Mathematical Methods

EP Curriculum Map

Mathematical Methods: Unit 1

Topic 1: Arithmetic and Geometric Sequences and Series 1

Arithmetic sequences

Content Descriptor	Lesson Names
recognise and use the recursive definition of an arithmetic sequence: t_n+1 = t_n+d	• Introduction to Sequences • Finding an Arithmetic Term • Recursive Sequences
use the formula t_n=t_1 + (n-1)d for the general term of an arithmetic sequence and recognise its linear nature	• Finding an Arithmetic Term • Finding a Term Number for an Arithmetic Sequence
use arithmetic sequences in contexts involving discrete linear growth or decay, such as simple interest	• Finding an Arithmetic Term • Finding a Term Number for an Arithmetic Sequence
establish and use the formula for the sum of the first n terms of an arithmetic sequence: S_n = n/2(2t_1+(n-1)d) = n/2(t_1+t_n)	• Summing Arithmetic Sequences • The Arithmetic Sum Rule • Arithmetic Sums: Solving for the First Term or Common Difference • Solving for an Arithmetic Term Number

Topic 2: Functions and Graphs

Functions

Content Descriptor	Lesson Names
understand the concept of a relation as a mapping between sets, a graph and as a rule or a formula that defines one variable quantity in terms of another	• Introduction to Functions • Function Notation
recognise the distinction between functions and relations and use the vertical line test to determine whether a relation is a function	• Introduction to Functions • Function Notation
use function notation, domain and range, and independent and dependent variables	• Introduction to Functions • Function Notation
examine transformations of the graphs of f(x), including dilations and reflections, and the graphs of y=af(x) and	• Inverse Functions and Transformations

y=(bx), translations and the graphs of y=f(x+c) and y=f(x)+d; a, b, c, d in R	
recognise and use piece-wise functions as a combination of multiple sub-functions with restricted domains	• Step Functions • Piecewise Functions
identify contexts suitable for modelling piece-wise functions and use them to solve practical problems (taxation, taxis, the changing velocity of a parachutist).	• Step Functions • Piecewise Functions

Review of quadratic relationships

Content Descriptor	**Lesson Names**
examine examples of quadratically related variables	• Parabolas
recognise and determine features of the graphs of y=x^2, y=ax^2 + bx + c, and y=a(x-b)(x-c), including their parabolic nature, turning points, axes of symmetry and intercepts	• Parabolas • Parabola Transformations • Multiple Transformations of Parabolas
solve quadratic equations algebraically using factorisation, the quadratic formula (both exact and approximate solutions), and completing the square and using technology	• Monic Factorisation • Non-Monic Factorisation • Solving Monic Quadratic Equations • Solving Non-Monic Quadratic Equations • The Quadratic Formula
identify contexts suitable for modelling with quadratic functions and use models to solve problems with and without technology; verify and evaluate the usefulness of the model using qualitative statements and quantitative analysis	• Writing Quadratic Equations • Applications of Quadratic Equations • Solving Quadratic Equations: Further Questions
understand the role of the discriminant to determine the number of solutions to a quadratic equation	• The Quadratic Formula
determine turning points and zeros of quadratic functions with and without technology.	• Monic Factorisation • Non-Monic Factorisation • Solving Monic Quadratic Equations • Solving Non-Monic Quadratic Equations • The Quadratic Formula

Inverse proportions

Content Descriptor	**Lesson Names**
examine examples of inverse proportion	• Hyperbola Graphs
recognise features of the graphs of y=1/x and y=a/(x-b), including their hyperbolic shapes, their intercepts, their asymptotes and behaviour as $x \to \infty$ and $x \to -\infty$.	• Hyperbola Graph Transformations

Powers and polynomials

Content Descriptor	Lesson Names
identify the coefficients and the degree of a polynomial	• Introduction to Polynomials
expand quadratic and cubic polynomials from factors	• Expanding Cubic Expressions
recognise and determine features of the graphs of $y=x^3$, $y=a(x-b)^3 + c$ and $y=k(x-a)(x-b)(x-c)$, including shape, intercepts and behaviour as $x \to \infty$ and $x \to -\infty$	• Features of Polynomial Graphs • Features of Graphs - Roots • Cubics • Cubic Transformations
use the factor theorem to factorise cubic polynomials in cases where a linear factor is easily obtained	• Dividing Polynomials • The Remainder Theorem • The Factor Theorem • Factorising Cubic Polynomials
solve cubic equations using technology, and algebraically in cases where a linear factor is easily obtained	• Factorising Cubic Polynomials • Solving Polynomials
recognise and determine features of the graphs $y = a(x - b)^4 + c$, including shape and behaviour	• Features of Polynomial Graphs • Features of Graphs - Roots • Quartics • Factorising Quartic Polynomials
solve equations involving combinations of the functions above, using technology where appropriate.	• Evaluating Polynomials • Adding, Subtracting and Multiplying Polynomials • Solving Polynomials

