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GCSE
Statistics
2017

Delivering GCSE (9–1) Statistics for the first time

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About your trainer

Agenda

- Specification structure
- Planning for delivery and the new content
- Selected new topics:
  - Skewness
  - Spearman's and Pearson's
  - Rates of change
- Strategies to support students with the new assessment including student exemplars and marking activity
- Supporting you

Your pack

- Agenda
- Presentation slides
- Specification and sample assessment materials
- Course planning activity:
  - Planner template
  - Delivery models
  - Course planner
  - Mapping: GCSE (9-1) Statistics ⇔ GCSE (9-1) Mathematics
- Skewness activity:
  - Salary activity
  - Match up cards
- Spearman's and Pearson's activity:
  - Scenarios
- Assessment activity:
  - Delegate booklet – Tasks
  - Delegate booklet – Student responses with examiner comments

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Statistics for the real world

- Straightforward assessment structure
  - Two papers of equal size, length and weighting
  - All content and AOs targeted equally in both papers
- Content that develops transferable skills
  - Develops understanding of how to interpret and apply data
  - Supports skills development for progression in a wide range of subjects including A Level Mathematics
- Clear and familiar course content and approach
  - Clear content coverage with plenty of guidance
- Question papers that support a range of abilities
  - Clear questions and presentation of data
  - Careful ramping within questions, across papers and between tiers
  - Engaging real-life statistical material and contexts
- Support resources to help you plan, teach, track and assess

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GCSE Statistics reforms

- Updated subject content (from the DfE) - overlap with GCSE Mathematics reduced
- New assessment objectives (from Ofqual)
- Controlled assessment has been removed:
  - all assessment including the statistical enquiry cycle will be within the examination
- Tiering retained

And in common with all reformed GCSEs:

- Fully linear structure
- New 9 to 1 grading scale
- General increase in level of demand and challenge, including extended response questions

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Tiering

Ofqual has approved the retention of tiering for GCSE Statistics. The approach to tiering follows that of GCSE (9–1) Mathematics. Both papers must be taken at the same tier.

- Foundation tier:
  - will span grades 1 to 5 (five grade range)
  - students will be assessed on content in standard and underlined type
  - papers will reach a higher level of demand than previous papers
- Higher tier:
  - will span grades 4 to 9 (six grade range)
  - students will be assessed on all content
  - papers will:
    - start at a higher level of demand and
    - reach a higher level of demand than current papers

Grade boundaries

GCSE Statistics (9-1) 1ST0
June 2019

1ST0		9	8	7	6	5	4	3	2	1
Foundation tier	Paper 1F					49	40	30	20	9
	Paper 2F					46	37	27	17	8
Higher tier	Paper 1H	61	52	44	34	24	15	10		
	Paper 2H	61	53	44	34	25	15	10		

(Marks for all papers out of 80)

1ST0		9	8	7	6	5	4	3	2	1
Foundation tier						95	77	57	37	17
Higher tier		122	105	88	68	49	30	20		

(Total marks out of 160)

Cumulative Percentage by grade – June 2019

1ST0		9	8	7	6	5	4	3	2	1
Total		3.7	10.4	20.1	34.3	54.1	73.3	87.0	95.1	98.5

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Statistical enquiry cycle

Through using the SEC students need to:

1. Understand the importance of initial planning
2. Recognise the constraints in sourcing appropriate data
3. Understand ways that data can be processed and presented including through use of technology
4. Interpret results in context
5. Understand importance of clear and concise communication

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Foundation content changes

Topics new to Foundation tier include:

- Context sensitivity as a source of bias
- Judgement, convenience and quota sampling
- RPI, CPI
- Rates of change over time e.g. birth rates
- Interpretation of Spearman's rank correlation coefficient
- Effect of sample size when estimating probability
- Relative and absolute risk
- Venn diagrams
- Conditional probability

Higher content changes: I

Topics new to Higher tier include:

- Misuse of frequency density formula
- Geometric mean
- Calculation of skewness
- Interdecile range
- Identify outliers using IQR or standard deviation
- Crude and standardised birth rates etc.
- Deeper understanding of Normal distribution

Higher content changes: II

Topics new to Higher tier include (continued):

- Distribution of sample means
- Placement of action and warning lines
- No expansion formula given for binomial calculations
- Multivariate data
- Interpretation of Pearson's product moment correlation coefficient
- Distinction between Spearman's and Pearson's coefficients

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Removed content

Topics no longer in the Edexcel specification:

Foundation	Higher
• Effects of accuracy on measurements • Non-linear models	• Effects of accuracy on measurements • Non-linear models • Discrete uniform distribution • Simulation for more complex probabilities

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Assessment objectives

Assessment objectives		Weighting
AO1	Demonstrate knowledge and understanding, using appropriate terminology and notation, of standard statistical techniques used to: • collect and represent data • calculate summary statistics and probabilities	55%
AO2	Interpret statistical information and results in context and reason statistically to draw conclusions	25%
AO3	Assess the appropriateness of statistical methodologies and the conclusions drawn through the application of the statistical enquiry cycle	20%

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Assessment structure

Paper 1 – 1ST0/1F, 1ST0/1H	Paper 2 – 1ST0/2F, 1ST0/2H
Compulsory paper Externally assessed 50% of the total GCSE 1 hour 30 minutes 80 marks	Compulsory paper Externally assessed 50% of the total GCSE 1 hour 30 minutes 80 marks
• Assesses all content • Questions on statistical methods and component parts of the SEC • Familiar and unfamiliar contexts • Short, medium and extended response questions	• Assesses all content • Questions on statistical methods and component parts of the SEC • Familiar and unfamiliar contexts • Short, medium and extended response questions

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Formulae sheet/notice

Some formulae may be given to students in the assessment. We have taken a different approach to the provision of these formulae according to tier:

- **Foundation tier**: no separate formulae sheet. The formula will be given alongside the question:
  - Rates of change
- **Higher tier**: separate formulae sheet provided on page 2 of the assessments:
  - Skew
  - Standard deviation (two versions of the formula)
  - Spearman's rank correlation coefficient
  - Rates of change

Calculators

- Both papers are calculator papers
- Students must have a scientific calculator with them in both papers which they may use
- Students are expected to be familiar with the statistical function keys
- The standard JCQ calculator requirements apply which includes that they may not:
  - Offer symbolic algebraic manipulation
  - Have retrievable information stored in them
- Use of statistical tables is not required.

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Planning for delivery

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Course planning

Why offer the course?

- Offers breadth and depth for (higher attaining) students
- Increases student exposure to mathematical techniques which supports their progress in maths
- Counts in the third bucket of Progress 8
- Gain an additional GCSE with potentially fewer hours contact time

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Course planning

Why offer the course? … continued

- For those planning to study A level Mathematics, statistics is now a compulsory topic whilst the statistical content of GCSE Mathematics has decreased. This course will help to bridge the gap.

