

5.7 Sampling Distributions for Sample Means

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS sampling distribution • standard error

Objective

Build the skills to answer exam questions on **the sampling distribution of a sample mean**.

You must be able to:

- use the mean $\mu_{\bar{x}} = \mu$
- use the standard deviation $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ (the standard error)

1 Key knowledge and worked examples

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

■ Centre and spread

For the sample mean $\bar{x}$:

$$\mu_{\bar{x}} = \mu, \quad \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}.$$

The standard deviation of $\bar{x}$ shrinks as n grows – larger samples give **less** variable means.

■ Example

$$\sigma = 20, n = 100: \sigma_{\bar{x}} = \frac{20}{\sqrt{100}} = 2.$$

2 Practice

2.1 Write the mean of the sampling distribution of $\bar{x}$.

[1]

2.2 For $\sigma = 15$ and $n = 25$, find $\sigma_{\bar{x}}$. [2]

2.3 State what happens to $\sigma_{\bar{x}}$ as n increases. [1]

3 Exam-style questions

3.1 The mean of the sampling distribution of $\bar{x}$ is [1]

- ☐ **A** $\bar{x}$
B μ
C σ
D 0

3.2 The standard deviation of $\bar{x}$ is [1]

- ☐ **A** σ
B $\frac{\sigma}{\sqrt{n}}$
C $\frac{\sigma}{n}$
D $\sqrt{\sigma}$

3.3 A population has $\mu = 50$ and $\sigma = 10$; samples of size $n = 100$ are taken.

(a) Find $\mu_{\bar{x}}$. [1]

(b) Find $\sigma_{\bar{x}}$. [2]

Solutions

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

2.1

- $\mu_{\bar{x}} = \mu$

2.2

- $\sigma_{\bar{x}} = \frac{15}{\sqrt{25}} = 3$

2.3

- it decreases

3.1 B

- μ .

3.2 B

- $\frac{\sigma}{\sqrt{n}}$.

3.3

(a)

- 50

(b)

- $\sigma_{\bar{x}} = \frac{10}{\sqrt{100}} = 1$