Graphs of relations

Content Descriptor	Lesson Names
recognise and determine features of the graphs of $x^2 + y^2 = r^2$ and $(x-a)^2 + (y-b)^2 = r^2$, including their circular shapes, centres and radii	• Circle Graphs
recognise and determine features of the graph of $y^2 = x$, including its parabolic shape and axis of symmetry.	*Coming Soon* We want to work with you! If you are interested in partnering with EP to develop this topic, please contact ben.hilliam@educationperfect.com with an expression of interest.

Topic 3: Counting and Probability

Language of events and sets

Content Descriptor	Lesson Names
recall the concepts and language of outcomes, sample	• Probability Terms and Concepts

spaces and events as sets of outcomes	• Terminology
use set language and notation for events, including Abar or A' for the complement of an event, A, A ∩ B for the intersection of events A and B, and A ∪ B for the union, and recognise mutually exclusive events	• Probability Terms and Concepts • Terminology • Venn Diagrams
use everyday occurrences to illustrate set descriptions and representations of events, and set operations, including the use of Venn diagrams.	• Venn Diagrams

Review of the fundamentals of probability

Content Descriptor	**Lesson Names**
recall probability as a measure of 'the likelihood of occurrence' of an event	• Outcomes • Likelihood
recall the probability scale: 0≤P(A)≤1 for each event A, with P(A)=0 if A is an impossibility and P(A)=1 if A is a certainty	• Likelihood
recall the rules P(Abar)=1-P(A) and P(A∪B) = P(A) + P(B) - P(A∩B)	• Multiplication & Addition Rules
use relative frequencies obtained from data as point estimates of probabilities.	• Relative Frequencies • Using Relative Frequencies

Conditional probability and independence

Content Descriptor	**Lesson Names**
understand the notion of a conditional probability, and recognise and use language that indicates conditionality	• Introduction to Conditional Probability
use the notation P(A|B) and the formula P(A∩B) = P(A|B)/P(B) to solve problems	• Introduction to Conditional Probability • Investigating Conditional Probability with Venn Diagrams • Investigating Conditional Probability with Two-Way Tables • Calculating Conditional Probability Using Tree Diagrams • Calculating Conditional Probabilities using Arrays • Word Problems
understand and use the notion of independence of an event A from an event B, as defined by P(A|B)=P(A)	• Introduction to Independence
establish and use the formula P(A∩B)=P(A)P(B) for independent events A and B	• Introduction to Independence
use relative frequencies obtained from data as point estimates of conditional probabilities and as indications	• Investigating Independent Events using Chance Diagrams

of possible independence of events.	

Binomial expansion

Content Descriptor	Lesson Names
understand the notion of a combination as an unordered set of r objects taken from a set of n distinct objects recognise and use the link between Pascal's triangle and the notation (n choose r) expand (x+y)^n for small positive integers n	*Coming Soon* We want to work with you! If you are interested in partnering with EP to develop this topic, please contact ben.hilliam@educationperfect.com with an expression of interest.

Topic 4: Exponential functions 1

Indices and the index laws

Content Descriptor	Lesson Names
recall indices (including negative and fractional indices) and the index laws	• Index Laws and Fractional Powers
convert radicals to and from fractional indices	• Introduction to Surds
understand and use scientific notation.	• Introduction to Scientific Notation (Standard Form) - Large Numbers • Introduction to Scientific Notation (Standard Form) - Small Numbers • Significant Figures and Scientific Notation (Standard Form) • Ordering Numbers and Estimating Calculations in Scientific Notation (Standard Form) • Adding and Subtracting with Scientific Notation (Standard Form) • Multiplying and Dividing in Scientific Notation (Standard Form) • Scientific Notation Glossary