- Reformed A levels in Sciences, Geography, Sociology, Business, Economics, Psychology have increased statistical content and rely on good data skills.

- Introduces and develops transferable skills at GCSE e.g. to Science, Geography.

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Course planning

Changes to the existing specification:

- Increased level of demand
- New topics at each tier
- Removal of controlled assessment (more time?)
- Reduced probability and statistics content in GCSE Mathematics (was 25% now 15%) so more to cover in GCSE Statistics – relies less on the overlap with GCSE Mathematics.

Time required

- 120 guided learning hours as before … BUT the majority of schools currently deliver successfully with fewer hours
- Loss of controlled assessment (was 25% of available marks)
- Addition of statistical enquiry cycle (SEC) with AO3. Students will need to have genuine experience of implementing the SEC in order to develop AO3 skills.

Delivery models

School A
Co-taught within GCSE Mathematics for Higher tier candidates 3 year KS4 model GCSE Statistics taken at end of Year 10 or end of Year 11
+ An extra GCSE to go in the third basket + Extra stimulus throughout the time - Some organisations don't like early entry GCSEs

Delivery models

School B
Taught as an optional twilight extra during Year 11 Higher tier only One year accelerated course
+ An extra GCSE to go in the third basket + Extra stimulus throughout the time - An extra two examination papers at the end of Year 11

Delivery models

School C
Taught within option blocks for both tiers e.g. 3 lessons per week 2 or 3 year course
+ Students gain an extra GCSE in a mathematical subject - May mean mixed ability classes - Students may make a poor choice of option unless guided

Delivery models

School D
Additional Statistics topics integrated within GCSE Mathematics course Revision days scheduled in ‘gap’ following GCSE Mathematics exams 1, 2 or 3 year course
+ Takes up little time during the ‘normal’ teaching week - Can be high pressure towards the end when other students have finished

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Summer 19 Entries

Age Category	Number of Candidates
Year 14+	16
Year 13	35
Year 12	156
Year 11	10734
Year 10	7849
Year 9	783
Total	**19573**

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Case study 1

- This school started teaching Statistics at the end of Year 10 as a separate option group.
- GCSE Statistics was in the same option block as other 'third basket' options such as Business, Media, etc.
- Students were guided in their options but because of numbers there was a mixture of Foundation and Higher students in the same group.
- This has led to the majority of lessons being pitched at Higher tier.
- Since Christmas some Foundation students have been given the option to use the Statistics time to concentrate on improving their GCSE Mathematics grade instead.
- Feedback from the students has been positive so far although there are some concerns about the level of literacy required from the EAL students.
- This school has used its own scheme of work adapted from the Edexcel one. There has been plenty of time to cover the syllabus. Resources to practise the AO3 questions are needed.

Case study 2

- This school has decided to teach the GCSE Statistics alongside the GCSE Mathematics course from Year 9. The students will sit the exam at the end of Year 10.
- This school currently has 5 hours of mathematics teaching a week.
- They have changed the order of their GCSE Mathematics scheme of work to ensure all statistics and probability is taught before Christmas in Year 10 and have added the Statistics syllabus into the relevant modules.
- The intention is that from May half term in Year 10 the students spend mathematics lessons preparing for the June GCSE Statistics exam.

Case study 3

- This school has decided to use GCSE Statistics to fill the 'third basket' where students are not showing progress in their other 'third basket' subject.
- These students will only be entered for the Foundation tier.
- They are predicted and targeted a Grade 4/5 in GCSE Mathematics.
- The students will spend an intensive revision day during Easter and then use the time after the GCSE Mathematics exams to fill in any gaps and to practise past papers.
- These students will not have study leave before the GCSE Statistics exams.
- Revision books and resources will be provided and an after school/ form time/lunch time intervention group may be formed.

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Where's the overlap?

Comparing GCSE (9–1) Statistics and GCSE (9–1) Mathematics (Higher tiers):

GCSE (9–1) Statistics	GCSE (9–1) Mathematics Higher tier
1. The collection of data	
(a) Planning	Not covered
(b) Types of data	S1, S2, S3 together refer to many types of data Not covered includes: raw data, multivariate data, explanatory and response variable
(c) Population and sampling	S1 implicitly covers aspects of sampling but there is greater emphasis in GCSE Statistics including additional sampling techniques
(d) Collecting data	S1 implicitly covers some aspects of 1d.01 and 1d.02 The remainder of 1d is not covered

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Where's the overlap?

GCSE (9–1) Statistics	GCSE (9–1) Mathematics Higher tier
2. Processing, representing and analysing data	
(a) Tabulation, diagrams and representation	S2, S3, S4 together cover a number of representations Not covered includes: population pyramid, choropleth, comparative pie, comparative 3D, misrepresentation, skew
(b) Measures of central tendency	S4, S5 cover mean, median, mode, modal class Not covered includes: weighted mean, geometric mean, MSV
(c) Measures of dispersion	S4, S5 cover range, quartiles, IQR Not covered includes: percentiles and IPR, deciles and IDR, SD, outliers by calculation, standardisation
(d) Further summary statistics	Not covered
(e) Scatter diagrams and correlation	S6 covers a number of the topics Not covered includes: double mean, regression line, Spearman's, PMCC

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Where's the overlap?

GCSE (9–1) Statistics	GCSE (9–1) Mathematics Higher tier
2. Processing, representing and analysing data (continued)	
(f) Time series	S2 covers construct and interpret time series graphs only Not covered includes: moving averages, interpret gradient of trend line, seasonal and cyclic trends, predictions
(g) Quality assurance	Not covered
(h) Estimation	S1, S5 cover inferring from a sample Not covered includes: estimating population mean, predicting population proportions
3. Probability	
	P1–P9 together cover a number of the topics Not covered includes: risk, general addition law, binomial distribution, normal distribution
Other	
	Not covered includes: statistical enquiry cycle, use of/issues with spreadsheets and software

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New Higher tier requirements: Skewness

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Skewness

Determining skewness from inspection has been on GCSE Statistics in the past but determining skewness from calculation is new.

	What students need to know	Guidance
2a.09	Determine skewness from data by inspection **and by calculation.** **Use of:** **Skew = $\frac{3(\text{mean} - \text{median})}{\text{standard deviation}}$** **Formula will be given in the formulae sheet.**	For example, know that, for positive skew could be indicated by: ● mean > median > mode ● median − LQ < UQ − median
2a.10	Interpret a distribution of data in terms of skewness identified from inspection **or calculation.**	For example, with positive skew know that values above the median have a greater spread than values below the median.

Note: Calculation of skew is not on Foundation.

