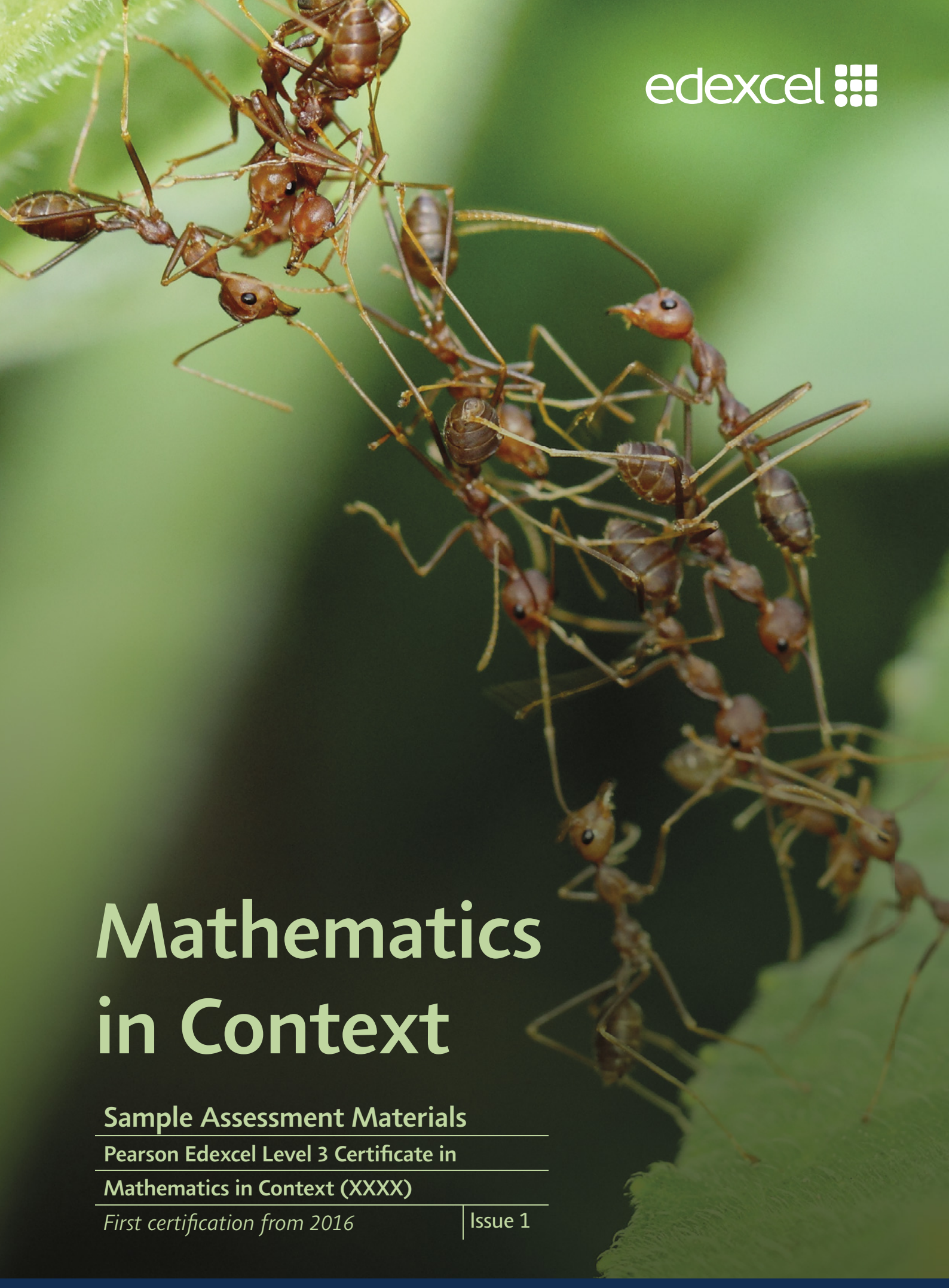

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Mathematics in Context

Sample Assessment Materials

Pearson Edexcel Level 3 Certificate in

Mathematics in Context (XXXX)

First certification from 2016 | Issue 1

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Pearson Edexcel Level 3 Certificate in Mathematics in Context (XXX)

Sample Assessment Materials

First Certification 2016

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Contents

Introduction

The Pearson Edexcel Level 3 Certificate in Mathematics in Context is designed for use in schools and colleges.

These sample assessment materials have been developed to support the qualification and will be used as the benchmark in developing the assessment that students will actually take.

General marking guidance

- All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than be penalised for omissions.
- Examiners should mark according to the mark scheme – not according to their perception of where the grade boundaries may lie.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification/indicative content will not be exhaustive.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, a senior examiner must be consulted before a mark is given.
- Crossed-out work should be marked **unless** the candidate has replaced it with an alternative response.

Guidance on the use of codes within the mark scheme:

- **B mark** is a standalone mark for accuracy (not linked to a method mark).
- **A mark** is a mark awarded for accuracy.
- **M mark** is a method mark.
- **C mark** is a mark that involves descriptive comment which may or may not contain a numerical solution to the problem.
- **oe** – or equivalent.
- **cao** – correct answer only.
- **ft** – follow through.
- **sc** – special case.
- **awrt** – answers which round to.

Pearson Edexcel Level 3 Certificate

Mathematics in Context

Paper 1: Comprehension

Sample Assessment Materials for first teaching September 2014

Source booklet

Paper Reference

XXXX/01

Do not return this source booklet with the question paper.

Turn over ▶

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2/2/

S 4 7 5 7 9 A

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Formulae sheet

There will be no credit for anything you write on this formulae sheet.

Mean of a frequency distribution $= \dfrac{\sum fx}{\sum f}$

Mean of a grouped frequency distribution $= \dfrac{\sum fx}{\sum f}$, where x is the mid-interval value

Variance $= \dfrac{\sum (x - \bar{x})^2}{n}$

Standard deviation (set of numbers) $\sqrt{\left[\dfrac{\sum x^2}{n} - \left(\dfrac{\sum x}{n}\right)^2\right]}$

or $\sqrt{\left[\dfrac{\sum (x - \bar{x})^2}{n}\right]}$

where $\bar{x}$ is the mean of the set of values

Standard deviation
(discrete frequency distribution) $\sqrt{\left[\dfrac{\sum fx^2}{\sum f} - \left(\dfrac{\sum fx}{\sum f}\right)^2\right]}$

or $\sqrt{\left[\dfrac{\sum f(x - \bar{x})^2}{\sum f}\right]}$

Spearman's rank correlation coefficient $1 - \dfrac{6\sum d^2}{n(n^2 - 1)}$

The product moment correlation coefficient is

$$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}} = \frac{\sum x_i y_i - \frac{\left(\sum x_i\right)\left(\sum y_i\right)}{n}}{\sqrt{\left(\sum x_i^2 - \frac{\left(\sum x_i\right)^2}{n}\right)\left(\sum y_i^2 - \frac{\left(\sum y_i\right)^2}{n}\right)}}$$

The regression coefficient of y on x is $b = \frac{S_{xy}}{S_{xx}}$

Least squares regression line of y on x is $y = a + bx$ where $a = \bar{y} - b\bar{x}$

Arithmetic series

$$u_n = a + (n - 1)d$$

$$S_n = \frac{1}{2}n(a + l) = \frac{1}{2}n[2a + (n - 1)d]$$

Geometric series

$$u_n = ar^{n-1}$$

$$S_n = \frac{a(1 - r^n)}{1 - r}$$

$$S_\infty = \frac{a}{1 - r} \text{ for } |r| < 1$$

There will be no credit for anything you write in this source booklet.

SECTION A: HOUSE PRICES

Data source A

In 2012, 43% of people aged 25–36 owned their own home. Of the first-time buyers (FTB) who bought in 2012, 64% received financial help from their parents.

But it is unlikely future generations will be able to help their offspring in the same way, warns HSBC, the bank which undertook this research.

Its findings, published today, show how much harder it is for 25–36-year-olds to afford a property now than it was for their parents, thanks to bigger deposits, higher house prices and stricter mortgage-lending criteria than previous generations.

	1983	**2007**	**2014**
Age of FTB	27	29	29
Property value	£17 021	£129 499	£147 000
LTV ratio	94%	90%	80%
Deposit	£1021	£12 950	£29 400
Borrower income	£8316	£35 000	£35 918

FTB – first-time buyer

LTV – loan-to-value ratio expresses the amount of a mortgage loan as a percentage of the total appraised value of property. For example, if a borrower wants £130 000 to purchase a house worth £250 000, the LTV ratio is £130 000/£250 000 or 52%.

Data source B

The average house price is rising at 7.3% annually but remains 12% below the 2007 peak.

House prices grew to an average of £175 546 by 31 January 2014, up 7.3% compared to the same period a year ago, according to the Halifax bank.

The UK's biggest mortgage lender said house prices climbed 1.1% in January following a 0.5% fall in December caused by seasonal factors.

The figures will further fuel concerns that a house price bubble is emerging. However, prices are still 12% below the peak of £199 612 in August 2007.