Topic 5: Arithmetic and Geometric Sequences and Series 2

Geometric sequences

Content Descriptor	Lesson Names
recognise and use the recursive definition of a geometric sequence: t_(n=1) = rt_n use the formula t_n = t_1 r^(n-1) for the general term of	• Recursive Sequences • Geometric Sequences

a geometric sequence and recognise its exponential nature understand the limiting behaviour as $n \to \infty$ of the terms t_n in a geometric sequence and its dependence on the value of the common ratio r	
establish and use the formula $S=t_1(r^n-1)(r-1)$ for the sum of the first n terms of a geometric sequence	• Summing Geometric Sequences
establish and use the formula $S_\infty = t_1 / (1-r)$, $\|r\|<1$ for the sum to infinity of a geometric progression	• Sums to Infinity
use geometric sequences in contexts involving geometric growth or decay, including compound interest and annuities.	• Logs of Geometric Sequences and Sums

Mathematical Methods: Unit 2

Topic 1 : Exponential Functions 2

Introduction to exponential functions

Content Descriptor	Lesson Names
recognise and determine the qualitative features of the graph of $y=a^x$ $(a>0)$, including asymptotes, and of its translations ($y=a^x + b$ and $y=a^{x+c}$) recognise and determine the features of the graphs of $y=b.\ a^x$ and $y=a^{kx}$ $(k\neq0)$ Identify contexts suitable for modelling by exponential functions and use models to solve practical problems; verify and evaluate the usefulness of the model using qualitative statements and quantitative analysis	• Exponential Graphs
solve equations involving exponential functions with and without technology.	• Solving Exponential Equations

Topic 2: The Logarithmic Function 1

Introduction to logs

Content Descriptor	Lesson Names
define logarithms as indices: $a^x = b$ is equivalent to $x=\log_a(b)$	• Introduction to Logarithms

recognise the inverse relationship between logarithms and exponentials: y=a^x is equivalent to x=log_a (y)	• Introduction to Logarithms • Log Laws and Log Functions
solve equations involving indices with and without technology.	• Log Laws and Log Functions

Topic 3: Trigonometric Functions 1

Circular measure and radian measure

Content Descriptor	Lesson Names
define and use radian measure and understand its relationship with degree measure	• The Unit Circle and Radians
calculate lengths of arcs and areas of sectors in circles.	• Area of Sectors and Segments Finding an Arc Length

Introduction to trigonometric functions

Content Descriptor	Lesson Names
understand the unit circle definition of cos(θ), sin(θ) and tan(θ) and periodicity using radians	• Understanding and Graphing Sine • Understanding and Graphing Cosine • Understanding and Graphing Tangent • Comparing Trigonometric Functions
recall the exact values of sin(θ), cos(θ) and tan(θ) at integer multiple of π /6 and π /4	• Special Triangles: 30-60-90 • Special Triangles: 45-45-90 • Trigonometric Ratios and Complementary Angles
sketch the graphs of y=sin(x), y=cos(x), and y=tan(x) on extended domains	• Understanding and Graphing Sine • Understanding and Graphing Cosine • Understanding and Graphing Tangent • Comparing Trigonometric Functions
investigate the effect of the parameters A, B, C and D on the graphs of y=A sin (B(x+C)) + D, y=A cos (B(x+C)) + D with and without technology sketch the graphs of y=A sin (B(x+C)) + D, y=A cos (B(x+C)) + D with and without technology identify contexts suitable for modelling by trigonometric functions and use them to solve practical problems; verify and evaluate the usefulness of the model using qualitative statements and quantitative analysis solve equations involving trigonometric functions with and without technology; including use of the Pythagorean identity sin^2 (A) + cos^2 (A) = 1	Coming Soon We want to work with you! If you are interested in partnering with EP to develop this topic, please contact ben.hilliam@educationperfect.com with an expression of interest.

