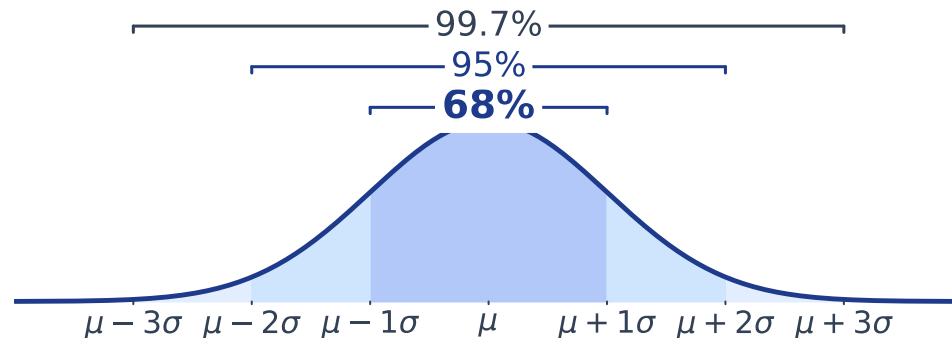
The normal distribution

The **normal distribution**

is set by μ and σ . The **empirical rule** (68–95–99.7):

- 68% within $\mu \pm \sigma$
- 95% within $\mu \pm 2\sigma$; 99.7% within 3σ

The **proportion** below a value = the **area** to its left, found from z .



for approx. normal data: ~68% within 1σ , ~95% within 2σ , ~99.7% within 3σ

Worked example – the empirical rule and z

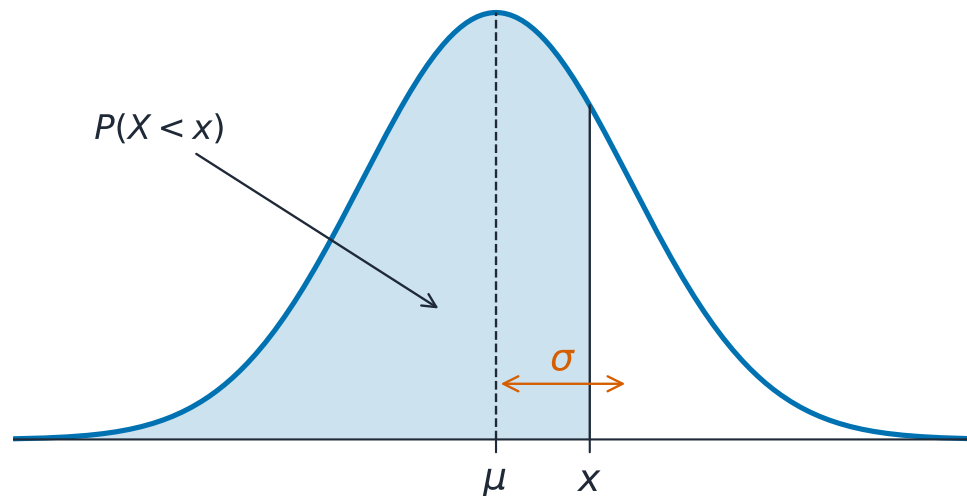
Heights are normal with $\mu = 170$ cm, $\sigma = 8$ cm. (a) What percent are between 154 and 186? (b) Where does 182 cm sit?

(a) $154 = \mu - 2\sigma$ and $186 = \mu + 2\sigma$, so by the empirical rule **95%**.

(b) $z = \frac{182 - 170}{8} = 1.5$ – one and a half SDs **above** the mean.

The empirical rule only works at **whole** multiples of σ . 182 is not one, so it needs z – and z answers “**how many SDs from the mean**”, which is what every later unit builds on.

The Normal Distribution, continued



The normal curve: a probability is the area under it, centred on the mean

Exam tips

- Describe a distribution by **shape, center, spread, and outliers** (SOCS) – always in context.
- The **mean** is pulled by outliers; the **median** resists them, so prefer the median for skewed data.
- For a **normal** distribution use the 68–95–99.7 rule and z-scores $z = \frac{x - \mu}{\sigma}$.
- Compare distributions with side-by-side boxplots and comment on center, spread, and shape.
- Standard deviation measures a typical distance from the mean; the IQR pairs with the median.

Exercises 2.1-2.3

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]

Exercises 2.1-2.3

2.1 State the three percentages of the empirical rule.

[2]

2.1

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

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

[2]

2.2

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

2.3 State the two parameters that define a normal distribution.

[1]

2.3

- the mean μ and the standard deviation σ

Exercise 3.1

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.

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- A 1
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3.1 B

- 2.

Exercise 3.2

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

Exercise 3.2

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

3.2 B

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

Exercise 3.3 (a)

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

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

[2]

Exercise 3.3 (a)

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

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

[2]

(a)

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

Exercise 3.3 (b)

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

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

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

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

(b)

- about 68%