Nicholas Ayre, managing director of homebuying agency Home Fusion, said: 'The definition of a house price bubble is when people will pay anything for a property. This is not what we are seeing here. Many people are still heavily indebted, particularly if they have maxed out on credit cards. This is hardly a market running away with itself.'

But earlier this week economic forecasters the EY Item Club said London is beginning to show 'bubble-like conditions'.

It said the cost of buying in London is 3.5 times more than the average house price in Northern Ireland and over 3.3 times the average in the north east of England. It added that income multiples are now back to pre-crisis levels in London as homeowners take on increasingly expensive mortgages.

The EY Item Club predicted the average house price in London will rise to £600 000 by 2018.

Howard Archer, chief UK economist at IHS Global Insight, said while he does not believe the UK is in the grip of a bubble, house prices look set for strong increases over the coming months – especially as a shortage of available properties is putting pressure on prices in a growing number of locations.

Matthew Pointon, property economist at Capital Economics, said: 'If prices continue to rise by 1.1% per month, house prices on this measure will pass their previous peak by the end of the year, which will stoke concerns that a new house price bubble is forming. But we expect gains will moderate over the year.'

'Rising wholesale interest rates suggest mortgage rates are likely to edge up over the year, curbing demand. And improved selling conditions should mean more homes come onto the market, relieving the upwards pressure on prices.'

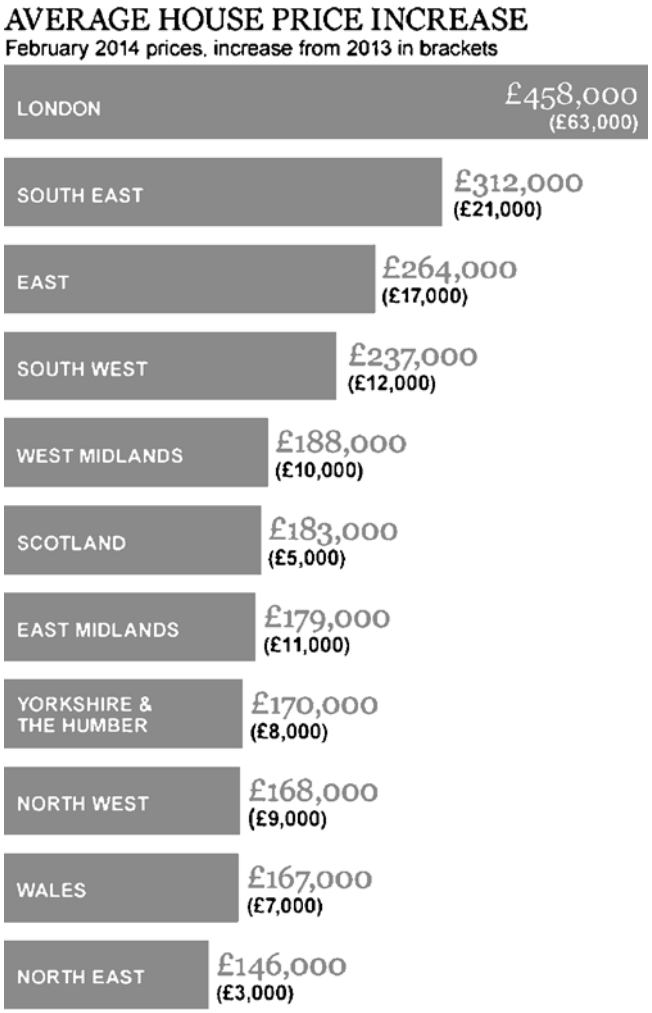
Halifax said that more than one million houses were sold in 2013. This is the first time this has happened since 2007, just before the financial crisis struck.

Data source C

London homes increased in value by more than twice the average person's income last year, figures show.

The typical value of properties in the capital rose by £63 000 in the last year, reaching an average of £458 000.

The surge came amid record rises in home prices across the country, according to figures published on Tuesday by the Office for National Statistics (ONS), prompting warnings of 'runaway train' increases. Experts said the rise in London prices was particularly 'extraordinary' when separate figures issued on the same day showed that inflation had fallen to a four-year low.



A graph showing average house price increases (source: ONS)

SECTION B: EUROVISION

The Eurovision Song Contest takes place annually. Each country that is part of the European Broadcasting Union is invited to participate and the final line up comprises 10 qualifying countries from the semi-finals and 16 automatic entries to the final. Each country involved in the contest votes for each of the songs featured in the final, with the exception that countries cannot vote for their own entry (so, for example, the televote in the UK will not allow votes in favour of the UK entry).

Data source D

Jury member selection criteria

All jury members are music professionals. They are being asked to judge:

- vocal capacity
- the performance on stage
- the composition and originality of the song
- the overall impression made by the act.

The average age of the jury members across Europe is 40 years old, 79 members are female, 106 are male.

Jury members signed a declaration stating they will vote independently.

The voting rules

Viewers in the countries of the Participating Broadcasters are invited to vote for their favourite songs (without the possibility of voting for the song representing their own country) by means of televoting. In addition, in each participating country there is a National Jury.

With respect to the televoting, the song that has received the highest number of votes shall be ranked first, the song that has received the second highest number of votes shall be ranked second and so on until the last song.

With respect to the National Jury voting, the jury members shall rank first their favourite song, second their second favourite song, third their third favourite song and so on until their least favourite song, which shall be ranked last.

The rankings of the televoting and the National Jury will then, in each of the participating countries, be used to calculate the average rank of each song. This combined ranking will then be transformed to the 'Eurovision system', with the top-ranked song getting 12 points, the second-highest ranked song 10 points and the remaining spots, from 8 points to 1 point, given to the songs ranked 3 to 10.

If there is a tie of two or more songs in the combined ranking between televotes and the jury, the song that obtains a better ranking from the televote will be placed ahead of the other country.

Source information

Data source A taken from:
www.telegraph.co.uk/finance/personalfinance/borrowing/mortgages/10620187/First-time-buyers-in-golden-age-for-mortgage-support.html

Data source B taken from:
www.telegraph.co.uk/finance/personalfinance/houseprices/10621089/Average-house-price-reaches-175546.html

Data source C taken from:
www.telegraph.co.uk/finance/personalfinance/houseprices/10768456/London-house-prices-jump-by-twice-the-average-income.html

Data source D taken from:
www.eurovision.tv/page/news?id=who_will_be_in_the_expert_juries

Write your name here

Surname	Other names

Pearson Edexcel Level 3 Certificate

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics in Context

Paper 1: Comprehension

Sample Assessment Materials for first teaching September 2014

Time: 1 hour 40 minutes

Paper Reference **XXXX/01**

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 60
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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2/2/

S 4 7 5 7 9 A 0 1 1 2

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SECTION A

Answer ALL questions. Write your answers in the spaces provided.

HOUSE PRICES

1 Refer to **data source A** in the source booklet.

(a) Use the LTV ratio from 2007 to calculate the value of the mortgage loan in 2007.

(2)

(b) Use the information in the table to give **two reasons** why it is harder for those aged 25–36 to afford a property in 2014 than it would have been for their parents in 1983. You should support your answers with appropriate calculations and conclusions.

(6)

(Total for Question 1 is 8 marks)

Refer to **data sources A, B and C** in the source booklet for Questions 2 to 5.

2 Determine whether the average house price at the end of November 2013 was greater or less than the average house price at the end of January 2014.

(3)

(Total for Question 2 is 3 marks)

3 (a) Work out an estimate for the average house price in London in 1983.

(3)

The EY Item Club predicted that the average house price in London will rise to £600 000 by 2018.

(b) If the EY Item Club is correct, will the average house price have risen at a greater average annual percentage rate between 1983 and 2014 or between 2014 and 2018?

State two assumptions that you have made.