Topic 4 : Introduction to Differential Calculus

Rates of change and the concept of derivatives

Content Descriptor	Lesson Names
explore average and instantaneous rate of change in a variety of practical contexts	• Rates of Change • Introduction to Derivatives • Sketching the Gradient Function from the Original Function
use a numerical technique to estimate a limit or an average rate of change	• Rates of Change • Introduction to Derivatives
examine the behaviour of the difference quotient (f(x+h)-f(x))/(h) as h→0 as an informal introduction to the concept of a limit	• Differentiation By First Principles • Sketching the Gradient Function from the Original Function
differentiate simple power functions and polynomial functions from first principles	• Differentiation By First Principles
interpret the derivative as the instantaneous rate of change	• Sketching the Gradient Function from the Original Function • Introduction to Derivatives
interpret the derivative as the gradient of a tangent line of the graph of y=f(x)	• Sketching the Gradient Function from the Original Function • Introduction to Derivatives

Properties and computation of derivatives

Content Descriptor	Lesson Names
examine examples of variable rates of change of non-linear functions	• Features of Graphs
establish the formula d/dx (x^n) = nx^{n-1} for positive integers	• Differentiating Polynomials • Rearranging Expressions to Index Form • Rearranging into Index Form with Negative and Non-Integer Powers • Differentiating Negative Powers • Differentiating Non-Integer Powers
understand the concept of the derivative as a function	• Differentiating Polynomials
recognise and use properties of the derivative d/dx (f(x) + g(x)) = d/dx f(x) + d/dx g(x)	• Differentiating Polynomials
calculate derivatives of power and polynomial functions	• Differentiating Polynomials • Rearranging Expressions to Index Form

	• Rearranging into Index Form with Negative and Non-Integer Powers • Differentiating Negative Powers • Differentiating Non-Integer Powers

Applications of derivatives

Content Descriptor	Lesson Names
determine instantaneous rates of change	• Applications of Rates of Change • Gradient at a Point
determine the gradient of a tangent and the equation of the tangent	• Finding a Tangent to a Curve
construct and interpret displacement-time graphs, with velocity as the slope of the tangent	• Analysing Travel Graphs • Plotting and Reading Travel Graphs • Distance, Velocity and Acceleration • Kinematics
sketch curves associated with power functions and polynomials up to and including degree 4; find stationary points and local and global maxima and minima with and without technology; and examine behaviour as $x \to \infty$ and $x \to -\infty$	• Sketching Graphs
identify contexts suitable for modelling optimisation problems involving polynomials up to and including degree 4 and power functions on finite interval domains, and use models to solve practical problems with and without technology; verify and evaluate the usefulness of the model using qualitative statements and quantitative analysis.	• Optimisation

Topic 5: Further Differentiation and Applications 1

Differentiation rules

Content Descriptor	Lesson Names
understand and apply the product rule and quotient rule for power and polynomial functions	• Differentiation of Polynomials • The Product Rule • The Quotient Rule
understand the notion of composition of power and polynomial functions and use the chain rule for determining the derivatives of composite functions	• The Chain Rule
select and apply the product rule, quotient rule and chain rule to differentiate power and polynomial functions; express derivative in simplest and factorised form.	• Combining Multiple Rules

Topic 6: Discrete random variables 1

General discrete random variables

Content Descriptor	Lesson Names
recognise uniform discrete random variables and use them to model random phenomena with equally likely outcomes examine simple examples of non-uniform discrete random variables recognise the mean or expected value of a discrete random variable as a measurement of centre, and evaluate it in simple cases recognise the variance and standard deviation of a discrete random variable as a measure of spread, and evaluate these in simple cases use discrete random variables and associated probabilities to solve practical problems.	• Expected Number *Further Development Coming Soon* We want to work with you! If you are interested in partnering with EP to develop this topic, please contact ben.hilliam@educationperfect.com with an expression of interest.

Mathematical Methods: Unit 3

Topic 1: The Logarithmic Function 2

Logarithmic laws and logarithmic functions

Content Descriptor	Lesson Names
establish and use logarithmic laws and definitions	• Deriving the Laws of Logarithms • Using the Laws of Logarithms • Combining Log Laws
interpret and use logarithmic scales such as decibels in acoustics, the Richter scale for earthquake magnitude, octaves in music, pH in chemistry	• Logarithmic Scales
solve equations involving indices with and without technology	• Solving Using Logarithm Laws • Exponentials and Logarithms: Multiple Variables • Solving Exponential Equations Using Logarithms • Applications of Exponential Equations
recognise the qualitative features of the graph of y=log_a (x) (a>1), including asymptotes, and of its translations y=log_a (x) + b and y=log_a (x+c)	*Further development planned*
solve equations involving logarithmic functions with and without technology	• Solving Using Logarithm Laws • Exponentials and Logarithms: Multiple Variables • Solving Exponential Equations Using Logarithms • Applications of Exponential Equations
identify contexts suitable for modelling by logarithmic functions and use them to solve practical problems; verify and evaluate the usefulness of the model using qualitative statements and quantitative analysis.	• Applications of Exponential Equations

