Topics	What students need to learn:		
	Content		Guidance
6 **Exponentials and logarithms** *continued*	6.3	Know and use the definition of $\log_a x$ as the inverse of a^x, where a is positive and $x \geqslant 0$ Know and use the function $\ln x$ and its graph Know and use $\ln x$ as the inverse function of e^x	$a \neq 1$ Solution of equations of the form $e^{ax+b} = p$ and $\ln(ax+b) = q$ is expected.
	6.4	Understand and use the laws of logarithms: $\log_a x + \log_a y = \log_a(xy)$ $\log_a x - \log_a y = \log_a\left(\frac{x}{y}\right)$ $k\log_a x = \log_a x^k$ (including, for example, $k = -1$ and $k = -\frac{1}{2}$)	Includes $\log_a a = 1$
	6.5	Solve equations of the form $a^x = b$	Students may use the change of base formula. Questions may be of the form, for example, $2^{3x-1} = 3$
	6.6	Use logarithmic graphs to estimate parameters in relationships of the form $y = ax^n$ and $y = kb^x$, given data for x and y	Plot $\log y$ against $\log x$ and obtain a straight line where the intercept is $\log a$ and the gradient is n Plot $\log y$ against x and obtain a straight line where the intercept is $\log k$ and the gradient is $\log b$
	6.7	Understand and use exponential growth and decay; use in modelling (examples may include the use of e in continuous compound interest, radioactive decay, drug concentration decay, exponential growth as a model for population growth); consideration of limitations and refinements of exponential models.	Students may be asked to find the constants used in a model. They need to be familiar with terms such as initial, meaning when $t = 0$. They may need to explore the behaviour for large values of t or to consider whether the range of values predicted is appropriate. Consideration of a second improved model may be required.

Topics	What students need to learn:		
		Content	**Guidance**
7 **Differentiation**	7.1	Understand and use the derivative of $\mathrm{f}(x)$ as the gradient of the tangent to the graph of $y = \mathrm{f}(x)$ at a general point (x, y); the gradient of the tangent as a limit; interpretation as a rate of change	Know that $\frac{\mathrm{d}y}{\mathrm{d}x}$ is the rate of change of y with respect to x. Knowledge of the chain rule is not required. The notation $\mathrm{f}'(x)$ may be used for the first derivative and $\mathrm{f}''(x)$ may be used for the second derivative.
		sketching the gradient function for a given curve	Given for example the graph of $y = \mathrm{f}(x)$, sketch the graph of $y = \mathrm{f}'(x)$ using given axes and scale. This could relate speed and acceleration for example.
		second derivatives	
		differentiation from first principles for small positive integer powers of x	For example, students should be able to use, for $n = 2$ and $n = 3$, the gradient expression $$\lim_{h \to 0}\left(\frac{(x+h)^n - x^n}{h}\right)$$ Students may use δx or h
		Understand and use the second derivative as the rate of change of gradient.	Use the condition $\mathrm{f}''(x) > 0$ implies a minimum and $\mathrm{f}''(x) < 0$ implies a maximum for points where $\mathrm{f}'(x) = 0$
	7.2	Differentiate x^n, for rational values of n, and related constant multiples, sums and differences.	For example, the ability to differentiate expressions such as $(2x + 5)(x - 1)$ and $\frac{x^2 + 3x - 5}{4x^{\frac{1}{2}}}$, $x > 0$, is expected.
	7.3	Apply differentiation to find gradients, tangents and normals,	Use of differentiation to find equations of tangents and normals at specific points on a curve.
		maxima and minima and stationary points.	To include applications to curve sketching. Maxima and minima problems may be set in the context of a practical problem.
		Identify where functions are increasing or decreasing.	To include applications to curve sketching.

Topics	What students need to learn:		
		Content	Guidance
8 **Integration**	8.1	Know and use the Fundamental Theorem of Calculus.	Integration as the reverse process of differentiation. Students should know that for indefinite integrals a constant of integration is required.
	8.2	Integrate x^n (excluding $n = -1$) and related sums, differences and constant multiples.	For example, the ability to integrate expressions such as $\frac{1}{2}x^2 - 3x^{-\frac{1}{2}}$ and $\frac{(x+2)^2}{x^{\frac{1}{2}}}$ is expected. Given $f'(x)$ and a point on the curve, Students should be able to find an equation of the curve in the form $y = f(x)$.
	8.3	Evaluate definite integrals; use a definite integral to find the area under a curve.	Students will be expected to understand the implication of a negative answer.
9 **Vectors**	9.1	Use vectors in two dimensions.	Students should be familiar with column vectors and with the use of $\mathbf{i}$, and $\mathbf{j}$ unit vectors.
	9.2	Calculate the magnitude and direction of a vector and convert between component form and magnitude/direction form.	Students should be able to find a unit vector in the direction of $\mathbf{a}$, and be familiar with the notation $\lvert\mathbf{a}\rvert$
	9.3	Add vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations.	The triangle and parallelogram laws of addition. Parallel vectors.
	9.4	Understand and use position vectors; calculate the distance between two points represented by position vectors.	$\overrightarrow{OB} - \overrightarrow{OA} = \overrightarrow{AB} = \mathbf{b} - \mathbf{a}$ The distance d between two points (x_1, y_1) and (x_2, y_2) is given by $d^2 = (x_1 - x_2)^2 + (y_1 - y_2)^2$