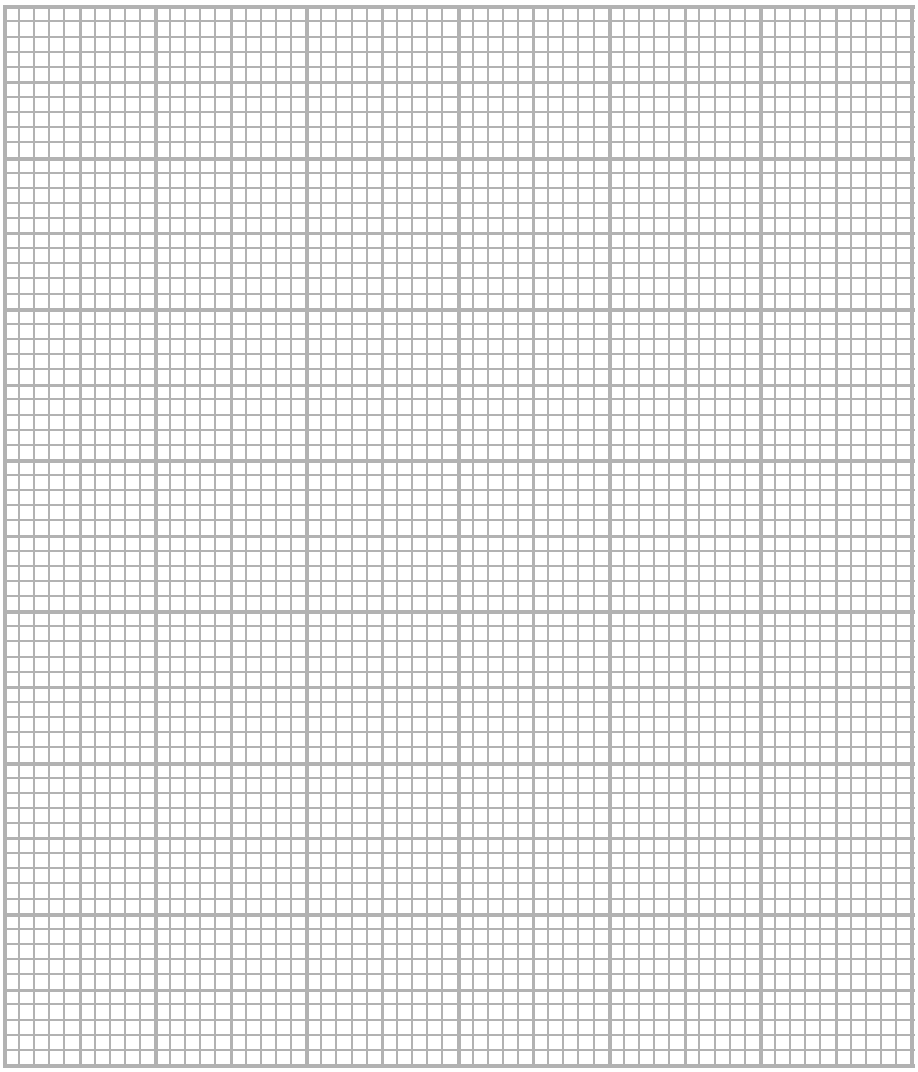
(6)

(Total for Question 3 is 9 marks)

4 By considering the data in the bar chart in **data source C** in the source booklet:

(a) draw an appropriate diagram on the graph paper provided below in order to determine the nature of the correlation between house prices in February 2014, £x, and the increase from 2013, £y, shown in brackets.

(4)



The equation of the line of regression of y on x is

$$y = 0.1734x - 23871$$

The correlation coefficient $r = 0.955$

(b) Interpret this information.

(3)

(Total for Question 4 is 7 marks)

5 An estate agent said: 'If prices continue to rise by 1.1% per month, house prices on this measure will pass their August 2007 peak within 12 months'.

Use figures from **data source B** in the source booklet and appropriate calculations to determine whether or not this statement is correct.

(3)

(Total for Question 5 is 3 marks)

(Total for HOUSE PRICES is 30 marks)

TOTAL FOR SECTION A IS 30 MARKS

SECTION B

Answer ALL questions. Write your answers in the spaces provided.

EUROVISION

Refer to **data source D** in the source booklet for Questions 6 to 10.

6 Calculate the total sum of the ages of the jury members across Europe.

(2)

(Total for Question 6 is 2 marks)

7 Find the percentage of the jury members that are female.

(2)

(Total for Question 7 is 2 marks)

8 (i) How many different finalists does each country award a non-zero number of points to?

(ii) Find the mean of the non-zero number of points.

(iii) Find the median of the non-zero number of points.

(5)

(Total for Question 8 is 5 marks)

9 The rankings of both the jury and the televote are taken into consideration in order to determine the overall rank of each country. Some information about how the jury and television audience from **one** country ranked other countries in 2014 is displayed in the table below.

	Jury member ranking					**Ranking**			
	A	**B**	**C**	**D**	**E**	**Overall jury**	**Televote**	**Combined rank 1 to 12**	**Points**
Ukraine	9	14	18	17	17		3		
Norway	7	6	5	13	4		12		
Armenia	18	11	23	10	12		7		
Austria	24	18	7	18	16		4		
Germany	5	8	17	5	5		5		
Sweden	10	16	22	11	13		6		
Finland	4	3	4	8	8		16		
Spain	14	7	16	6	6		11		
Switzerland	2	5	9	9	2		1		
Malta	3	2	2	2	3		22		
Denmark	12	9	12	3	9		10		
The Netherlands	1	1	1	1	1		2		

Complete the table.

(9)

(Total for Question 9 is 9 marks)

10 The table below gives some information relating to the total points scored, the final position, the average jury rank and the average televote rank.

Country	Final position	Points	Average jury rank	Average televote rank
Denmark	1	281	6.23	4.97
Azerbaijan	2	234	7.77	5.86
Ukraine	3	214	8.74	5.66
Norway	4	191	8.23	7.14
Russia	5	174	9.67	6.84
Greece	6	152	12.28	6.00
Italy	7	126	9.46	11.70
Malta	8	120	9.54	10.97
The Netherlands	9	114	9.05	11.70
Hungary	10	84	15.59	8.19
Belgium	11	71	9.92	16.03
Moldova	12	71	8.69	16.57

Consider the information for the top 12 countries given in the table.

(a) Moldova and Belgium should be equally ranked according to the points that they scored. State whether you agree or disagree with their final positions, giving a reason to support your view.

(2)

In order to evaluate the 'fairness' of the new system the Eurovision organisers decide to consider the degree of agreement in judgements of the average jury rank, the average televote rank and the final position for each country in the top 12.

The organisers find that Spearman's rank correlation coefficient between the average jury rank and the final position of each country is 0.608.

The organisers find that Spearman's rank correlation coefficient between the average televote rank and the final position of each country is 0.903.

(b) (i) Find Spearman's rank correlation coefficient for the juries' judgements and the televote results.

(ii) Which of the three values shows the best degree of agreement? Give a reason for your answer.

Eurovision organisers are considering changing the system next year so that it is based only on the televote results.

(iii) Explain whether or not this is an appropriate change.

(10)

(Total for Question 10 is 12 marks)

(Total for EUROVISION is 30 marks)

TOTAL FOR SECTION B IS 30 MARKS

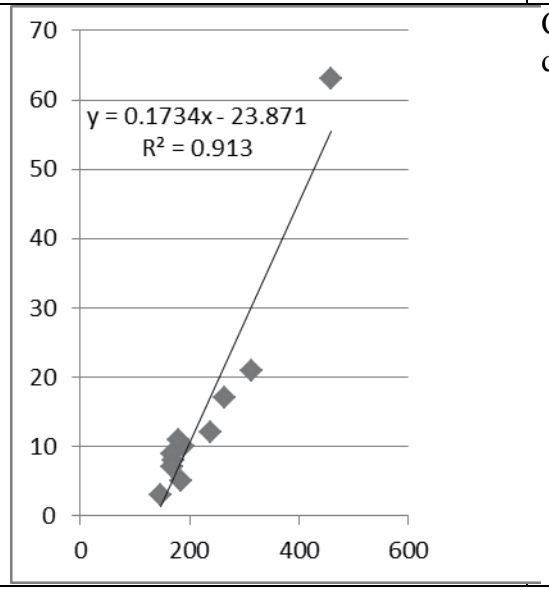
TOTAL FOR PAPER IS 60 MARKS

Paper 1 Mark Scheme

SECTION A – TASK 1: HOUSE PRICES

Question	Working	Answer	Mark	Notes
1 (a)	0.9×129499 Alt 129499-(0.1×129499) (£)116549.1(0)	£116549.10	2	M1 for method to find 90% of £129499 **Alt** M1 for method to find £129499-10% of £129499 **oe** A1 £116549.1(0)
1 (b)	**Deposit as a proportion of property value** M1 1021/17021 **and** 29400/147000 seen (**oe**) A1 **awrt** 0.06 and 0.2 seen **or awrt** 6% and 20% seen C1 conclusion that the deposit in 2014 is a higher proportion of the property value than in 1983 **Borrower income as a proportion of property value** M1 8316/17021 **and** 35918/147000 seen (**oe**) A1 **awrt** 0.5 and **awrt** 0.2 seen **or awrt** 50% and **awrt** 20% seen C1 conclusion that the income in 1983 is a higher proportion of the property value than in 2014 (or vice versa)		6	C1 only for comparison using figures straight from table or statements from article **B1 for each statement (maximum 2 marks),** eg:- older FTB in 2014 than 1983 suggests it is harder property value has increased amount of mortgage has increased bigger deposits in 2014 than 1983 higher house prices in 2014 than 1983 stricter mortgage lending criteria in 2014 **Deposit as a proportion of property value** M1 attempt ratio or percentage comparison between deposit and property value for **both** 1983 and 2014 A1 both ratios/percentages correct C1 using their figures as justification