Topic 2: Further Differentiation and Applications 2

Calculus of exponential functions

Content Descriptor	Lesson Names
estimate the limit of (a^{h-1})/(h) as h→0 using technology, for various values of a>0 recognise that e is the unique number a for which the above limit is 1 define the exponential function e^x	• Exponential Functions *Further Development Coming Soon* We want to work with you! If you are interested in partnering with EP to develop this topic, please contact ben.hilliam@educationperfect.com with an expression of interest.

establish and use the formula d/dx (e^x) = e^x and d/dx e^{f(x)} = f'(x) e^{f(x)} identify contexts suitable for mathematical modelling by exponential functions and their derivatives and use the model to solve practical problems; verify and evaluate the usefulness of the model using qualitative statements and quantitative analysis.	

Calculus of logarithmic functions

Content Descriptor	Lesson Names
define the natural logarithm ln(x) = log_e (x) recognise and use the inverse relationship of the functions y=e^x and y= ln(x) establish and use the formulas d/dx (ln(x)) = 1/x and d/dx (ln f(x)) = f'(x) / f(x) use logarithmic functions and their derivatives to solve practical problems	• Natural Logarithms *Further Development Coming Soon* We want to work with you! If you are interested in partnering with EP to develop this topic, please contact ben.hilliam@educationperfect.com with an expression of interest

Calculus of trigonometric functions

Content Descriptor	Lesson Names
establish the formulas d/dx sin(x) = cos(x), and d/dx cos(x) = -sin(x) by numerical estimations of the limits and informal proofs based on geometric constructions identify contexts suitable for modelling by trigonometric functions and their derivatives and use the model to solve practical problems; verify and evaluate the usefulness of the model using qualitative statements and quantitative analysis use trigonometric functions and their derivatives to solve practical problems; including trigonometric functions of the form y=sin(f(x)) and y=cos(f(x))	• Trigonometric Functions *Further Development Coming Soon* We want to work with you! If you are interested in partnering with EP to develop this topic, please contact ben.hilliam@educationperfect.com with an expression of interest

Differentiation rules

Content Descriptor	Lesson Names
select and apply the product rule, quotient rule and chain rule to differentiate functions; express derivatives in simplest and factorised form.	• Mixed Differentiation Techniques

Topic 3: Integrals

Anti-differentiation

Content Descriptor	Lesson Names
recognise anti-differentiation as the reverse of differentiation	• Sketching the Original Function • Anti-Differentiating Polynomials • Equation of the Original Function
use the notation $\int f(x)\,dx$ for the anti-derivatives of indefinite integrals	• Sketching the Original Function • Anti-Differentiating Polynomials • Equation of the Original Function
establish and use the formula $\int x^n\,dx = \frac{1}{n+1} x^{n+1} + c$ for $n \neq -1$	• Anti-Differentiating Polynomials • Equation of the Original Function • Integrating Polynomials
establish and use the formula $\int e^x\,dx = e^x + c$	• Integrating Exponentials • Finding the Constant of Integration
establish and use the formulas $\int 1/x\,dx = \ln(x) + c$, for $x>0$ and $\int 1/(ax+b)\,dx = 1/a \ln(ax+b) + c$	*Further development planned*
establish and use the formulas $\int \sin(x)dx = -\cos(x)$ and $\int \cos(x)dx = \sin(x)+c$	• Integrating Trigonometric Functions • Trigonometric Functions: Finding the Constant
understand and use the formula for indefinite integrals of the form $\int (f(x)+g(x))dx = \int f(x)dx + \int g(x)dx$	• Anti-Differentiating Polynomials • Equation of the Original Function • Integrating Polynomials • Integrating Exponentials • Finding the Constant of Integration • Integrating Trigonometric Functions • Trigonometric Functions: Finding the Constant
determine indefinite integrals of the form $\int f(ax+b)dx$	*Further development planned*
determine $f(x)$, given $f'(x)$ and an initial condition $f(a)=b$	• Finding the Constant of Integration • Trigonometric Functions: Finding the Constant
determine the integral of a function using information about the derivative of the given function (integration by recognition)	*Further development planned*
determine displacement given velocity in linear motion problems.	• Rates of Change • Kinematics