Topics	What students need to learn:		
	Content		Guidance
9 **Vectors** *continued*	9.5	Use vectors to solve problems in pure mathematics and in context, (including forces).	For example, finding position vector of the fourth corner of a shape (e.g. parallelogram) $ABCD$ with three given position vectors for the corners A, B and C finding position vector of a point C on a line through A and B dividing AB in a given ratio, where position vectors of A and B are given. Contexts such as velocity, displacement, kinematics and forces will be covered in Paper 3, Sections 6.1, 7.3 and 8.1–8.4

Assessment information

- First assessment: May/June 2018.
- The assessment is 2 hours.
- The assessment is out of 100 marks.
- Students must answer all questions.
- Calculators can be used in the assessment.
- The booklet '*Mathematical Formulae and Statistical* Tables' will be provided for use in the assessment.

Synoptic assessment

Synoptic assessment requires students to work across different parts of a qualification and to show their accumulated knowledge and understanding of a topic or subject area.

Synoptic assessment enables students to show their ability to combine their skills, knowledge and understanding with breadth and depth of the subject.

This paper assesses synopticity.

Sample assessment materials

A sample paper and mark scheme for this paper can be found in the *Pearson Edexcel Level 3 Advanced Subsidiary GCE in Mathematics Sample Assessment Materials (SAMs)* document.

Paper 2: Statistics and Mechanics

All the content of the specification for Paper 1 is assumed knowledge for Paper 2 and may be tested within parts of questions.

Topics	What students need to learn:		
	Content		Guidance
1 **Statistical sampling**	1.1	Understand and use the terms 'population' and 'sample'. Use samples to make informal inferences about the population.	Students will be expected to comment on the advantages and disadvantages associated with a census and a sample.
		Understand and use sampling techniques, including simple random sampling and opportunity sampling. Select or critique sampling techniques in the context of solving a statistical problem, including understanding that different samples can lead to different conclusions about the population.	Students will be expected to be familiar with: simple random sampling, stratified sampling, systematic sampling, quota sampling and opportunity (or convenience) sampling.
2 **Data presentation and interpretation**	2.1	Interpret diagrams for single-variable data, including understanding that area in a histogram represents frequency. Connect to probability distributions.	Students should be familiar with histograms, frequency polygons, box and whisker plots (including outliers) and cumulative frequency diagrams.

Topics	What students need to learn:		
	Content		Guidance
2 **Data presentation and interpretation** *continued*	2.2	Interpret scatter diagrams and regression lines for bivariate data, including recognition of scatter diagrams that include distinct sections of the population (calculations involving regression lines are excluded).	Students should be familiar with the terms 'explanatory (independent)' and 'response (dependent)' variables. Use of interpolation and the dangers of extrapolation. Variables other than x and y may be used.
		Understand informal interpretation of correlation.	Use of terms such as 'positive', 'negative', 'zero', 'strong' and 'weak' are expected.
		Understand that correlation does not imply causation.	No calculations or appreciation of values of correlation are required.
	2.3	Interpret measures of central tendency and variation, extending to standard deviation.	Data may be discrete, continuous, grouped or ungrouped. Understanding and use of coding. Measures of central tendency: mean, median, mode. Measures of variation: variance, standard deviation, range and interpercentile ranges. Use of linear interpolation to calculate percentiles from grouped data is expected.
		Be able to calculate standard deviation, including from summary statistics.	Students should be able to use the statistic $S_{xx} = \sum (x - \bar{x})^2 = \sum x^2 - \frac{(\sum x)^2}{n}$ Use of standard deviation $= \sqrt{\frac{S_{xx}}{n}}$ (or equivalent) is expected but the use of $S = \sqrt{\frac{S_{xx}}{n-1}}$ (as used on spreadsheets) will be accepted.