Question	Working	Answer	Mark	Notes
1 (b) contd.	**Deposit as a proportion of borrower income** M1 1021/8316 **and** 29400/35918 seen (**oe**) A1 **awrt** 0.1 and **awrt** 0.8 seen **or awrt** 10% and **awrt** 80% seen C1 conclusion that the deposit in 1983 is a lower proportion of the income than in 2014 (or vice versa)			**Borrower income as a proportion of property value** M1 attempt ratio or percentage comparison between income and property value for **both** 1983 and 2014 A1 both ratios/percentages correct C1 using their figures as justification **Deposit as a proportion of borrower income** M1 attempt ratio or percentage comparison between deposit and borrower income for **both** 1983 and 2014 A1 both ratios/percentages correct C1 using their figures as justification NB these comparisons could be made the 'opposite' way round
2	N×0.995×1.011 = 175546 N = 175546/(0.995×1.011) N = 174508.54	Greater and 174508.54 oe	3	M1 a correct equation linking Nov (N) and Jan figures, eg:- Nov×0.995×1.011 = Jan **or** N×0.995×1.011 = 175546 **or** 0.995×1.011 accept values to 2 dp for this mark A1 174508-174509 **or** 1.00594-1.00595 C1 conclusion consistent with value found **This mark is dependent on previous M1**
3 (a)	17021/147000 × 458000	£53 031.41	3	M1 17021/147000 **oe** M1 17021/147000 × 458000 **oe** A1 for £53 031 or better (**awrt**)

Question	Working	Answer	Mark	Notes
3 (b)	$458000\times n^4 = 600\ 000$ $n = (600000/458000)^{0.25}$ $n = 1.0698464$ '53 031.4' $\times n^{31} = 458\ 000$ $n = (458000/\text{'53 031.4'})^{1/31}$ $n = 1.0720234$	1.0698464… and 1.0720234 And Two valid assumptions	6	M1 $458000\times n^4 = 600\ 000$ **or** '53 031.41'$\times n^{31} = 458\ 000$ M1 one correct expression with n the subject (n =) A1 one correct answer 1.0698464… **or** 1.0720234 … C1 both values correct and a correct conclusion C1 one valid assumption eg the house prices given are exact and have not been rounded to the nearest thousand C1 a second valid assumption eg the average house prices are proportional to the property values given in the table
4 (a)		Correct diagram	4	M1 scatter graph M1 at least 5 points plotted correctly A1 all points plotted correctly B1 consistent linear scale on both axes

Question	Working	Answer	Mark	Notes
4 (b)		Valid comment for gradient in context Valid comment for intercept in context Valid comment for correlation coefficient in context	3	C1 valid comment for the gradient in context eg the more expensive the house the greater the increase in price C1 valid comment for the intercept in context eg using 2014 prices rather than the 2013 prices C1 valid comment for the correlation coefficient eg very high linear correlation between 2014 prices and increase in price
5	$175546 \times 1.011^{12} = 200172.68$ and correct statement **OR** $1.011^{12} = 1.140286$ and correct statement	200172.68 **OR** 1.140286 and correct statement	3	M1 for 175 000 (or 175546)$\times 1.011^{12}$ (allow 1.011^{11}) **OR** M1 for 1.011^{12} or 1.011^{11} evaluated A1 for **awrt** 200170 or **awrt** 1.14 C1ft for comparison of their value with £199 612 and consistent conclusion (**ft** on their value dependent on previous M mark)

SECTION B – TASK 2: EUROVISION

Question	Working	Answer	Mark	Notes
6	(79+106)×40 = 185×40 = 7400	7400	2	M1 (79+106)×40 **or** 185×40 A1 7400
7	79/(79+106)×100 = 79/185×100 = 42.702702	42.702702 %	2	M1 79/(79+106) **or** 79/185 seen A1 79/185×100 = 42.702702…(%) **awrt** 42.7
8 (i)		10	5	B1 states 10
(ii)	(1+2+3+4+5+6+7+8+10+12)/10 = 58/10 = 5.8	5.8		M1 (1+2+3+4+5+6+7+8+10+12)/10 **ft** on (a) A1 58/10 = 5.8
(iii)	(5+6)/2 = 5.5			M1 identifies 'middle' values A1 add their two 'consecutive' values and divide by 2 **OR** B2 Median = 5.5

<table>
<tr><th>Question</th><th>Working</th><th>Answer</th><th>Mark</th><th>Notes</th></tr>
<tr>
<td>9</td>
<td>
<table>
<tr><td>Country</td><td>Jury</td><td>Comb</td><td>Pts</td></tr>
<tr><td>Ukraine</td><td>11</td><td>4</td><td>7</td></tr>
<tr><td>Norway</td><td>5</td><td>9 (7=)</td><td>2</td></tr>
<tr><td>Armenia</td><td>10</td><td>7 (7=)</td><td>4</td></tr>
<tr><td>Austria</td><td>12</td><td>6</td><td>5</td></tr>
<tr><td>Germany</td><td>6</td><td>3</td><td>8</td></tr>
<tr><td>Sweden</td><td>9</td><td>5</td><td>6</td></tr>
<tr><td>Finland</td><td>3.5</td><td>11</td><td>0</td></tr>
<tr><td>Spain</td><td>8</td><td>10</td><td>1</td></tr>
<tr><td>Switz</td><td>3.5</td><td>2</td><td>10</td></tr>
<tr><td>Malta</td><td>2</td><td>12</td><td>0</td></tr>
<tr><td>Denmark</td><td>7</td><td>8 (7=)</td><td>3</td></tr>
<tr><td>Neth</td><td>1</td><td>1</td><td>12</td></tr>
</table>
</td>
<td>Ukr = 7 pts
Nor = 2
Arm = 4
Aus = 5
Ger = 8
Swe = 6
Fin = 0
Spa = 1
Switz = 10
Malta = 0
Den = 3
Neth = 12</td>
<td>9</td>
<td>Jury column
M1 at least 6 rankings correct
A1 all rankings correct
B1 Finland and Switzerland equal rank

Combined column
M1 at least 6 rankings correct
B1 Norway, Armenia and Denmark equal rank
B1 Armenia, Denmark, Norway ranked consecutively decreasing (using televote criteria given equal combined rank)
A1 all rankings correct

Points column
B1 Finland and Malta 0 points
B1 all correct</td>
</tr>
<tr>
<td>10 (a)</td>
<td>Agree or disagree with consistent supporting statement</td>
<td>View and consistent statement</td>
<td>2</td>
<td>C1 agree or disagree with a supporting statement

C1 a full supporting statement consistent with view and valid

egs:-

Agree since Moldova has got a better (lower) average jury rank (8.69 against 9.92)

Agree since Moldova has got a better (lower) average jury rank + average televote rank (25.26 against 25.95)

Disagree since Moldova has got a worse (higher) average televote rank (16.57 against 16.03)</td>
</tr>
</table>

Question	Working	Answer	Mark	Notes
10 (b)(i)	Jury | Tele | d | d^2 1 | 1 | 0 | 0 2 | 3 | 1 | 1 5 | 2 | 3 | 9 3 | 6 | 3 | 9 9 | 5 | 4 | 16 11 | 4 | 7 | 49 7 | 9.5 | 2.5 | 6.25 8 | 8 | 0 | 0 6 | 9.5 | 3.5 | 12.25 12 | 7 | 5 | 25 4 | 12 | 8 | 64 10 | 11 | 1 | 1 | | | 192.5 SR = 1-(6x192.5)/(12x143) = 1-(35/52) = 17/52 = 0.327	0.327	10	M1 attempts to rank jury and televote values (either way round but consistent) B1ft finds d values consistent with their rankings so far B1ft finds their d squared values and sums them A1 sums d squared values 192.5 M1 (SR) = 1-(6×their sum)/(12x143) **o**e A1 17/52 or 0.327 exact answer or **awrt** 0.327 If correct answer only stated with no supporting working (17/52 or 0.327) award full marks for efficient and accurate use of calculator
(ii)		States 0.903 A valid reason		C1 states 0.903 C1 gives a reason eg from the three values 0.903 is the closest to 1 which indicates complete agreement between the ranks

Question	Working	Answer	Mark	Notes
10 (iii)		Explain voting method and a reason in favour A second reason in favour or against other methods	2	C1 explains their preferred method for voting (eg televoting only or jury voting only or current system) and one reason in favour of their method (eg strongest agreement between tele voting and final rankings, independent jury voting free of bias, a mixture of two views so less chance of social media campaign **oe** skewing the voting) C1 a second reason in favour of their method or for rejecting a different method

Pearson Edexcel Level 3 Certificate

Mathematics in Context

Paper 2: Applications

Sample Assessment Materials for first teaching September 2014

Source booklet

Paper Reference

XXXX/02

Do not return this source booklet with the question paper.

Turn over ▶

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Formulae sheet

There will be no credit for anything you write on this formulae sheet.

