Random-variable sums and sampling distributions

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A sample from this topic. The complete topic collection contains three different resources and worked solutions.

Read the worked example, then show each step in the practice questions. Show the mathematical steps. A calculator, graphing tool or CAS may be used to check results where useful.

What you will practise

• Simulation, sampling and sampling distributions

Useful starting skills: Year 10 and relevant Year 10A algebra, functions and trigonometry; concurrent Methods supports these topics.

A sample mean changes when a new random sample is drawn. Its sampling distribution describes this variation, rather than the distribution of the original observations.

Independent copies of a random variable add variances; multiplying one variable by a constant squares the multiplier in its variance. Thus 2 X differs from X_1+X_2 even when all have the same mean.

Worked example

X has mean 3 and variance 2. Compare mean and variance of 2 X with X_1+X_2 for independent copies.

Var(2 X)=4 Var X; Var(X_1+X_2)=2+2.

Answer: Both means 6; variances 8 and 4.

Try it yourself

Name: _____ Date: _____

1. A variable takes 0 or 1 with equal probability. Find mean and variance.

2. For independent copies of that variable, give distribution of X_1+X_2.

Answers and explanations

Check the method as well as the final answer. An alternative correct method is also valid.

1. 1/2 and 1/4.

$E(X)=1/2$, $E(X^2)=1/2$; subtract 1/4.

2. Values 0, 1, 2 with probabilities 1/4, 1/2, 1/4.

List the four equally likely ordered outcomes.

Curriculum reference: Specialist Mathematics Units 1–2 — Simulation, sampling and sampling distributions

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