

## 2.2 AS UNIT 2

### Unit 2: Further Statistics A

Written examination: 1 hour 30 minutes

13 $\frac{1}{3}$ % of A level qualification (33 $\frac{1}{3}$ % of AS qualification)

70 marks

The subject content is set out on the following pages. There is no hierarchy implied by the order in which the content is presented, nor should the length of the various sections be taken to imply any view of their relative importance.

Candidates will be expected to be familiar with the knowledge, skills and understanding implicit in AS Mathematics.

Where specific content requires knowledge of concepts or results from A2 Mathematics, this will be made explicit in the Guidance section of the content.

Topics	Guidance
<b>2.2.1 Random Variables and the Poisson Process</b>	
Understand and use the mean and variance of linear combinations of independent random variables. ie. use of results: $E(aX + b) = aE(X) + b$ $\text{Var}(aX + b) = a^2\text{Var}(X)$ $E(aX + bY) = aE(X) + bE(Y)$  For independent $X$ and $Y$ , use the results: $E(XY) = E(X)E(Y)$ $\text{Var}(aX + bY) = a^2\text{Var}(X) + b^2\text{Var}(Y)$	For discrete and continuous random variables.
Probability: Discrete probability distributions.  Find the mean and variance of simple discrete probability distributions.	Use of $E(X) = \mu = \sum xP(X = x)$ and $\text{Var}(X) = \sigma^2 = \sum x^2P(X = x) - \mu^2$

Topics	Guidance
<p>Probability: Continuous probability distributions.</p> <p>Understand and use probability density and cumulative distribution functions and their relationships.</p> <p>Find and use the median, quartiles and percentiles.</p> <p>Find and use the mean, variance and standard deviation.</p> <p>Understand and use the expected value of a function of a continuous random variable.</p>	<p>Use of the results <math>f(x) = F'(x)</math> and <math>F(x) = \int_{-\infty}^x f(t) dt</math>.</p> <p><math>E[g(X)] = \int g(x)f(x) dx</math></p> <p>Simple functions only, e.g. <math>\frac{1}{X^2}</math> and <math>\sqrt{X}</math>.</p>
<p>Statistical distributions: Poisson and exponential distributions.</p> <p>Find and use the mean and variance of a Poisson distribution and an exponential distribution.</p> <p>Understand and use Poisson as an approximation to the binomial distribution.</p> <p>Apply the result that the sum of independent Poisson random variables has a Poisson distribution.</p> <p>Use of the exponential distribution as a model for intervals between events.</p>	<p>Use of formula and tables/calculator for Poisson distribution.</p> <p>Knowledge and use of:                      If <math>X \sim \text{Po}(\lambda)</math> then <math>E(X) = \lambda</math> and <math>\text{Var}(X) = \lambda</math></p> <p>If <math>Y \sim \text{Exp}(Y)</math> then <math>E(Y) = \frac{1}{\lambda}</math> and <math>\text{Var}(Y) = \frac{1}{\lambda^2}</math></p> <p>Learners will be expected to know that  <math>\frac{d}{dx}(e^{kx}) = ke^{kx}</math></p>

Topics	Guidance
<b>2.2.2 Exploring relationships between variables and goodness of fit of a model</b>	
<p>Understand and use correlation and linear regression:</p> <p>Explore the relationships between several variables.</p> <p>Calculate and interpret</p> <ul style="list-style-type: none"> <li>• Spearman's rank correlation coefficient</li> <li>• Pearson's product-moment correlation coefficient.</li> </ul> <p>Calculate and interpret the coefficients for a least squares regression line in context; interpolation and extrapolation.</p>	<p>To include tests for significance. Excludes tied ranks. Use of tables for Spearman's and Pearson's product moment correlation coefficients. Be able to choose between Spearman's rank correlation coefficient and Pearson's product-moment correlation coefficient for a given context.</p> <p>Including from summary statistics.</p>
<p>Understand and use the Chi-squared distribution:</p> <p>Conduct goodness of fit test using <math>\sum \frac{(O - E)^2}{E}</math>, or equivalent form, as an approximate <math>\chi^2</math> statistic (for use with categorical data).</p> <p>Use <math>\chi^2</math> test to test for association in a contingency table and interpret results</p>	<p>For use with binomial, discrete uniform and Poisson distributions, for known parameters only.</p> <p>To include pooling. Not including Yates continuity correction.</p>