Fundamental theorem of calculus and definite integrals

Content Descriptor	**Lesson Names**
examine the area problem, and use sums of the form $\sum_i f(x_i)\delta x_i$, to estimate the area under the curve $y=f(x)$	*Coming Soon* We want to work with you! If you are interested in partnering with EP to develop this topic, please contact ben.hilliam@educationperfect.com with an expression of interest.
use the trapezoidal rule for the approximation of the value of a definite integral numerically	• The Trapezium Rule
interpret the definite integral $\int_a^b f(x)dx$ as area under the curve $y=f(x)$ if $f(x)>0$	• Introduction to Definite Integrals • Area Under a Curve
recognise the definite integral $\int_a^b f(x)dx$ as a limit of sums of the form $\sum_i f(x_i)\delta x_i$	• Introduction to Definite Integrals
understand the formula $\int_a^b f(x)dx=F(b)-F(a)$ and use it to calculate definite integrals	• Introduction to Definite Integrals

Applications of integration

Content Descriptor	**Lesson Names**
calculate the area under a curve	• Area Under a Curve • Area Above and Below the x-Axis
calculate total change by integrating instantaneous or marginal rate of change	• Area Above and Below the x-Axis
calculate the area between curves with and without technology	*Coming Soon* We want to work with you! If you are interested in partnering with EP to develop this topic, please contact ben.hilliam@educationperfect.com with an expression of interest.
determine displacements given acceleration and initial values of displacement and velocity.	• Rates of Change • Kinematics

Mathematical Methods: Unit 4

Topic 1: Further Differentiation and Applications 3

The second derivative and applications of differentiation

Content Descriptor	Lesson Names
understand the concept of the second derivative as the rate of change of the first derivative function recognise acceleration as the second derivative of displacement position with respect to time understand the concepts of concavity and points of inflection and their relationship with the second derivative understand and use the second derivative test for finding local maxima and minima sketch the graph of a function using first and second derivatives to locate stationary points and points of inflection solve optimisation problems from a wide variety of fields using first and second derivatives, where the function to be optimised is both given and developed.	• The Second Derivative *Further Development Coming Soon* We want to work with you! If you are interested in partnering with EP to develop this topic, please contact ben.hilliam@educationperfect.com with an expression of interest.

Topic 2: Trigonometric Functions 2

Cosine and sine rules

Content Descriptor	Lesson Names
recall sine, cosine and tangent as ratios of side lengths in right-angled triangles	• Review Lesson: Trigonometric Ratios
understand the unit circle definition of cos(θ), sin(θ) and tan(θ) and periodicity using degrees and radians	• Included in Unit 2 Topic 3
establish and use the sine (ambiguous case is required) and cosine rules and the formula area=1/2 bc sin(A) for the area of a triangle	• The Sine Rule • Finding Angles Using the Sine Rule • The Sine Rule: The Ambiguous Case • The Cosine Rule • Finding Angles Using the Cosine Rule
construct mathematical models using the sine and cosine rules in two- and three-dimensional contexts	• The Sine Rule • Finding Angles Using the Sine Rule

(including bearings in two-dimensional context) and use the model to solve problems; verify and evaluate the usefulness of the model using qualitative statements and quantitative analysis.	• The Sine Rule: The Ambiguous Case • The Cosine Rule • Finding Angles Using the Cosine Rule

Topic 3: Discrete Random Variables 2

Bernoulli distributions

Content Descriptor	Lesson Names
use a Bernoulli random variable as a model for two-outcome situations identify contexts suitable for modelling by Bernoulli random variables recognise and determine the mean p and variance p(1-p) of the Bernoulli distribution with parameter p use Bernoulli random variables and associated probabilities to model data and solve practical problems.	*Coming Soon* We want to work with you! If you are interested in partnering with EP to develop this topic, please contact ben.hilliam@educationperfect.com with an expression of interest.