Mean of a frequency distribution $= \dfrac{\sum fx}{\sum f}$

Mean of a grouped frequency distribution $= \dfrac{\sum fx}{\sum f}$, where x is the mid-interval value

Variance $= \dfrac{\sum (x - \bar{x})^2}{n}$

Standard deviation (set of numbers) $\sqrt{\left[\dfrac{\sum x^2}{n} - \left(\dfrac{\sum x}{n}\right)^2\right]}$

or $\sqrt{\left[\dfrac{\sum (x - \bar{x})^2}{n}\right]}$

where $\bar{x}$ is the mean of the set of values

Standard deviation
(discrete frequency distribution) $\sqrt{\left[\dfrac{\sum fx^2}{\sum f} - \left(\dfrac{\sum fx}{\sum f}\right)^2\right]}$

or $\sqrt{\left[\dfrac{\sum f(x - \bar{x})^2}{\sum f}\right]}$

Spearman's rank correlation coefficient $1 - \dfrac{6\sum d^2}{n(n^2 - 1)}$

The product moment correlation coefficient is

$$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}} = \frac{\sum x_i y_i - \frac{\left(\sum x_i\right)\left(\sum y_i\right)}{n}}{\sqrt{\left(\sum x_i^2 - \frac{\left(\sum x_i\right)^2}{n}\right)\left(\sum y_i^2 - \frac{\left(\sum y_i\right)^2}{n}\right)}}$$

The regression coefficient of y on x is $b = \frac{S_{xy}}{S_{xx}}$

Least squares regression line of y on x is $y = a + bx$ where $a = \bar{y} - b\bar{x}$

Arithmetic series

$$u_n = a + (n - 1)d$$

$$S_n = \frac{1}{2}n(a + l) = \frac{1}{2}n[2a + (n - 1)d]$$

Geometric series

$$u_n = ar^{n-1}$$

$$S_n = \frac{a(1 - r^n)}{1 - r}$$

$$S_\infty = \frac{a}{1 - r} \text{ for } |r| < 1$$

There will be no credit for anything you write in this source booklet.

SECTION A: EUROVISION

The Eurovision Song Contest takes place annually. Each country that is part of the European Broadcasting Union is invited to participate and the final line up comprises 10 qualifying countries from the semi-finals and 16 automatic entries to the final. Each country involved in the contest votes for each of the songs featured in the final, with the exception that countries cannot vote for their own entry (so, for example, the televote in the UK will not allow votes in favour of the UK entry).

Data source A

Jury member selection criteria

All jury members are music professionals. They are being asked to judge:

- vocal capacity
- the performance on stage
- the composition and originality of the song
- the overall impression made by the act.

The average age of the jury members is 40 years old, 79 members are female, 106 are male.

Jury members signed a declaration stating that they will vote independently.

The voting rules

Viewers in the countries of the Participating Broadcasters are invited to vote for their favourite songs (without the possibility of voting for the song representing their own country) by means of televoting. In addition, in each participating country there is a National Jury.

With respect to the televoting, the song which has received the highest number of votes shall be ranked first, the song which has received the second highest number of votes shall be ranked second and so on until the last song.

With respect to the National Jury voting, the jury members shall rank first their favourite song, second their second favourite song, third their third favourite song and so on until their least favourite song, which shall be ranked last.

The rankings of the televoting and the jury will then, in each of the participating countries, be used to calculate the average rank of each song. This combined ranking will then be transformed to the 'Eurovision system', with the top-ranked song getting 12 points, the second-highest ranked song 10 points, and the remaining spots, from 8 points to 1 point, given to the songs ranked 3 to 10.

If there is a tie of two or more songs in the combined ranking between televotes and the jury, the song that obtains a better ranking from the televote will be placed ahead of the other country.

Data source B: Spread sheet for Eurovision 2014 the results

Country receiving votes	Country voting																																			Total votes received	Position
	Albania	Armenia	Austria	Azerbaijan	Belarus	Belgium	Denmark	Estonia	Macedonia	Finland	France	Georgia	Germany	Greece	Hungary	Iceland	Ireland	Israel	Italy	Latvia	Lithuania	Malta	Moldova	Montenegro	Norway	Poland	Portugal	Romania	Russia	San Marino	Slovenia	Spain	Sweden	Switzerland	The Netherlands	Ukraine	United Kingdom		
Armenia (Arm)			12		10		2	5	8	4	12	12	6	7	7	2		6		10		6	3	10		1	4	7	8	6		4	5		7	10		174	4
Austria (Au)	5			1		12	8	4	3	12	10	10	7	12	10	10	12	12	12	6	10	10	7	2	10		12	8	5		12	12	12	12	12	8	12	290	1
Azerbaijan (Az)					A							7																	C	12						1		33	22
Belarus (Bel)		8		7														1			3		5	1					12						6		43	16
Denmark (Den)		1				6				6	3		8			8					1				1	6	5	4		1	6	3	8	3	1		3	74	9
Finland (Fin)			4			3	4	6					4		6	5			6	3					7	3				3			6	4	2		6	72	11
France (Fra)										1																							1					2	26
Germany (Ger)	4	6										5														8		2			2			7		5		39	18
Greece (Gre)	2	7		4	6							4						2	3			1							D								2	35	20
Hungary (Hun)	8		7	8	5	7	3	7	10	5				6		6	1	7		1			4	12			6	10	6	7		2	7	1	4	3		143	5
Iceland (Ice)			2				5				7		2		5				7						6				1	8		1	4		6		4	58	15
Italy	10								2		1											12		6									2					33	21
Malta	1			5						3							3		1											4					5		10	32	23
Montenegro	6	12							12																						7							37	19
Norway			1		4		6	3		7	2		5	3		1	7			5	8	2				7	3	1			5		3	5	10			88	8
Poland				2	B				5		5		10	1	3	3			8				2	4	2						1		2			7		62	14
Romania			8	6	1	5			4								2	8	5			8	12		4		1					8						72	12
Russia		10		12	12			1	6			8		10				3		2	6	5	8				2									4		89	7
San Marino	3	3		3											4								1															14	24
Slovenia									1															8														9	25
Spain	12	2				2		2			6		1				6	4		4	4				5	2		5			4			8		2	5	74	10
Sweden	7		6			10	12	10		10	4	2		2	8	7	4	10		8	7	7	6	3	8	4	8	12	2	10	8	10		6	8	12	7	218	3
Switzerland		5	3									1	3	4	1		5		2		2	3		5		10	7	6			3				3		1	64	13
The Netherlands		4	10		2	8	10	12	7	8	8		12	8	12	12	10		4	12	12				12	12	10	3	3	2	10	7	10	10			8	238	2
Ukraine			5	10	8	4	1	8		2		6		5	2			5	10	7	5		10	7		5			7			6						113	6
United Kingdom						1	7					3				4	8					4			3					5		5						40	17

Source information

Data source A taken from: www.eurovision.tv/page/news?id=who_will_be_in_the_expert_juries

Write your name here

Surname	Other names

Pearson Edexcel Level 3 Certificate

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics in Context

Paper 2: Applications

Sample Assessment Materials for first teaching September 2014

Time: 1 hour 40 minutes

Paper Reference **XXXX/02**

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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SECTION A

Answer ALL questions. Write your answers in the spaces provided.

EUROVISION

Refer to **data sources A and B** in the source booklet for Questions 1 to 3.

1 Using the spreadsheet **'Eurovision 2014 the results':**

(a) What is the highest total number of points that a song can get?

(2)

(b) Find the values denoted by A, B, C and D in the spreadsheet.

(2)

(Total for Question 1 is 4 marks)

2 A summary of the point scores awarded to Austria and the Netherlands is shown in the tables below.

Austria

Score	0	1	2	3	4	5	6	7	8	10	12
Frequency		1	1	1	1	2	1	2	3	7	13

$\sum fx = 290$ $\sum fx^2 = 2978$

Table 1

The Netherlands

Score	0	1	2	3	4	5	6	7	8	10	12
Frequency	9	0	2	2	2	0	0	2	5	7	8

$\sum fx = 238$ $\sum fx^2 = 2328$

Table 2

The information in tables 1 and 2 has been partially summarised in table 3

Figures have been written correct to 3 significant figures where appropriate.

	Median	**Mean**	**Range**	**Standard Deviation**
Austria	10	7.84	12	4.37
The Netherlands				

Table 3

(a) (i) Complete the missing entry in table 1

(ii) Complete the 4 missing entries in table 3

Those for Austria have already been done.

(8)

In order to encourage countries with low scores, it is proposed that all scores have 10 added to them.

(b) Describe what effect this proposal would have on the values for Austria in table 3

(2)

An alternative proposal is to double all the scores.

(c) Describe what effect this proposal would have on the values for Austria in table 3

(2)

(Total for Question 2 is 12 marks)

3 Compare the results of the two countries.

(4)

(Total for Question 3 is 4 marks)

TOTAL FOR SECTION A IS 20 MARKS

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SECTION B

Answer ALL questions. Write your answers in the spaces provided.

TASK 1: VACCINES AND BLOOD GROUPS

4 Kevin teaches at a college.

He carries out a survey of 100 of the students at the college.

He finds out that:

87 students have had the DTP vaccine

77 students have had the Meningitis C (Men C) vaccine

86 students have had the MMR vaccine

75 students have had all three vaccines

2 students have not had any vaccines

2 students have had just the Men C and the MMR vaccine

No students have had just the DTP and MMR vaccines

(a) Work out the probability that a student, chosen at random, has had only the DTP vaccine.

(5)

(b) Two students are chosen at random.

Work out the probability that both students have received fewer than two of the vaccines.

