

Exercise walk-through

5.8

Sampling Distributions for Differences in Sample Means

AP Statistics

Sampling distribution of a proportion

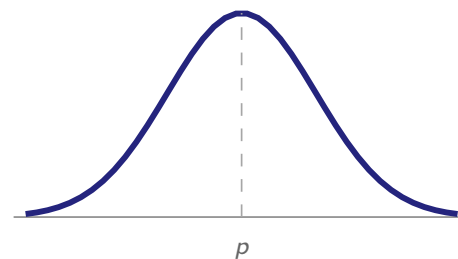
For a sample proportion $\hat{p}$:

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

Normal when two conditions hold:

- **large counts** : $np \geq 10$ and $n(1-p) \geq 10$
- **10% condition** 10% : $n \leq 0.10 N$

$\hat{p}$ is unbiased; bigger n under the root
 $\Rightarrow$ less bounce.



Centered on p ,
spread $\sigma_{\hat{p}}$.

Exam tips

- A **sampling distribution** is the distribution of a statistic over many samples, **centered on the true parameter**.
- The **Central Limit Theorem**: for a large enough sample the sample mean is approximately normal, even if the population is not.
- Larger samples give **less** variability (a smaller standard error).
- Check the conditions (random, independent/10%, large enough) before using a normal model.
- Keep straight what varies – the statistic – versus the fixed parameter.

Check yourself

- 1 Is μ a parameter or a statistic?
- 2 What does the CLT promise for large n ?
- 3 Write the standard error of a sample mean.
- 4 When combining independent variables, what adds?



Answers 1. parameter 2. $\bar{x}$ is approximately normal 3. $\sigma/\sqrt{n}$ 4. the variances

Exercises 2.1-2.3

2.1 Write the mean of the sampling distribution of $\bar{x}_1 - \bar{x}_2$. [1]

2.2 For $\sigma_1 = 6$, $n_1 = 36$, $\sigma_2 = 8$, $n_2 = 64$, find the standard deviation. [2]

2.3 State what this sampling distribution compares. [1]

Exercises 2.1-2.3

2.1 Write the mean of the sampling distribution of $\bar{x}_1 - \bar{x}_2$. [1]

2.1

- $\mu_1 - \mu_2$

2.2 For $\sigma_1 = 6$, $n_1 = 36$, $\sigma_2 = 8$, $n_2 = 64$, find the standard deviation. [2]

2.2

- $\sqrt{\frac{36}{36} + \frac{64}{64}} = \sqrt{1 + 1} = \sqrt{2} \approx 1.41$

2.3 State what this sampling distribution compares. [1]

2.3

- the difference between two population means

Exercise 3.1

3.1 The mean of $\bar{x}_1 - \bar{x}_2$ is

[1]

☐

A $\mu_1 \cdot \mu_2$

B $\mu_1 - \mu_2$

C $\mu_1 + \mu_2$

D 0

Exercise 3.1

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[1]

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A $\mu_1 \cdot \mu_2$

B $\mu_1 - \mu_2$

C $\mu_1 + \mu_2$

D 0

3.1 B

- $\mu_1 - \mu_2$.

Exercise 3.2

3.2 The standard deviation of $\bar{x}_1 - \bar{x}_2$ is $\sqrt{\quad}$ where the blank is

[1]

- ☐ **A** $\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}$
- B** $\frac{\sigma_1}{n_1} + \frac{\sigma_2}{n_2}$
- C** $\sigma_1^2 - \sigma_2^2$
- D** $\sigma_1 \cdot \sigma_2$

Exercise 3.2

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- D** $\sigma_1 \cdot \sigma_2$

3.2 A

• $\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}.$

Exercise 3.3 (a)

3.3 $\sigma_1 = 10$, $n_1 = 25$, $\sigma_2 = 10$, $n_2 = 25$.

(a) Write the formula for the standard deviation.

[1]

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[1]

(a)

- $\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$

Exercise 3.3 (b)

3.3 $\sigma_1 = 10$, $n_1 = 25$, $\sigma_2 = 10$, $n_2 = 25$.

(b) Find its value.

[2]

Exercise 3.3 (b)

3.3 $\sigma_1 = 10$, $n_1 = 25$, $\sigma_2 = 10$, $n_2 = 25$.

(b) Find its value.

[2]

(b)

- $\sqrt{\frac{100}{25} + \frac{100}{25}} = \sqrt{8} \approx 2.83$