Binomial distributions

Content Descriptor	Lesson Names
understand the concepts of Bernoulli trials and the concept of a binomial random variable as the number of 'successes' in n independent Bernoulli trials, with the same probability of success p in each trial identify contexts suitable for modelling by binomial random variables determine and use the probabilities P(X=r)=(n choose r) p^r (1-p)^{n-r} associated with the binomial distribution with parameters n and p calculate the mean np and variance np(1-p) of a binomial distribution using technology and algebraic methods identify contexts suitable to model binomial distributions and associated probabilities to solve practical problems, including the language of 'at most' and 'at least'.	• Introducing the Binomial Distribution • Using the Binomial Distribution • Binomial Distribution: Working Backwards • Further Questions: Binomial Distribution

Topic 4: Continuous Random Variables and the Normal Distribution

General continuous random variables

Content Descriptor	**Lesson Names**
use relative frequencies and histograms obtained from data to estimate probabilities associated with a continuous random variable understand the concepts of a probability density function, cumulative distribution function, and probabilities associated with a continuous random variable given by integrals; examine simple types of continuous random variables and use them in appropriate contexts calculate the expected value, variance and standard deviation of a continuous random variable in simple cases understand standardised normal variables (z-values, z-scores) and use these to compare samples	*Coming Soon* We want to work with you! If you are interested in partnering with EP to develop this topic, please contact ben.hilliam@educationperfect.com with an expression of interest.

Normal distributions

Content Descriptor	**Lesson Names**
identify contexts, such as naturally occurring variations, that are suitable for modelling by normal random variables	• Introducing the Normal Distribution • The Standard Normal Distribution • Calculating Probabilities with the Normal Distribution • Applications of the Normal Distribution
recognise features of the graph of the probability density function of the normal distribution with mean μ and standard deviation σ and the use of the standard normal distribution	• Introducing the Normal Distribution • The Standard Normal Distribution
calculate probabilities and quantiles associated with a given normal distribution using technology and use these to solve practical problems.	• Calculating Probabilities with the Normal Distribution • Applications of the Normal Distribution • Working Backwards: Calculating Bounds • Working Backwards: Mean and Standard Deviation • The Normal Distribution: Further Questions

Topic 5: Interval estimates for proportions

Random sampling

Content Descriptor	**Lesson Names**
understand the concept of a random sample	• What is Sampling? • Random Sampling
discuss sources of bias in samples, and procedures to ensure randomness investigate the variability of random samples from various types of distributions, including uniform, normal and Bernoulli, using graphical displays of real and simulated data.	• Random Sampling • Types of Sampling: Probability Sampling • Types of Sampling: Non-Probability Sampling

Sample proportions

Content Descriptor	**Lesson Names**
understand the concept of the sample proportion p-hat as a random variable whose value varies between samples, and the formula for the mean p and standard deviation √(p(1-p)/n) of the sample proportion p-hat	• Samples and Populations
consider the approximate normality of the distribution of p-hat for large samples simulate repeated random sampling, for a variety of values of p and a range of sample sizes, to illustrate the distribution of p-hat and the approximate standard normality of (p-hat - p)/√(p-hat(1-p-hat)/n) where the closeness of the approximation depends on both n and p	*Coming Soon* We want to work with you! If you are interested in partnering with EP to develop this topic, please contact ben.hilliam@educationperfect.com with an expression of interest.

Confidence intervals for proportions

Content Descriptor	**Lesson Names**
understand the concept of an interval estimate for a parameter associated with a random variable	• Applications of Single Samples • Constructing a Confidence Interval • Interpreting a Confidence Interval
use the approximate confidence interval (p-hat - z√(p-hat(1-p-hat)/n), p-hat + z√(p-hat(1-p-hat)/n), as an interval estimate for p, where z is the appropriate quantile for the standard normal distribution	• Interpreting a Confidence Interval • Comparison Within a Sample: Margin of Error • Comparison Within a Sample: Confidence Intervals • Comparison Within a Sample: Interpreting Confidence Intervals

define the approximate margin of error $E=z\sqrt{(\hat{p}(1-\hat{p})/n)}$ and understand the trade-off between margin of error and level of confidence	• Comparison Within a Sample: Margin of Error • Comparison Within a Sample: Confidence Intervals • Comparison Within a Sample: Interpreting Confidence Intervals
use simulation to illustrate variations in confidence intervals between samples and to show that most but not all confidence intervals contain p	• Comparison Between Two Samples: Margin of Error • Comparison Between Two Samples: Confidence Intervals • Comparison Between Two Samples: Interpreting Confidence Intervals • Comparison Between Two Samples: Making a Call