

Exercise walk-through

Sampling Distributions for Sample Proportions ■ 5.5

eXercise

You must be able to

- use the mean $\mu_{\hat{p}} = p$
- use the standard deviation $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$
- state the condition for it to be approximately **normal**

Method — Centre and spread

For the sample proportion $\hat{p}$:

$$\mu_{\hat{p}} = p, \quad \sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}.$$

Method — Normal condition

The distribution of $\hat{p}$ is approximately **normal** when $np \geq 10$ and $n(1 - p) \geq 10$.

Method — Example

$$p = 0.5, n = 100: \sigma_{\hat{p}} = \sqrt{\frac{0.25}{100}} = 0.05.$$

Practice 2.1 ■ 1 mark

Write the mean of the sampling distribution of $\hat{p}$.

Solution 2.1

Worked steps

$$\mu_{\hat{p}} = p \quad \text{B1}.$$

Practice 2.2 ■ 2 marks

For $p = 0.4$ and $n = 100$, find $\sigma_{\hat{p}}$.

Solution 2.2

Worked steps

$$\sigma_{\hat{p}} = \sqrt{\frac{0.4 \times 0.6}{100}} = \sqrt{0.0024} = 0.049 \text{ M1 A1}.$$

Practice 2.3 ■ 1 mark

State the condition for the distribution of $\hat{p}$ to be approximately normal.

Solution 2.3

Method: Normal condition

Worked steps

$np \geq 10$ and $n(1 - p) \geq 10$ **B1**.

Exam-style 3.1 ■ 1 mark

The mean of the sampling distribution of $\hat{p}$ is

A $\hat{p}$

B p

C n

D 0

Solution 3.1

A $\hat{p}$

B p



C n

D 0

Worked steps

B.

Exam-style 3.2 ■ 1 mark

The standard deviation of $\hat{p}$ is

A $\frac{p(1-p)}{n}$

B $\sqrt{\frac{p(1-p)}{n}}$

C $\sqrt{np}$

D $\frac{p}{n}$

Solution 3.2

A $\frac{p(1-p)}{n}$

B $\sqrt{\frac{p(1-p)}{n}}$



C $\sqrt{np}$

D $\frac{p}{n}$

Worked steps

B.

Exam-style 3.3 ■ 1 mark

A population has $p = 0.2$; samples of size $n = 64$ are taken.

(a) Find $\mu_{\hat{p}}$.

(b) Find $\sigma_{\hat{p}}$.

Solution 3.3

Worked steps

$$(a) 0.2 \text{ (B1)}. (b) \sigma_{\hat{p}} = \sqrt{\frac{0.2 \times 0.8}{64}} = \sqrt{0.0025} = 0.05 \text{ (M1) (A1)}.$$