(3)

(Total for Question 4 is 8 marks)

5 The MMR vaccine protects against measles, mumps and rubella.

In Kevin's survey of 100 students, 86 of them have had the MMR vaccine.

If a student has received the vaccine then the probability that they will get measles is 0.01
If a student has **not** received the vaccine then the probability that they will get measles is 0.9

One of the 100 students in Kevin's sample is chosen at random.
Work out the probability that this student will get measles.

(4)

(Total for Question 5 is 4 marks)

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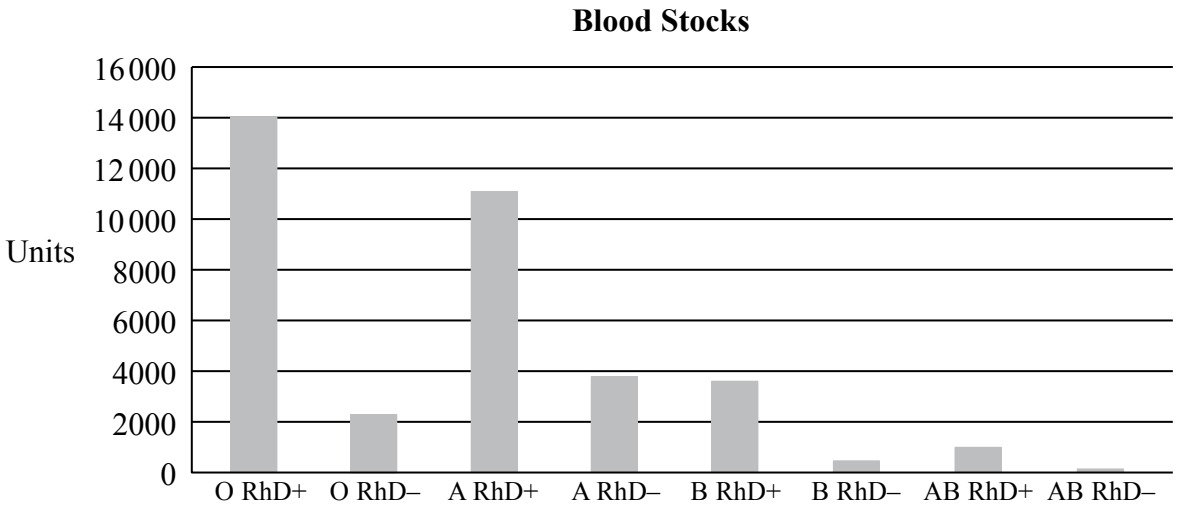
6 Kevin teaches his biology class about blood groups.

Red blood cells sometimes contain a protein known as the RhD antigen. If this is present then the blood group is RhD positive (RhD+). If this is absent then the blood group is RhD negative (RhD–).

UK population		
Blood group	**RhD status**	**Percentage**
O	RhD+	37%
	RhD–	7%
A	RhD+	35%
	RhD–	7%
B	RhD+	8%
	RhD–	2%
AB	RhD+	3%
	RhD–	1%



(Source: adapted from NHS Blood.co.uk)

Blood is normally stored for a maximum of 30 days.
8 000 units of blood are needed each day by hospitals in the UK.

(a) Is there enough of stock B RhD+ blood available for the next 8 days?

(2)

All the students in Kevin's biology class test their blood to find out their blood group.

The table shows their results.

Kevin's class	
Blood group	**Number of students**
O	13
A	7
B	4
AB	0

A student from Kevin's biology class is picked at random.

(b) Work out an estimate for the probability that this student is RhD–.

(4)

A person is selected at random from the UK population.

(c) Given that this person is RhD+, work out the probability that they have blood group A.

(2)

(Total for Question 6 is 8 marks)

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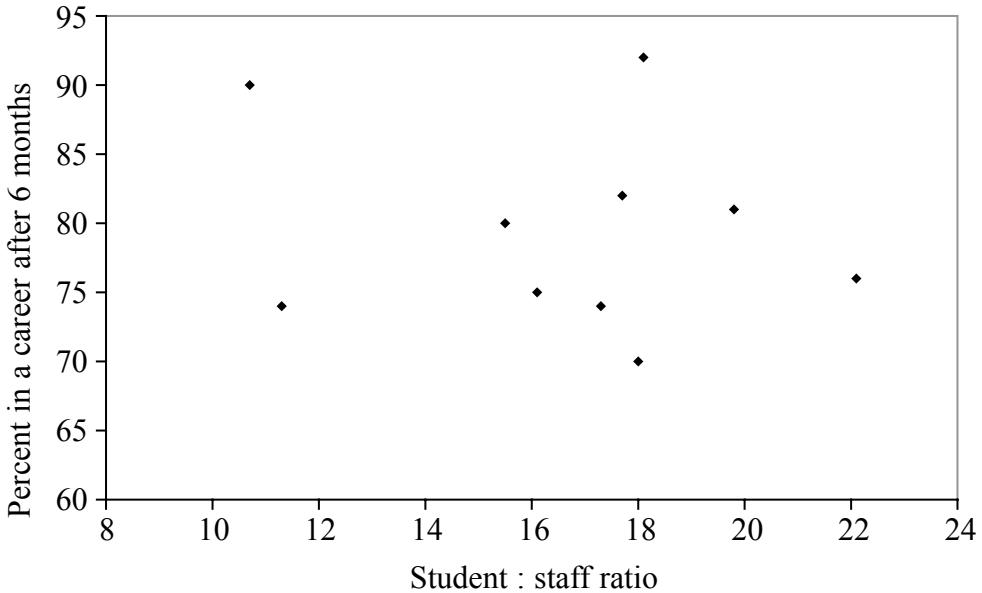
TASK 2: UNIVERSITY

7 Shazia is going to apply to university to study politics.

She finds out this data about politics courses at some universities.

			Student satisfaction: % of students satisfied with				
Rating	**Name of institution**	**Survey score (%)**	**course**	**teaching**	**feedback**	**Student : staff ratio**	**Students in a career after 6 months (%)**
1	Oxford	100.0	93	94	65	11.3 : 1	74
2	St Andrews	99.7	89	93	71	18.1 : 1	92
3	Cambridge	99.2	98	97	75	16.5 : 1	
4	LSE	98.3	87	87	76	10.7 : 1	90
5	UCL	91.5	78	87	66	15.5 : 1	80
6	Durham	85.9	88	87	74	19.8 : 1	81
7	Surrey	85.2	96	93	86	17.5 : 1	
8	Warwick	82.8	89	91	68	17.7 : 1	82
9	KCL	82.3	91	88	69	18.0 : 1	70
10	Birmingham	82.0	86	92	73	22.1 : 1	76
11	Bristol	80.5	80	91	71	16.1 : 1	75
12	York	79.8	86	92	72	17.3 : 1	74

She wants to know if there is any relationship between the student:staff ratio and the percentage of students in a career after 6 months. She starts by using the information from the table to draw a scatter graph.



Data from: www.theguardian.com/education/table/2013/jun/04/university-guide-politics

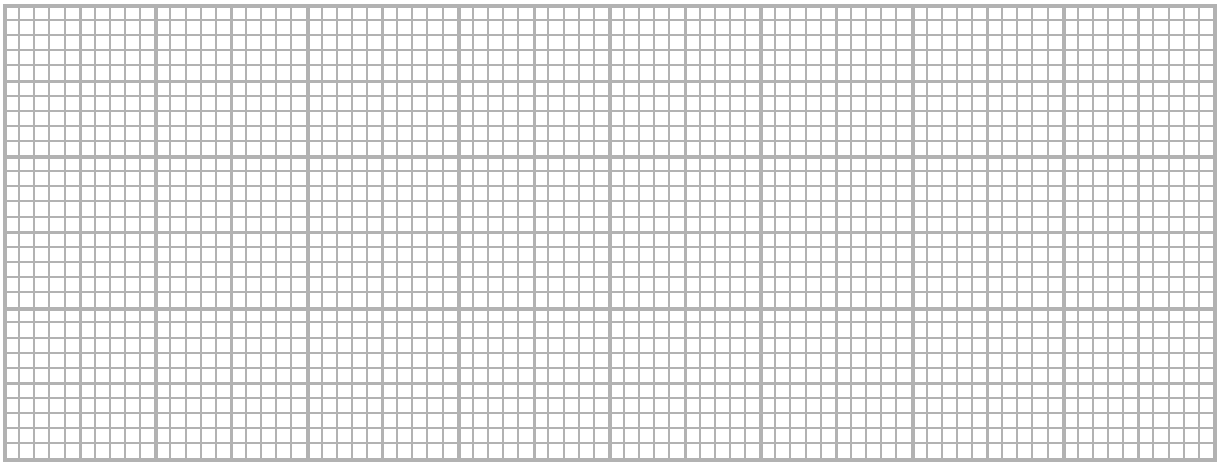
(a) Explain what the scatter graph shows about any relationship between the student:staff ratio and the percentage of students in a career after 6 months.

(2)

An outlier can be defined as any value that is:

- greater than the upper quartile + (1.5 × interquartile range)
- less than the lower quartile – (1.5 × interquartile range).