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Skewness

Prior knowledge that students will need to know:

- Calculating the mean, mode and median (including grouped data)
- Calculating quartiles
- Calculating standard deviation
- Drawing and reading from box plots
- Drawing and reading from histograms
- Drawing and reading from cumulative frequency diagrams

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Salaries

The annual salaries are listed below for employees in a company. Work out the mean and median salary

Employee	Annual salary
Secretary	£20,152
Team Leader	£25,467
Chief Executive	£78,500
Apprentice technician	£16,000
Office manager	£25,675
Finance officer	£23,367
Manufacturing technician	£27,500

Mean = £30,951.57

Median = £25,467

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Salaries (continued)

Mean = £30,951.57
Median =£25,467

- The median is a more meaningful measure of the average wage because the mean is being pulled up by the wage of the Chief Executive. The mean is higher than all the employees apart from the Chief Executive so doesn't reflect the majority of the staff in the company.

- This is making the result **positively skewed**, as we have an extreme wage above the mean. When data is skewed, the median is normally a better measure of location than the mean as the mean is being 'pulled up' by this extreme value.

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Calculating skewness

$$\text{Use of: } \text{Skew} = \frac{3(\text{mean} - \text{median})}{\text{standard deviation}}$$

Formula will be given in the exam

- If the result is zero, the data is symmetrical.
- A positive result means the data has a positive skew.
- A negative result means the data is negatively skewed.
- The larger the number the bigger the skew.

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Calculating and interpreting skewness

The maths scores for a class of students are recorded. The test was out of 100. The summary statistics are shown below. Calculate the skew for the maths scores and **interpret the skew in context**.

Mean	**38**
Mode	**33**
Median	**34**
Standard deviation	**15.5**

Calculating and interpreting skewness

$$\text{Skew} = \frac{3(38 - 34)}{15.5}$$

$$\text{Skew} = 0.774$$

Positive skew means that the majority of students got a lower maths score with fewer higher scores, OR there is a greater spread of scores at the upper end.

June 19 Paper 1H 10bc

The table below gives the mean, the standard deviation and the median for the times spent on social media during one day by a sample of sixty year olds.

Mean (minutes)	Standard deviation (minutes)	Median (minutes)
125	25	130

(b) Calculate the skew of the times spent on social media by the sample of sixty year olds.

(c) Interpret your answer to part (b).

.....

(2)

(2)

June 19 Paper 1H 10bc

(b)	M1 for $\frac{3(125-130)}{25}$ A1 -0.6	M1 for correct use of ; $\frac{3(\text{mean} - \text{median})}{\text{sd}}$ cao	(2)
(c)	B1ft Skew is negative B1 e.g. More than half of 60 year olds spend longer than the mean time on social media Or B1 Values below the median have a greater spread than values above the median	B1ft for correct conclusion about skewness for **their** value in (c) even if it came from an incorrect formula. B1 for correct interpretation of the skewness Any reference to the spread of values below/above the **mean** is B0.	(2)

Examiner's feedback

Mark distribution:

12% 0 marks
4% 1 mark
25% 2 marks
54% 3 marks
5% 4 marks

- Part (b) – rare to see an incorrect value given.
- Part (c) – most students identified negative skew, but were unable to interpret what negative skew meant in context of the question.

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Linked topics:
Teaching Spearman's and Pearson's

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Two exciting ways to compare the way two variables change together!

- Spearman's rank correlation coefficient

and

- Pearson's product moment correlation coefficient

Both named after the brilliant mathematicians who first calculated them!

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In the specification…

At Foundation tier, students need to learn:

(e) Scatter diagrams and correlation		
2e.06	Interpret given Spearman's rank correlation coefficient in the context of the problem.	

In the specification…

At Higher tier, students need to learn:

(e) Scatter diagrams and correlation		Guidance
2e.05	**Apply formula to determine Spearman's rank correlation coefficient. Values found using calculator functions will be permissible.**	**Formula will be given in the formulae sheet. Tied ranks will not be tested. *(Scientific calculator functions are sufficient.)***
2e.06	Interpret **calculated or** given Spearman's rank correlations coefficient in the context of the problem.	
2e.07	**Interpret given Pearson's product moment correlation coefficient (PMCC) in the context of the problem.**	
2e.08	**Understand the distinction between Spearman's rank correlation coefficient and Pearson's product moment correlation coefficient (PMCC).**	**e.g. recognise the relative strengths of rank correlation and product moment correlation on a scatter graph. The PMCC measures the strength of linear correlation. The calculation of PMCC is not required.**

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Which to pick?

Spearman's rank correlation coefficient is best used for ordinal data (where the value has no significance in the context of anything else) and can be used when two variables change together but not necessarily at the same rate.

Pearson's product moment correlation coefficient is best used for normal continuous linear data, where a change in one variable may lead to a proportional change in the other.

There are situations where either calculation could be used!

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What does the correlation coefficient mean?

- The coefficient should lie between -1 and 1
- A result of exactly 1 would mean there is a perfect positive relationship between the two variables (in the case of PMCC this relationship would also change in a linear fashion).
- A result of exactly -1 would mean there is a perfect negative relationship between the two variables.
- A result of 0 would mean there is no relationship between the two variables.

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June 19 Paper 2H Q11c

11 Gisele collected data about the age and the salary of each employee at a small company.

Gisele calculated correlation coefficients for her data. She obtained the following results.

Spearman's rank correlation coefficient	0.95
Pearson's product moment correlation coefficient	0.77

Figure 1

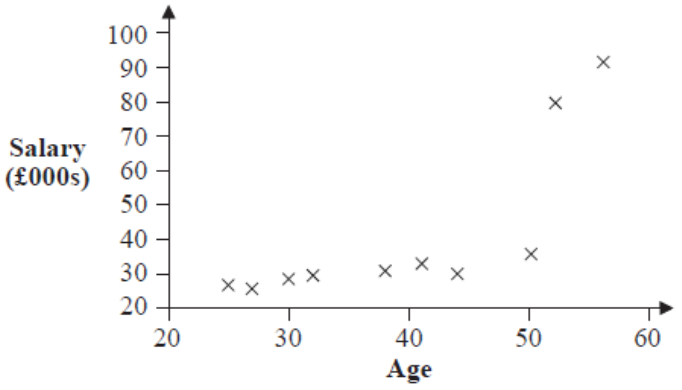
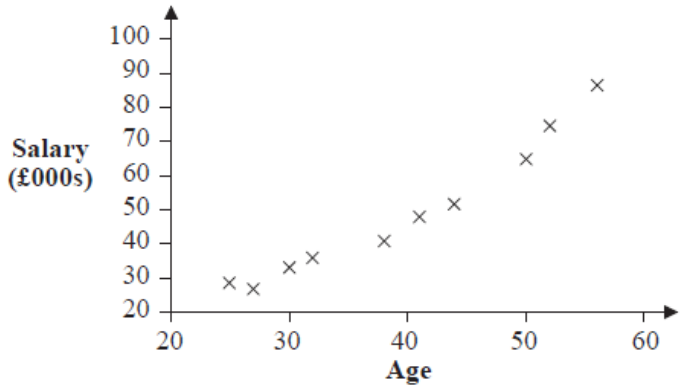


Figure 2



(c) Which one of these two diagrams most likely represents the data?
You must give a reason for your answer.

