



Year 12 Further Mathematics – Discrete Random Variables

Learning about this topic is important because:

Being able to work with discrete random variables is an important tool in probability. Banks and stock market traders use random variables to model their risks on investments and in calculating the expected value of their profits.

This builds on: Probability Y11/Y12, Probability distributions Y12, Measures of location and spread Y12, Coding Y12

This leads to: Poisson distribution Y12FM, Chi-squared tests Y12FM, Probability generating functions Y13FM

We will learn to:

- Find the expected value of a discrete random variable X
- Find the expected value of X^2
- Find the variance of a discrete random variable
- Use the expected value and variance of a function of X
- Solve problems involving random variables

We will develop/practise skills including:

- Use and apply standard techniques: Select and correctly carry out routine procedures; and accurately recalling facts, terminology and definitions.
- Reason, interpret and communicate mathematically: Construct rigorous mathematical arguments, make deductions and inferences, assess the validity of mathematical arguments, explaining your reasoning; and using mathematical language and notation correctly.
- Solve problems within mathematics and in other contexts: Translate problems in mathematical and non-mathematical contexts into mathematical processes, use mathematical models and interpret solutions to problems in their original context, and, where appropriate, evaluating their accuracy and limitations and explain how to refine them.

Some of the vocabulary that we will use includes:

Discrete, random variable, probability, probability distribution, expected value, variance, function, coded, sample space diagram, uniform distribution.

You could learn more about this topic by:

Completing all exercises, mixed exercises, challenges and review questions from the textbook, seeking additional support from your teachers at lunchtime drop-in sessions, searching online for the topic and GeoGebra to find relevant visual and interactive tools for understanding new concepts, using free question banks and revision tools on websites such as MathsGenie and Physics Maths Tutor.





Year 12 Further Mathematics – Discrete Random Variables

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The work you produce in class (your file), homework, independent study and regular assessment all form the key pieces of work in this topic.



Year 12 Further Mathematics – Poisson Distributions

Learning about this topic is important because:

Being able to work with the Poisson distribution is important to be able to model real-world situations in which you want to estimate the number of times an event occurs within a fixed time frame. This is useful in predicting weather events, predicting calls in a call centre, number of patients arriving in A&E or number of customers arriving in a shop/restaurant.

This builds on: Probability Y11/Y12, Probability distributions Y12, binomial distribution Y12, Hypothesis testing Y12, Measures of location and spread Y12, Coding Y12

This leads to: Hypothesis testing Y12FM, Chi-squared tests Y12FM, Probability generating functions Y13FM

We will learn to:

- Use the Poisson distribution to model real-world situations
- Use the additive property of the Poisson distribution
- Understand and use the mean and variance of the Poisson distribution
- Understand and use the mean and variance of the binomial distribution
- Use the Poisson distribution as an approximation to the binomial distribution

We will develop/practise skills including:

- Use and apply standard techniques: Select and correctly carry out routine procedures; and accurately recalling facts, terminology and definitions.
- Reason, interpret and communicate mathematically: Construct rigorous mathematical arguments, make deductions and inferences, assess the validity of mathematical arguments, explaining your reasoning; and using mathematical language and notation correctly.
- Solve problems within mathematics and in other contexts: Translate problems in mathematical and non-mathematical contexts into mathematical processes, use mathematical models and interpret solutions to problems in their original context, and, where appropriate, evaluating their accuracy and limitations and explain how to refine them.

Some of the vocabulary that we will use includes:

Binomial distribution, Poisson distribution, modelling, Independent, time frame, constant rate, mean, variance, parameter, approximation, probability, probability distribution.

You could learn more about this topic by:

Completing all exercises, mixed exercises, challenges and review questions from the textbook, seeking additional support from your teachers at lunchtime drop-in sessions, searching online for the topic and GeoGebra to find relevant visual and interactive tools for understanding





Year 12 Further Mathematics – Poisson Distributions

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Year 12 Further Mathematics – Hypothesis Testing

Learning about this topic is important because:

Being able to carry out a hypothesis test is important to help decide whether the *observed* number of events is consistent with a known or expected event rate, or whether the rate has increased, decreased, or changed significantly. This helps organisations detect surges in demand (ER, call centres, retail), system degradation (failures, outages) or economic shifts.

This builds on: Probability Y12, Hypothesis testing Y12, Poisson distribution Y12FM

This leads to: Hypothesis Testing Y13FM, Chi-squared tests Y12FM

We will learn to:

- Use hypothesis tests to test for the mean λ of a Poisson distribution
- Find critical regions of a Poisson distribution using tables

We will develop/practise skills including:

- Use and apply standard techniques: Select and correctly carry out routine procedures; and accurately recalling facts, terminology and definitions.
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- Solve problems within mathematics and in other contexts: Translate problems in mathematical and non-mathematical contexts into mathematical processes, use mathematical models and interpret solutions to problems in their original context, and, where appropriate, evaluating their accuracy and limitations and explain how to refine them.

Some of the vocabulary that we will use includes:

Hypothesis test, critical value, extreme value, null hypothesis, alternate hypothesis, binomial distribution, significance level, sufficient/insufficient evidence, accept, reject, one-tailed, two-tailed.

You could learn more about this topic by:

Completing all exercises, mixed exercises, challenges and review questions from the textbook, seeking additional support from your teachers at lunchtime drop-in sessions, searching online for the topic and GeoGebra to find relevant visual and interactive tools for understanding new concepts, using free question banks and revision tools on websites such as MathsGenie and Physics Maths Tutor.





Year 12 Further Mathematics – Hypothesis Testing



West Kirby
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Year 12 Further Mathematics – Chi-Squared Tests

Learning about this topic is important because:

Being able to carry out a chi-squared test is important to test whether patterns are real or just occur at random. Chi-squared tests are useful for example to test whether vaccinated and unvaccinated groups have different hospitalization rates or to test if disease occurrence is associated with particular habits; such as smoking or drinking. It can also be used in business, politics, education and many more areas.

This builds on: Probability Y12, Hypothesis testing Y12, Binomial distribution Y12, Poisson distribution Y12FM

This leads to: Chi-squared tests Y13FM

We will learn:

- Form hypotheses about how well a distribution fits as a model for an observed frequency distribution and measure goodness of fit of a model to observed data
- Understand degrees of freedom and use the chi-squared (χ^2) family of distributions
- Be able to test a hypothesis
- Apply goodness-of-fit tests to discrete data
- Use contingency tables

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- Reason, interpret and communicate mathematically: Construct rigorous mathematical arguments, make deductions and inferences, assess the validity of mathematical arguments, explaining your reasoning; and using mathematical language and notation correctly.
- Solve problems within mathematics and in other contexts: Translate problems in mathematical and non-mathematical contexts into mathematical processes, use mathematical models and interpret solutions to problems in their original context, and, where appropriate, evaluating their accuracy and limitations and explain how to refine them.

Some of the vocabulary that we will use includes:

Null Hypothesis, alternative hypothesis, theoretical distribution, observed frequency, expected frequency, goodness of fit, degrees of freedom, constraint, hypothesis test, critical value, region, model, uniform distribution, poisson distribution, binomial distribution, probability, contingency table.

You could learn more about this topic by:

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