(b) (i) Using the graph paper below draw a box plot to show the information from the staff:student ratio column in the table. You must show any outliers on your box plot, along with calculations used to identify these outliers.



(ii) Comment on the statement " Staff:student ratios are not very different whichever university you look at"

(7)

(Total for Question 7 is 9 marks)

8 Mohammed finished university with a student loan of £14 000.

He started work with a salary of £19 000 per year.

After one year, he had a pay rise of £1500.

At the end of each full year of work:

- 9% of his earnings above £16 365 go towards paying off his loan
- interest of 1.5% of the outstanding amount is added to his loan.

How much will Mohammed still owe on his student loan after 2 full years of work?

(5)

(Total for Question 8 is 5 marks)

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9 Sarah leaves university with a student loan of £15 000.
The interest rate has changed to 2%.

Sarah can earn £17 000 per year before she starts paying back her student loan.
She starts work with a salary of £20 000.
She expects to get an increase in salary of £1000 per year.

Sarah uses this recurrence relation to work out the amount she will owe on her student loan after n years:

$$S_n = 1.02(S_{n-1} - 180n - 90)$$

where S_n is the amount left to pay on her student loan n years after starting work.

Given that $S_0 = 15\,000$

(a) show clearly that $S_1 = 15\,024.60$ and find the value of S_2

(2)

Let $T_n = S_n - S_{n-1}$

(b) (i) Show that $T_{n+1} = 1.02T_n - k$

where k is a constant to be found

(ii) Show that once the amount that Sarah has left to pay starts decreasing then it will always be decreasing year after year.

(4)

(Total for Question 9 is 6 marks)

TASK 3: COST AND PROFIT

10 A company sells bird tables and bird feeders.

Shop	Number of bird tables	Number of bird feeders	Total order	Total cost (£)
A	50	25	75	15000
B	100	50	150	30000
C	72	18	90	1980
D	80	60	140	2600
E	160	120	280	5200
F	90	50	140	

The price paid by each shop for a bird table was the same.
The price paid by each shop for a bird feeder was the same.
The total cost for shop F is missing.

(i) Complete the table.

(ii) If the price of a bird table had been £1 more and of a bird feeder £1 less how would this have affected the total cost for shop F?

(6)

(Total for Question 10 is 6 marks)

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11 The company also makes swing seats and benches.

The manager of the company wants to maximise the profit they get from selling swing seats and benches.

Let x be the number of swing seats made each week.

Let y be the number of benches made each week.

(a) The graph on page 27 shows two constraints and the unwanted region.

(i) Write down the constraints shown on the graph, giving your answers as inequalities in terms of x and/or y.

(ii) Give an interpretation of each of your inequalities.

(4)

It takes 10 production hours to make one swing seat.

It takes 4 production hours to make one bench.

There are 160 production hours available in one week.

(b) Write down an inequality to represent this information.

Give your inequality in its simplest form.

(2)

It takes 30 minutes to get each swing seat ready for delivery.

It takes 20 minutes to get each bench ready for delivery.

There are 10 hours available in one week to get ready for delivery.

(c) Using the information above and the inequality formed in (b), add two lines and shading to the graph on page 27 to show the feasible region.

Label the feasible region **R**.

(5)

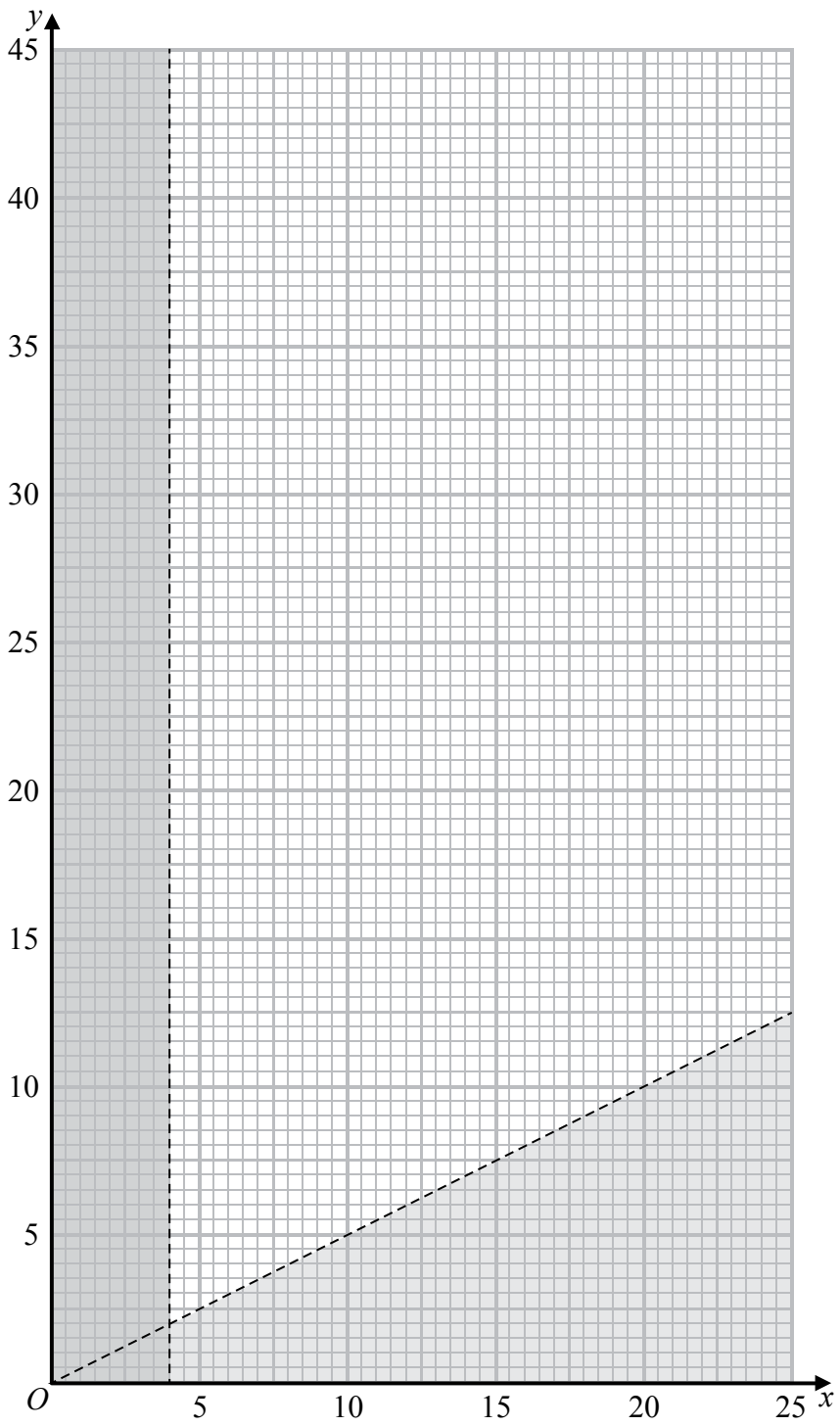
The company makes a profit of £65 on each swing seat and £40 on each bench.

(d) Find the maximum profit the company could make in one week.

You should state the number of swing seats and benches they should make to achieve this.

You must make your method of solution clear.

(3)



(Total for Question 11 is 14 marks)

TOTAL FOR SECTION B IS 60 MARKS

TOTAL FOR PAPER IS 80 MARKS

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Paper 2 Mark scheme

SECTION A

TASK 1: EUROVISION

Question	Working	Answer	Mark	Notes
1 (a)	(37-1)×12=432	Correct statement	2	M1 (37-1)×12 A1 432
1 (b)	B = 7 D = 4 A = 3 C = 10	A = 3 B = 7 C=10 D = 4	2	A = 3, B = 7, C = 10 and D = 4 B1 two correct values from spreadsheet linked to appropriate entry ie two correct from A = 3, B = 7, C = 10 and D = 4 must reference letter and value B1 all four correct must reference letter from spreadsheet and value ie A = 3, B = 7, C = 10 and D = 4 oe

Question	Working	Answer	Mark	Notes
2 (a)(i)		5	8	B1 **cao**
(ii)	Median is (37+1)/2 = 19th value Ned mean = 238/37 = 6.432 Ned range 0 to 12 or 12 $2328/37 - (238/37)^2$ $\sqrt{21.54...}$	Median Ned 8 6.43 0 to 12 or 12 4.641415		B1 **cao** M1 $\Sigma fx / \Sigma f$ A1 mean for Netherlands **awrt** 6.43 B1 range is 0 to 12 or 12 M1 use of correct formula for variance M1* square root A1 **awrt** 4.64 If correct answer only stated with no supporting working (awrt 4.64) award full marks for efficient and accurate use of calculator
2 (b)		The range and the SD would be unaffected The mean and the median would increase by 10	2	C1 for range and SD unaffected **oe** C1 for mean and median increased by 10 **oe**
2 (c)		The range and the SD would increase The mean and the median would be doubled	2	C1 for range and SD increased **oe** C1 for mean and median doubled **oe**
3	Austria higher mean and median Higher mean than Ned	Full comparison	4	C2 Austria had a higher mean and median so did better **oe** (C1 for reference to just one measure of location and interpretation) C2 Austria had a lower SD so the variation of scores was less (C1 for just a reference to SD with no interpretation)