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June 19 Paper 2H Q11c

Question number	Answer	Additional guidance	Mark
(c)	B1 Figure 1 B1 e.g. 'Figure 1 as pmcc < Spearman (so that means the correlation will be less linear)'	B1 for Figure 1 depB1 (dependent upon 1st B1) either pmcc/0.77 < Spearman/0.95 or for understanding that **Spearman** shows **rank** correlation and **pmcc** shows **linear** correlation)	(2)

Mark distribution:

92% 0 marks
6% 1 mark
2% 2 marks

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New Foundation tier requirements: Rates of change

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In the specification...

(d) Further summary statistics		Guidance
2d.01	Interpret data related to rates of change over time (including, but not limited to, percentage change, births, deaths, house prices, and unemployment) when given in graphical form. Calculate and interpret rates of change over time from tables using context specific formula .	Making predictions using rates of change formula is expected. e.g. Crude birth rate = $\frac{\text{number of births}}{\text{total population}} \times 1000$ Formula will be given.

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June 19 1F Q16

16 In 2016, the population of New Zealand was 4 660 833
In the same year, there were 59 430 births in New Zealand.

(Source: *www.worldometers.info* and *www.stats.govt.nz*)

(a) Using the formula below, work out the crude birth rate for New Zealand in 2016

$$\text{crude birth rate} = \frac{\text{number of births} \times 1000}{\text{total population}}$$

Give your answer correct to 1 decimal place.

.....

(2)

The crude birth rate for Albania in 2015 was 12
The crude birth rate for Bolivia in 2015 was 24

(Source: *data.worldbank.org*)

Louise says,

"There were twice as many births in Bolivia as in Albania in 2015"

(b) State what must be true about the populations of Albania and Bolivia for Louise to be correct.

.....

.....

.....

(1)

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June 19 1F Q16

Question number	Answer	Additional guidance	Mark
16 (a)	M1 $\frac{59430 \times 1000}{4660833}$ A1 12.8	Do not accept 100 as a misread of 1000 Accept answers in the range 12.7-12.8	(2)
(b)	B1 e.g. the size of the populations are the same	B1 for any reason which implies that the populations must be the same.	(1)

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Examiner's report

Question 16

Part (a) of this question required students to calculate the crude birth rate using the formula that had been provided in the question. The majority of students were able to do this correctly. Incorrect responses included examples of correct substitution followed by incorrect evaluation (gaining 1 mark) or students who changed the 1000 in the formula to 100. A minority of students did not attempt this part of the question. Part (b) of this question had a reasonable number of fully correct answers where students indicated that the two populations would need to be equal in size. Common incorrect answers included reference to one population being twice the other (seen both ways around) or showing that one of the birth rates was twice the other by giving the calculation $12 \times 2 = 24$.

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Higher tier only

(d) Further summary statistics		Guidance
2d.02	Interpret data related to rates of change over time (including, but not limited to, percentage change, births, deaths, house prices, and unemployment) when given in graphical form. Calculate and interpret rates of change over time from tables using context specific formula.	Making predictions using rates of change formulae is expected, e.g. crude birth rate = $\frac{\text{number of births} \times 1000}{\text{total population}}$ **standardised birth rate** = $\frac{\text{crude rate} \times \text{standard population}}{1000}$ Formulae will be given.

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Strategies to support students with the new assessment

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Assessment changes

- Controlled assessment has been removed. All new GCSEs in Statistics will be assessed entirely by written examination.
- Understanding of the statistical enquiry cycle (SEC) will be assessed in written form throughout the two papers.
- This is AO3 and will be 20% of the questions.
- Also AO1's requirement of '... using appropriate terminology and notation ...'.

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SEC in the exams

The papers will assess the key stages of the statistical enquiry cycle:

- Importance of initial planning
- Constraints in sourcing data; including effects of rounding
- Ways data can be processed and presented, including use of technology
- Results interpreted in the context of problems
- Clear, concise communication of key findings including
    - Importance of awareness of target audience
    - Importance of evaluating statistical work

Differences in the new questions compared to the old specification

- Many of the questions on both papers will look very similar to previous exam sessions.
- Both papers will now contain open/extended response questions and will test students' understanding of the SEC.
- This will include extended response questions giving students opportunities to analyse and evaluate, allowing them to demonstrate their ability to draw together different areas using higher cognitive processes.
- Foundation tier will include at least 3 extended response questions.
- Higher will include at least 6 extended response questions.
- These extended response questions will be worth 5 or 6 marks.

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June 19 Paper 1F Q15

15 A driving school has 40 cars.

The cars are either petrol cars or diesel cars.
The cars have either a manual gearbox or an automatic gearbox.

16 of the cars have an automatic gearbox.
10 of the petrol cars have an automatic gearbox.
There are 30 petrol cars.

One of the petrol cars is to be picked at random.
One of the diesel cars is to be picked at random.

Derek says,

"The probability that the petrol car has a manual gearbox is greater than the probability that the diesel car has a manual gearbox".

Is he correct?
You must show working and justify your answer.

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June 19 Paper 1F Q15

Question number	Answer	Additional guidance	Mark
15	B1 for finding the total number of diesel cars (10) AND the number of manual petrol cars (20) OR for finding the number of manual petrol cars (20) AND the total number of manual cars (24) B1 for finding the number of manual diesel cars (4) M1 for finding the probability of a manual diesel car $\frac{'4'}{'10'}$ OR a manual petrol car $\frac{'20'}{30}$ A1 $\frac{4}{10}$ and $\frac{20}{30}$ oe depB1ft correct conclusion for their two probabilities	B1B1 may be scored in a table or frequency (tree) diagram. Values may be implied by relevant probabilities, e.g. manual diesel $\frac{4}{10}$ oe implies 4 manual diesel cars and 10 diesel cars; petrol manual $\frac{20}{30}$ oe implies 20 petrol manual cars Numbers alone are not sufficient – there must be an indication of class of car e.g. diesel 10, petrol manual 20 Accept 0.66, 0.67 or better for $\frac{20}{30}$ Dependent on M1 scored.	(5)

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June 19 Paper 2F Q8b

8 Mayokun measured and recorded the height, to the nearest cm, of each of the first 20 female students and of each of the first 20 male students to arrive at his college one morning.

