



Year 13 Further Mathematics – Geometric and Negative Binomial Distributions

Learning about this topic is important because:

The geometric and negative binomial distributions are used to deal with repeated, independent attempts when you want to understand how long it takes for successes to occur. This is particularly useful in Infectious disease studies to predict the number of contacts until a person transmits a disease x times or in quality control to predict the number of items until a defective item occurs.

This builds on: Probability Y12, Binomial distribution Y12, Discrete random variables Y12FM,

This leads to: Hypothesis testing Y13FM, Central Limit Theorem Y13FM, Chi-Squared tests Y13FM, Probability Generating Functions Y13FM, Quality of Tests Y13FM

We will learn to:

- Understand and use the geometric distribution
- Calculate and use the mean and variance of the geometric distribution
- Understand and use the negative binomial distribution
- Calculate and use the mean and variance of the negative 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:

Geometric distribution, negative distribution, successive, Independent trials, probability, probability function, cumulative geometric distribution, assumption, mean, variance, success.

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 13 Further Mathematics – Geometric and Negative Binomial Distributions

	new concepts, using free question banks and revision tools on websites such as MathsGenie and Physics Maths Tutor.
--	--

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 13 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 is especially valuable in manufacturing, sales, polling, engineering, and biological systems.

This builds on: Geometric Distributions Y13FM, Hypotheses testing Y12FM

This leads to: Quality of Tests Y13FM

We will learn to:

- Use hypothesis tests to test for the parameter p in a geometric distribution
- Find critical regions of a geometric distribution
- Apply goodness-of-fit tests to geometric distributions

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:

Hypothesis test, null hypothesis, alternative hypothesis, assumption, geometric distribution, significance level, critical value, region, probability, expected frequency, observed frequency, assumption, goodness of fit, degrees of freedom, constraints, (in)sufficient evidence.

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 13 Further Mathematics – Hypothesis Testing

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 13 Further Mathematics –Central Limit Theorem

Learning about this topic is important because:

The central limit theorem gives information about the distribution of the sample mean. It is used in statistics to infer how likely the views of a sample are to be representative of the population.

This builds on: Normal Distribution Y13, Poisson distribution Y12FM, Binomial distribution Y12 and Y13FM

This leads to: Maths and Statistics in Further Education

We will learn:

- Understand and apply the central limit theorem to approximate the sample mean of a random variable
- Apply the central limit theorem to other distributions

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:

Normal distribution, poisson distribution, binomial distributions, geometric distribution, probability, sample, sample mean, population, mean, variance.

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 13 Further Mathematics –Central Limit Theorem

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 13 Further Mathematics – Probability Generating Functions

Learning about this topic is important because:

Probability Generating Functions are used in real life whenever you need to model random counts, repeated events, or processes that evolve over time, especially when you want to compute expectations, variances, or distributions of sums of random variables efficiently. It can be used by actuaries to calculate risk in order to advise insurance companies what premiums to charge customers.

This builds on: Probability Y12, Discrete Random Variables Y12FM, Binomial distributions Y12 and Y13FM, Poisson distribution Y12FM, Differentiation Y12/13,

This leads to: Maths and Statistics in Further Education.

We will learn to:

- Understand the use of probability generating functions
- Use probability generating functions for standard distributions
- Use probability generating functions to find the mean and variance of a distribution
- Know the probability generating function of the sum of independent 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:

Probability, binomial distribution, poisson distribution, discrete random variable, dummy variable, expectation, mean, variance, differentiation, coding.

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 13 Further Mathematics – Probability Generating Functions

	new concepts, using free question banks and revision tools on websites such as MathsGenie and Physics Maths Tutor.
--	--

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 13 Further Mathematics – Quality of Tests



West Kirby
Grammar School

Learning about this topic is important because:

Being able to analyse the reliability of a hypothesis test is important to ensure accuracy in results. This is useful to test if marketing campaigns or medical treatments are effective for example and can determine whether drugs get approved for public use.

This builds on: Probability Y12, Hypothesis testing Y12 and Y13FM, Distributions Y12/13 statistics

This leads to: Maths and Statistics in Further Education

We will learn:

- Know about Type I and Type II errors
- Find Type I and Type II errors using the normal distribution
- Calculate the size and power of a test
- Draw a graph of the power function for a test

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:

Type I error, type II error, probability, hypothesis test, significance level, critical value/region, null hypothesis, alternative hypothesis, accept, reject, true, false, given, one-tailed, two-tailed, binomial distribution, normal distribution, sample mean, sample variance, size of the test, power of the test, power function.

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 13 Further Mathematics – Quality of Tests



West Kirby
Grammar School

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.