SECTION B

TASK 1: VACCINES AND BLOOD GROUPS

Question	Working	Answer	Mark	Notes
4 (a)	Appropriate Venn diagram with 3 intersecting circles within a rectangle Correct values displayed in the appropriate areas of the diagram Correct probability stated 0.12 Or n(D or C or R) = n (D) + n(C) + n(R) - n(D&C) - n(D&R) - n(C&R) + n(D&C&R) 100 - 2 = 87 + 77 + 86 - n(D&C) - n(D&R) -n(C&R) + 75 n(C&R) = 77, (D&R) = 75 n(D&C) = 75	0.12	5	M1 for 3 intersecting circles within a rectangle A1 for any 3 of 75, 2, 2, and 0 in correct positions A1 for at least 2 correct calculated values A1 for completely correct diagram A1 **ft** diagram their '12'/100 OR M1 for correct statement of inclusion/exclusion relation A1 for correct substitution of given values A1 for n(C&R) = 77, (D&R) = 75 A1 for n(D&C) = 75 A1 **ft** diagram their '12'/100
4 (b)	$\frac{23}{100}\times\frac{22}{99}$ $=\frac{23}{450}$ or $0.051\dot{}$	$\frac{23}{450}$ **oe**	3	M1 for consideration of students receiving 0 vaccines and/or 1 vaccine M1 for $\frac{23}{100}\times\frac{22}{99}$ **oe** A1 for $\frac{23}{450}$ or $0.051\dot{}$ **oe**

Question	Working	Answer	Mark	Notes
5	1-0.86 (= 0.14) 0.86×0.01 **or** 0.14×0.9 (= 0.126) 0.86×0.01+0.14×0.9 = 0.1346	0.1346	4	M1 for P(MMR′) = 1 - 0.86 (= 0.14) (may be seen on a tree diagram) M1 for P(MMR ∩ M) = 0.86×0.01 **or** P(MMR′ ∩ M) = 0.14×0.9 M1 for 0.86×0.01+0.14×0.9 A1 for 0.1346 – may be rounded to 2 or more sf
6 (a)	3600 ÷(8000×0.08)	No and supporting evidence	2	M1 (3100 to 3900) ÷(8000×0.08) C1* no and a valid reason eg only enough for 4-6 days Or M1 8 days×8000 = 64000 and '64000'×0.08 =5120 C1* no and a valid reason eg 5120>3100 to 3900
6 (b)	7/44×13+7/42×7+2/10×4 =2663/660 (= 4.03484848…) Answer above divided by 24 =(2663/15840)=0.168	0.168 **oe**	4	M1 for 7/44×13 or 7/42×7 or 2/10×4 M1 for 7/44×13+7/42x7+2/10x4 (=2663/660) M1 for their answer divided by 24 (their answer must come from 3 calculated fractions) A1 for answer in range 0.168 – 0.169 (accept fraction, percentage or decimal)

Question	Working	Answer	Mark	Notes
6 (c)	$0.35\div(0.37+0.35+0.08+0.03)$ $=\frac{35}{83}$ or 0.42–0.422	$\frac{35}{83}$	2	M1 for $0.35\div(0.37+0.35+0.08+0.03)$ or $0.35 = 0.83\times P(A \mid RhD+)$ or $\frac{n}{83}$ A1 for $\frac{35}{83}$ or 0.42 – 0.422 **oe**

TASK 2: UNIVERSITY

Question	Working	Answer	Mark	Notes
7 (a)		Reason Explanation	2	B1 for no correlation or negative correlation B1 for 'shown by scattered points' or 'shown by line of best fit with negative gradient'
7 (b)(i)	10.7 11.3 15.5 16.1 16.5 17.3 17.5 17.7 18 18.1 19.8 22.1 Median (17.3+17.5)/2=17.4 Lower Quartile =15.5(n/4) Upper Quartile = 18(3n/4) 1.5×(18-15.5) (=3.75) 18+3.75=21.75 so 22.1 outlier 15.5-75=11.75 so 11.3 and 10.7 outliers Box plot LQ =15.5, Me =17.4 UQ =18 Min =11.75 Max =21.75 Outliers at 10.7 11.3 22.1	LQ = 15.5 Me = 17.4 UQ = 18 Min = 11.75 Max = 21.75 Outliers at 10.7 11.3 22.1	7	M1 for method to find median, eg put data in order and attempt to find middle value **or** median =17.4 M1 for method to find either LQ or UQ **or** LQ =15.5 **or** UQ =18 M1 for 1.5×('18'-'15.5') (=3.75) A1 for identification of 11.3 and 22.1 as outliers with calculations present and correct B1 for a fully-correct box plot showing outliers NB: also allow LQ as 15.65 or 15.8 UQ as 18.05 or 18.075 With associated values for outliers coming from these values
(ii)		The statement is incorrect and full supporting statement		B2 the statement is incorrect with full supporting statement eg 2 of the universities have substantially lower student/staff ratios and 1 university has substantially higher student/staff ratio B1 the statement is incorrect with a supporting statement eg 3 of the universities are substantially different from the rest

Question	Working	Answer	Mark	Notes
8	(19000-16365)×0.09 =237.15 (14000-237.15)×1.015 =13969.29… (19000+1500-16365)×0.09 =372.15 (13969.29...-372.15)×1.015 =£13801.09989	(£)13801.10 Accept 13801-13802	5	M1 for (19000-16365)×0.09 (=237.15) M1 for (14000-237.15)×1.015 (=13969.29…) M1 for (19000+1500-16365)×0.09 or 237.15+0.09×1500 (=372.15) M1 for ('13969.29'-372.15)×1.015 (=13801.09989) A1 for 13801-13802
9 (a)	S_1 =1.02×(15000-180-90) =15024.6 S_2 = 1.02×(15024.6-180×2-90) =14866.09(2)	1.02×14370 = 15024.6 14866.09	2	B1 for 1.02×(15000-180-90) =15024.6 B1 for 14866.09
9 (b)(i)	 S_{n+1} =1.02(S_n–180(n+1)–90) S_n =1.02(S_{n-1}–180n–90) S_{n+1}-S_n =1.02(S_n–180(n+1)–90-S_{n-1} +180n+90) T_{n+1} =1.02T_n−183.6	Shown with k = 183.6	4	M1 for S_{n+1} - S_n =1.02(S_n–180(n+1)–90-S_{n-1} +180n +90) A1 for T_{n+1} =1.02 T_n−183.6
(ii)				C1 statement that for some n, T_n<0 C1 since T_{n+1} =1.02T_n−183.6 and T_n<0 then T_{n+1}<0 and hence $S_{n+1} < S_n$

TASK 3: COST AND PROFIT

Question	Working	Answer	Mark	Notes
10 (i)		2750	6	M1 selects 2 independent rows and writes in a suitable form e.g. $80x+60y=2600$ and $72x+18y=1980$ M1 for correct method to eliminate one variable M1* for correct method to enable missing value in table to be found e.g using found value for x and substituting to find value of y A1 for $x=25$ and $y=10$ or $10=250$ and $10y=100$ **oe** A1 for 2750
(ii)		Cost increases by (£)40		B1 a correct statement about the change in cost and a correct numerical value
11 (a)(i)	$x>4$ or $x\geq 4$ $2y>x$ or $2y\geq x$	$x>4$ or $x\geq 4$ $2y>x$ or $2y\geq x$	4	B1 for $x>4$ or $x\geq 4$ B1 for $2y>x$ or $2y\geq x$
(ii)	The number of swing seats must be greater than or equal to 4 There must be at least twice as many swing seats as benches	Correct interpretation		B1 for eg the number of swing sets must be greater than or equal to 4 B1 for eg there must be at least twice as many swing seats as benches **oe**
11 (b)	$10x+4y\leq 160$ $5x+2y\leq 80$	$5x+2y\leq 80$	2	M1 for $10x+4y\leq 160$ (condone < at this stage) A1 for $5x+2y\leq 80$

Question	Working	Answer	Mark	Notes
11 (c)	$30x+20y\leq600$ oe $5x+2y=80$ drawn correctly $3x+2y=60$ drawn correctly Correct region shown on graph unambiguously	Correct region shown	5	B1 for $30x+20y\leq600$ **oe** (eg $3x+2y\leq60$) B1 for "$5x+2y=80$" drawn correctly B1 for "$3x+2y=60$" drawn correctly B1 for correct shading for at least one inequality added to graph B1 for correct region shown on graph unambiguously
11 (d)	$P=65x+40y$ stated/implied Using profit line **or** for identifying vertices as points to test £1250, $x=10$, $y=15$	£1250, $x=10$, $y=15$	3	M1 for $P=65x+40y$ or evidence that this has been used to determine profit M1 for using profit line or for identifying vertices as points to test A1 for £1250, $x=10$, $y=15$

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