He used statistical software to produce these diagrams and these summary statistics to help him compare the distributions.

Female students

13	4
14	2 7 7
15	1 1 2 6 9 9
16	3 5 7 7 9 9
17	1 4 8
18	4

Male students

14	6
15	4 4 4 6 6 7 8 9
16	2 4 4 5 8
17	2 2 7
18	2 5
19	1

Key:

13 | 4 represents 134 cm

	Median	Mean	Range	IQR
Females	161 cm	160 cm	50 cm	18 cm
Males	163 cm	165 cm	45 cm	16 cm

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June 19 Paper 2F Q8b

Before collecting his data, Mayokun wrote down two hypotheses.

1. Males are taller than females.
2. The heights of males vary more than the heights of females.

(b) Using appropriate results from Mayokun's survey, discuss any conclusions that he might have made about his hypotheses.

You should comment on the reliability of the conclusions.

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June 19 Paper 2F Q8b

(b)	B1 B1 B1 B1 for four correct statements from • First hypothesis is supported / males are taller • Males have a higher median (or mean) OR males are 2 cm (or 5 cm) taller on average, (Accept "163 > 161" or "165 > 160") • Second hypothesis is not supported / female heights have greater spread • Males have lower IQR (or lower range). (Accept 16 < 18 or 45 < 50) • Median is more appropriate than mean (as males' data is positively skewed) B1B1 any two comments from • conclusion(s) are not reliable (condone 'data' are not reliable) • not a representative sample / only early arrivals • small sample only (e.g. only/just used 20/40) • quota sampling (or convenience sample) • not random • sample is only for college age / he didn't record age • sample is for one area only / only his college	B1 for each of four statements from the options given, maximum 4 marks • statement supporting first hypothesis (condone 'is correct') • correct supporting evidence (can ignore figs for 'median') (Comparison of e.g. tallest male/female alone is B0) • statement refuting second hypothesis (condone 'incorrect') • correct use of measure of dispersion. • recognition of appropriate average due to skew Note: for the first 4 marks it needs to be clear which hypothesis or gender their comment refers to. B1 for each of two statements from the options given, maximum 2 marks. **Allow each bullet once only.** **Do not accept contradictory comments for any bullet point.**	(6)

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June 19 Common question
Paper 2F Q10
2H Q1

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1 At a university, 70% of students are undergraduates and 30% of students are postgraduates.

Amy and Robert want to do a survey.

Amy decides to use simple random sampling to collect a sample of 100 students.

She uses the university database as a sample frame and she numbers each student on the database.
She then generates exactly 100 random numbers and uses these random numbers to select her sample.

(a) Give **two** reasons why Amy's method may **not** produce a sample of 100 students.

.....

.....

.....

.....

(2)

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June 19 Common question
Paper 2F Q10
2H Q1

Robert decides to use quota sampling to collect a sample of 100 students.
He plans to stand outside the main building until he has interviewed 70 undergraduates and 30 postgraduates.

(b) Give **two** advantages of using quota sampling.

(2)

(c) Explain why this quota sample is **not** a random sample.

(1)

June 19 Common question Paper 2F Q10 2H Q1

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Question number	Answer	Additional guidance	Mark
1 (a)	B1B1 Any two from: • Repeated random numbers • Random numbers out of range/may not correspond to students' numbers • Selected students may not (want to) participate • Some students may have left the university	B1 for each bullet point up to a maximum of 2 Accept each bullet point only once Students may have joined the university is B0. There may not be 100 students at the university is B0. Random numbers may not be whole numbers is B0. Database may not be up to date **on its own** is B0. Do not accept (random) numbers may be more than 100 for the second bullet point. Ignore extraneous non-contradictory comments.	(2)
(b)	B1B1 Any two advantages from: • Easy/convenient/quick/efficient/cheap • Represents population (proportions) • Allows for comparison (between undergraduates and postgraduates) • No sample frame required	B1 for each bullet point up to a maximum of 2 Accept each bullet point only once For 2nd bullet point allow e.g. 'fair number of each (group)' 'Unbiased' on its own is B0. Ignore extraneous non-contradictory comments.	(2)
(c)	B1 Any one from: • Not every student has an **equal**(o.e.) chance of being selected • Only those in the main building can be selected/not every student has a chance of being selected • Robert is **choosing** the students	B1 for a reason which states or implies 'equal likelihood' of being selected **or** that Robert is doing the choosing Do not allow 'even' chance or 'its biased' for the first bullet point, but condone 'fair chance'.	(1)

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June 2019 Paper 1H Q11a

11 Some students at a school walk home and some students go home by bus.

The times taken by the students at the school to walk home have a mean of 25 minutes and a standard deviation of 6 minutes.

The times taken to walk home can be modelled by a normal distribution.

(a) Shanaya says,

"More than 80% of the students who walk home take between 19 and 37 minutes"

Use statistical calculations to assess Shanaya's conclusion.

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June 19 Paper 1H Q11a

Question number	Answer	Additional guidance	Mark
11 (a)	M1 for standardising $\frac{37-25}{6}(=2)$ oe **OR** by inspection stating 37 minutes is 2 sd's above 25 minutes. [May be seen on a diagram] M1 for standardising $\frac{19-25}{6}(=-1)$ oe **OR** by inspection stating 19 minutes is 1 sd below 25 minutes. [May be seen on a diagram] M1 for either 0.95 ÷ 2 (=0.475) or 0.68 ÷ 2 (= 0.34) Al 0.815 or 81.5% depB1ft 0.815 > 0.8 so Shanaya is correct	M1 for working out 37 is 2 s.d. above the mean. Allow M1 for $25+\mathbf{2}\times 6=37$ M1 for working out 19 is 1 s.d. below the mean. A Allow M1 for $25-(\mathbf{1})\times 6=19$ M1 for correct use of either awrt 0.67 or 0.68 or awrt 67% or 68% **OR** for the correct use of either 0.95 or 95% i.e. 95% ÷ 2 **OR** 67/8% ÷ 2 A1 – for use of both 47.5% or 0.475 **AND** 34% or 0.34 AND adding them to achieve 81.5% or 0.815 Allow answers greater than 81% or less than and equal to 82%. Note: Value from calculator is 81.8% Sight of 0.815 or 81.5% with no working is M1M1M1A1 Dependant on getting **any one** of the M marks. depB1ft for correct conclusion based on **their** evaluated probability between 0 and 100%. Follow through their value. Conclusion required for this mark.	(5)

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Preparing your students for the open, extended response questions

Here is a suggested list of activities that could be done with students before and throughout the GCSE Statistics course.

1. Complete mini statistical projects throughout Key Stage 3 by building them into current schemes of work.
2. Complete several mini projects during Key Stage 4. This could be done by starting with a structure in place and then gradually removing the steps until students can complete tasks themselves.

   The Final stage is to explain the steps without actually carrying out the projects then students can just be given exam questions to complete.

   Ensure projects cover all the types of analysis e.g. discrete data, grouped data, quantitative data, qualitative data.

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3. Complete an old coursework type activity or a simplified version – students to come up with their own hypothesis, collect data and come to their own conclusions.

4. Classroom discussions/group work – students are given a hypothesis and asked to work together to explain the steps of how they would go about answering it.

   This could be done as a class activity or group work and answers may be displayed as a flow chart, poster design.

   These posters could then be displayed on classroom walls to help students when answering exam style questions.

5. Design a framework for the students to use to help them structure their answers. This could be displayed on classroom walls.

6. Share exemplar solutions for these questions or mark schemes – students to mark them themselves, discuss merits of each example.

7. The more practice students have with these types of questions, the better they will be at them. More exemplar materials will be made available throughout the course.

8. Have a set of prompt cards that could be handed out to students to help them when they are completing projects or extended exam questions. Examples given below:
    - *Have you considered this...?*
    - *What types of graphs might you draw?*
    - *What calculations might you need to do?*
    - *What are the advantages of this…?*
    - *What are the disadvantages of this...?*
    - *How would you collect the data?*
    - *What data do you need?*
    - *What graphs, charts would be useful?*
    - *Why have you used that technique?*
    - *Can you justify why you have done that…?*
    - *Have you used keywords?*
    - *What diagrams or calculations would be appropriate?*

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9. Have a colourful word wall in classrooms which includes statistical key words that should be used in their answers. This could be added to throughout the course as new topics are introduced.

Pie chart
Range
Summarise
Box plot
Pilot survey
Discrete
Plan
Stem and leaf
Stratified
Justify
Primary
Advantages
Median
Sample
Hypothesis
Questionnaire
Disadvantages
Continuous
Secondary
Histogram
Data
Compare
Appropriateness
Cumulative frequency

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10. Ask your students how they would answer these types of questions in other subjects e.g. Science, Geography. You will be amazed at how much they have already learnt that will help from their other subjects.

11. Ensure that students are aware that this is a data handling CYCLE: the investigation is not necessarily over when they have come to a conclusion, but instead this may encourage further investigation.

12. When students have attempted these questions prior to the exam for revision, get them to critique other students' work (not exactly spot the mistake but more like improving the way something is done). E.g. get them to rewrite an answer more succinctly or cross out the redundant bits.

Good exam practice

Good practice for students when answering these questions in an exam:

1. Read each question carefully and underline/highlight key parts of question before attempting to answer it. Perhaps use headings in their answers to ensure all parts are given a full written answer.

2. Use the correct keywords e.g. use the word median not average; use IQR or range and not spread.

3. Emphasise to students that it is quality and not necessarily quantity that is needed. In similar types of questions on the old specification students often gave very lengthy answers that scored no marks. They need to answer what is been asked and not 'waffle' about things that are not needed. If the question says, 'you do not need to include...', then don't include it.

4. Keep an eye on the time – students may run out of time if they spend too long on these questions.

Feedback from examiner's report June 2019

- Practise writing clear explanations, bearing in mind exactly what is asked in the question and what evidence you should give to support your answer. The open response questions require not only a description but calculations to support explanations, together with reasons why such a statistical method would be use (Paper 1H).

- Carry out statistical investigations using real data (both primary and secondary) to develop their understanding of the statistical enquiry cycle (Paper 2F).

Feedback from examiner's report June 2019

- Practise drawing conclusions (and assessing conclusions) from results presented to them (or that they have produced). Comparing data sets remains a key element in statistical investigations, using measures of average and spread. Such analysis needs to include a consideration of the appropriateness of statistical methods and conclusions drawn (Paper 2H).

- Practise questions which target A03, particularly those questions where the command word is 'assess' (Paper 2H).

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GCSE
Statistics
2017

Supporting you

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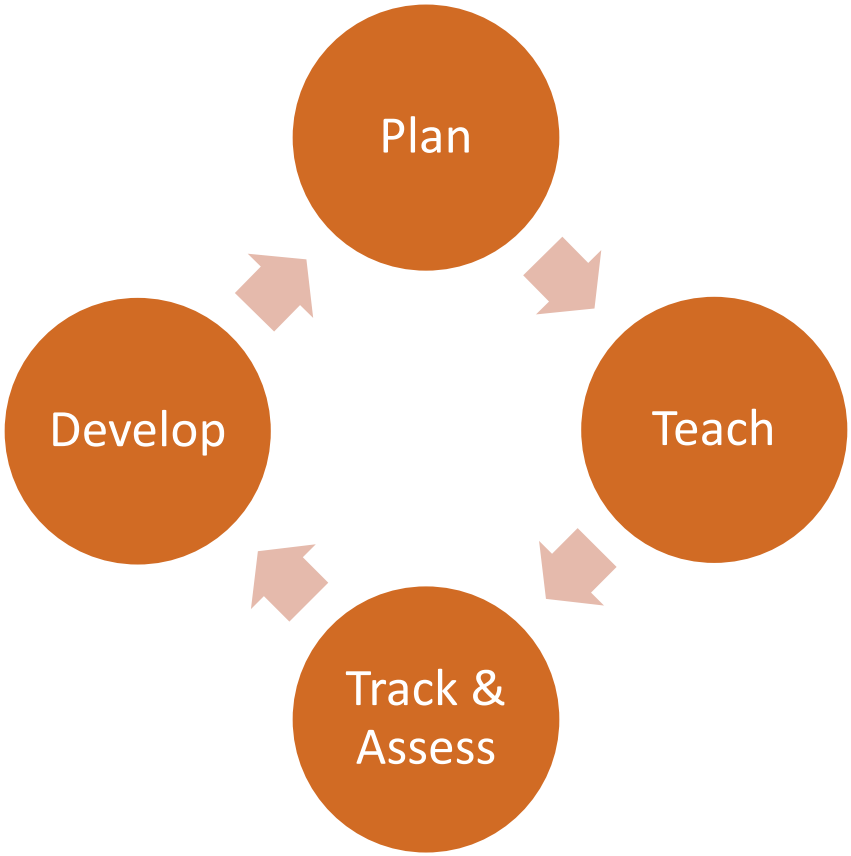
Supporting great Statistics teaching



- Extensive free support to help you plan, teach, track and assess, and develop the new course
- This includes free qualification support to download from our website as well as published resources*

Free qualification support: http://quals.pearson.com/stats17
* You do not have to purchase any resources to deliver our qualification

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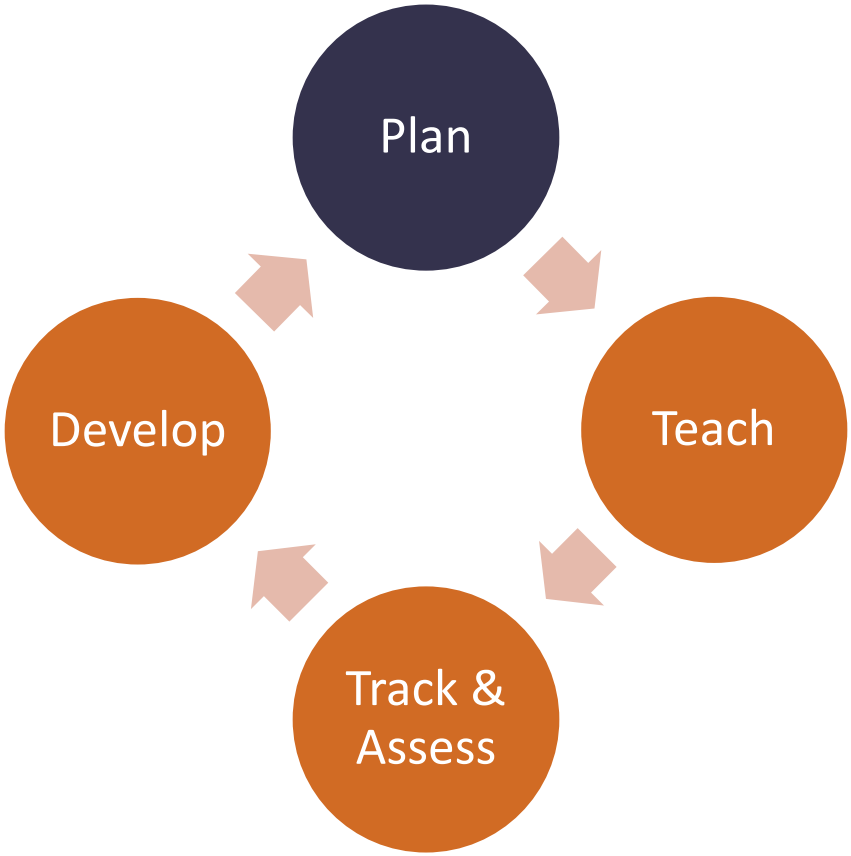
Plan

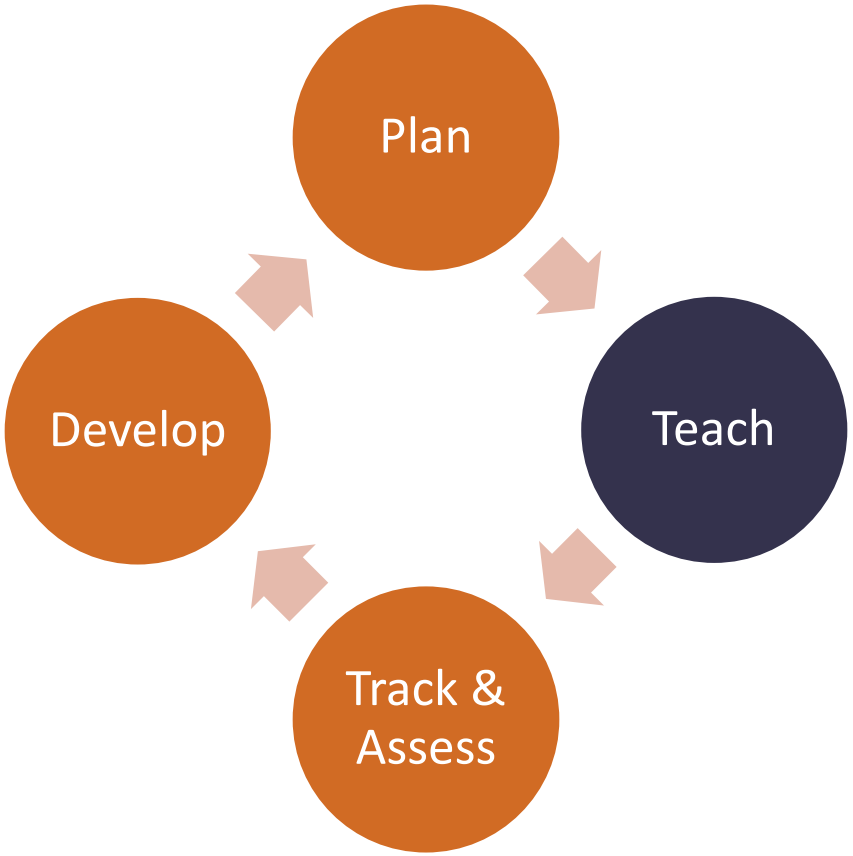


To help you plan the new course:

Free support for the qualification:

- Getting Started Guide
- Course planner
- Flexible and adaptable scheme of work
- Mapping documents

Teach



Teaching and learning support to help you deliver the new qualification:

Free support for the qualification:

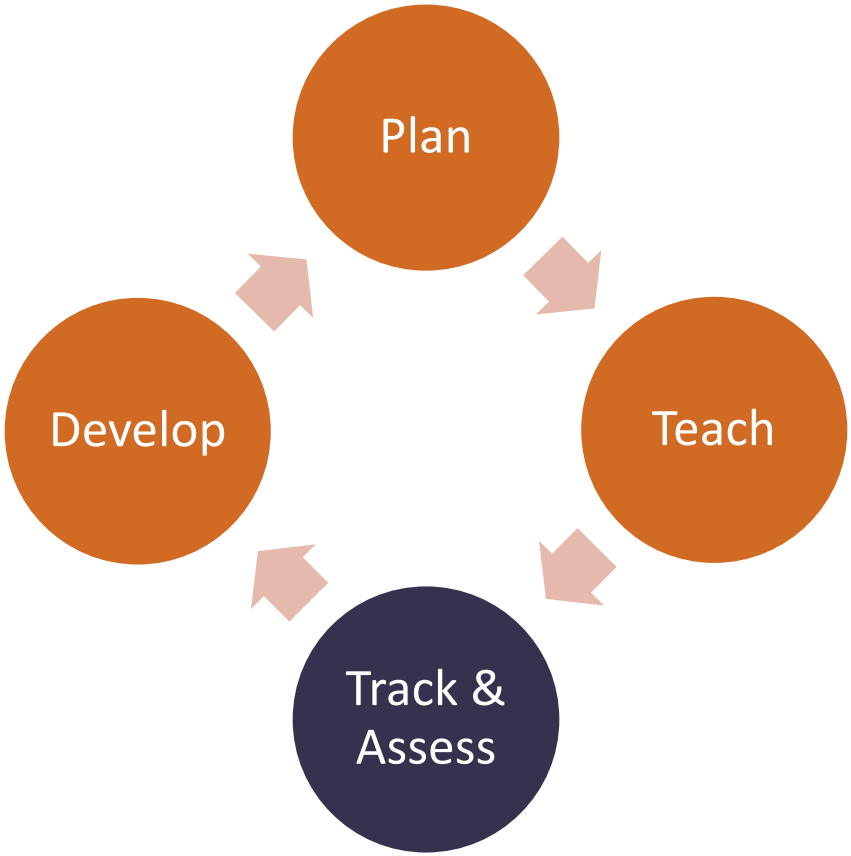
- Teaching points and common misconceptions
- Support for the statistical enquiry cycle

Published resources from Pearson*:

- Student Book and ActiveBook

* You do not have to purchase any resources to deliver our qualification

Track and assess



To help you prepare your students for the assessments:

Free support for the qualification:

- Plenty of specimen papers to support formative assessment and mock exams
- Marked exemplars of student work with examiner commentaries
- Extra SEC practice questions
- ResultsPlus and examWizard

Published resources from Pearson*:

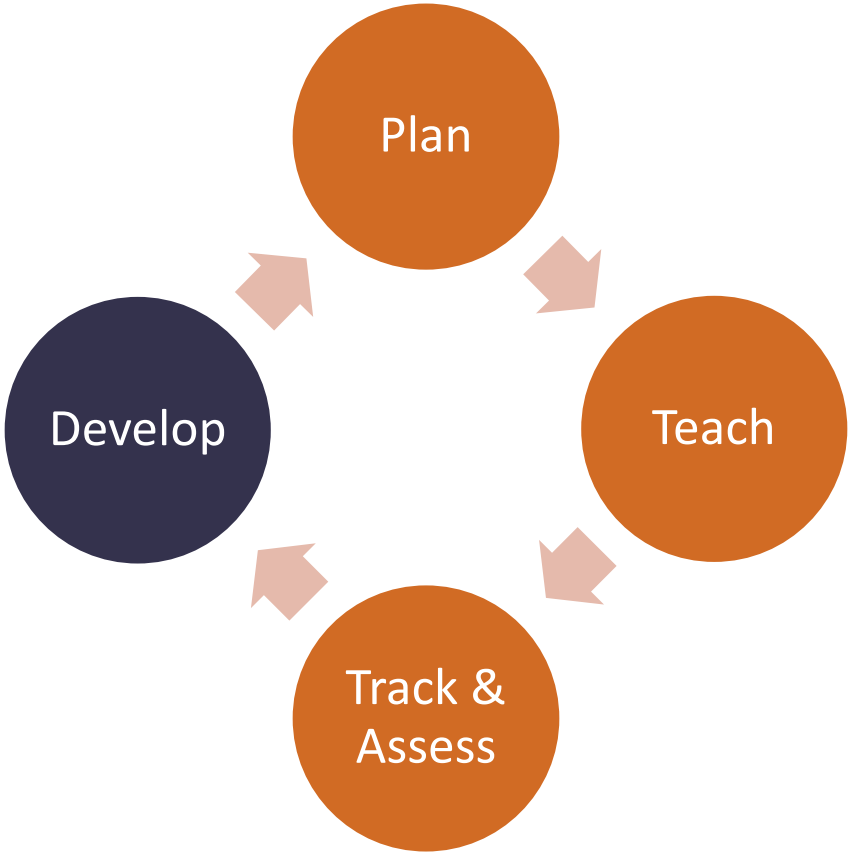
- Pearson Progression Service

* You do not have to purchase any resources to deliver our qualification

ResultsPlus and examWizard

- **ResultsPlus** provides the most detailed analysis available of your students' exam performance. This free online service helps you identify topics and skills where students could benefit from further learning, helping them gain a deeper understanding of Statistics.
- **examWizard** is a free exam preparation tool containing a bank of past Edexcel exam questions, mark schemes and examiners' reports, so you can create mock papers, homework or practice tests in minutes.

Develop



Our training programme includes:

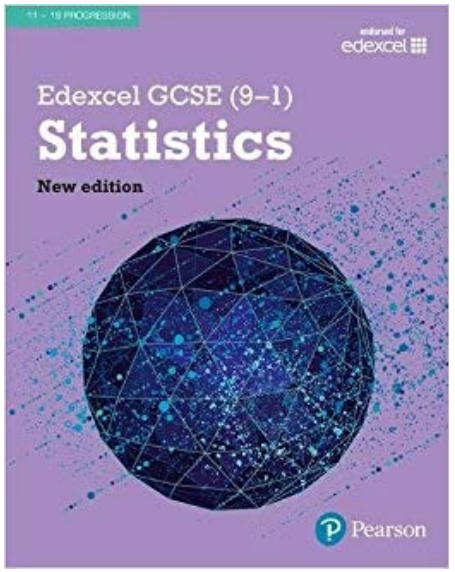
- Delivering GCSE (9–1) Statistics for the first time
- Mocks Marking Training
- Collaborative Network meetings

Our subject advisor team led by Graham Cumming, and the support and resources of the Mathematics Emporium, will guide you through all the changes and are on hand to answer any questions you might have.

Published resources

- We’re committed to helping teachers deliver our Edexcel qualifications and students to achieve their potential
- To do this, we aim for our qualifications to be supported by a range of high-quality resources, produced by a range of publishers
- However, it is not necessary to purchase endorsed resources to deliver our qualification.

Published resources



Pearson's new resources:

- For students:
  - Student Book*
  - ActiveBook (eBook version of the Student Book)
  - Revision Guide
  - Revision Workbook
- For teachers:
  - Pearson Progression Service (eBook version of the Student Book plus assessments mapped to the Edexcel scheme of work with accompanying markbook)

* This resource has been endorsed by Edexcel.

You do not have to purchase any resources to deliver our qualification

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AS/A level Statistics

- Pearson is offering AS and A level Statistics
  - First teaching in September 2017
  - First assessment of AS in summer 2018
  - First assessment of AL in summer 2019

- Find out more:
  - Accredited specifications and SAMs are available on the website
  - Scheme of work and mapping documents on the website
  - Getting Ready to Teach event slides on the Emporium
  - If you're interested in delivering these qualifications, please contact mathsemporium@pearson.com so that we can keep you informed and updated about these new qualifications.

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Finally

Thank you for joining us in today's event. We hope you found it useful.

- Please let us know if you have any questions
- If you have questions after the event, please contact Graham Cumming and his team at the NEW Mathematics Emporium
  - mathsemporium@pearson.com
  - www.mathsemporium.com

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