



National
Qualifications
2022

2022 Applications of Mathematics

Higher

Finalised Marking Instructions

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General marking principles for Higher Applications of Mathematics

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

For each question, the marking instructions are generally in two sections:

- *generic scheme* – this indicates why each mark is awarded
- *illustrative scheme* – this covers methods which are commonly seen throughout the marking

In general, you should use the illustrative scheme. Only use the generic scheme where a candidate has used a method not covered in the illustrative scheme.

- Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.
- If you are uncertain how to assess a specific candidate response because it is not covered by the general marking principles or the detailed marking instructions, you must seek guidance from your team leader.
- One mark is available for each •. There are no half marks.
- If a candidate's response contains an error, all working subsequent to this error must still be marked. Only award marks if the level of difficulty in their working is similar to the level of difficulty in the illustrative scheme.
- Only award full marks where the solution contains appropriate working. A correct answer with no working receives no mark, unless specifically mentioned in the marking instructions.
- Candidates may use any mathematically correct method to answer questions, except in cases where a particular method is specified or excluded.
- If an error is trivial, casual or insignificant, for example $6 \times 6 = 12$, candidates lose the opportunity to gain a mark, except for instances such as the second example in point (h) below.
- If a candidate makes a transcription error (question paper to script or within script), they lose the opportunity to gain the next process mark, for example

This is a transcription error and so the mark is not awarded.

This is no longer a solution of a quadratic equation, so the mark is not awarded.

$$x^2 + 5x + 7 = 9x + 4$$

$$x - 4x + 3 = 0$$

$$x = 1$$

The following example is an exception to the above

This error is not treated as a transcription error, as the candidate deals with the intended quadratic equation. The candidate has been given the benefit of the doubt and all marks awarded.

$$x^2 + 5x + 7 = 9x + 4$$

$$x - 4x + 3 = 0$$

$$(x - 3)(x - 1) = 0$$

$$x = 1 \text{ or } 3$$

(i) **Horizontal/vertical marking**

If a question results in two pairs of solutions, apply the following technique, but only if indicated in the detailed marking instructions for the question.

Example:

$$\begin{array}{cc} \bullet^5 & \bullet^6 \\ \bullet^5 & x = 2 \quad x = -4 \\ \bullet^6 & y = 5 \quad y = -7 \end{array}$$

Horizontal: $\bullet^5 x = 2$ and $x = -4$ Vertical: $\bullet^5 x = 2$ and $y = 5$
 $\bullet^6 y = 5$ and $y = -7$ $\bullet^6 x = -4$ and $y = -7$

You must choose whichever method benefits the candidate, **not** a combination of both.

(j) In final answers, candidates should simplify numerical values as far as possible unless specifically mentioned in the detailed marking instruction. For example

$$\begin{array}{ll} \frac{15}{12} \text{ must be simplified to } \frac{5}{4} \text{ or } 1\frac{1}{4} & \frac{43}{1} \text{ must be simplified to } 43 \\ \frac{15}{0.3} \text{ must be simplified to } 50 & \frac{4}{\cancel{5}}/3 \text{ must be simplified to } \frac{4}{15} \\ \sqrt{64} \text{ must be simplified to } 8^* & \end{array}$$

*The square root of perfect squares up to and including 144 must be known.

(k) Commonly Observed Responses (COR) are shown in the marking instructions to help mark common and/or non-routine solutions. CORs may also be used as a guide when marking similar non-routine candidate responses.

(l) Do not penalise candidates for any of the following, unless specifically mentioned in the detailed marking instructions:

- working subsequent to a correct answer
- correct working in the wrong part of a question
- legitimate variations in numerical answers/algebraic expressions, for example angles in degrees rounded to nearest degree
- omission of units
- bad form (bad form only becomes bad form if subsequent working is correct), for example

$$\begin{aligned} & (x^3 + 2x^2 + 3x + 2)(2x + 1) \text{ written as} \\ & (x^3 + 2x^2 + 3x + 2) \times 2x + 1 \\ & = 2x^4 + 5x^3 + 8x^2 + 7x + 2 \\ & \text{gains full credit} \end{aligned}$$

- repeated error within a question, but not between questions or papers

(m) In any ‘Show that...’ question, where candidates have to arrive at a required result, the last mark is not awarded as a follow-through from a previous error, unless specified in the detailed marking instructions.

(n) You must check all working carefully, even where a fundamental misunderstanding is apparent early in a candidate’s response. You may still be able to award marks later in the question so you must refer continually to the marking instructions. The appearance of the correct answer does not necessarily indicate that you can award all the available marks to a candidate.

- (o) You should mark legible scored-out working that has not been replaced. However, if the scored-out working has been replaced, you must only mark the replacement working.
- (p) If candidates make multiple attempts using the same strategy and do not identify their final answer, mark all attempts and award the lowest mark. If candidates try different valid strategies, apply the above rule to attempts within each strategy and then award the highest mark.

For example:

Strategy 1 attempt 1 is worth 3 marks.	Strategy 2 attempt 1 is worth 1 mark.
Strategy 1 attempt 2 is worth 4 marks.	Strategy 2 attempt 2 is worth 5 marks.
From the attempts using strategy 1, the resultant mark would be 3.	From the attempts using strategy 2, the resultant mark would be 1.

In this case, award 3 marks.

Marking Instructions for each question

Question	Generic scheme	Illustrative scheme	Max mark
1.	<ul style="list-style-type: none"> •¹ Calculate monthly interest rate •² Calculate loan outstanding at the end of month 1 •³ Calculate loan outstanding at the end of month 2 	<ul style="list-style-type: none"> •¹ 0.72...% stated or implied by •² •² 5504.71 •³ 5358.37 	3

Notes:

1.

Time (months)	Repayment (£)	Interest content of repayment (£)	Capital content of repayment (£)	Loan outstanding (£)
0				5650
1	186.01	40.72	145.29	5504.71
2	186.01	39.67	146.34	5358.37

2. At •¹, accept any answer which rounds to 0.7%.

3. If a candidate uses any incorrect interest rate mark 1 is not awarded but marks 2 and 3 may be awarded as follow through marks.

Commonly Observed Responses:

1. Based on candidate using 0.7% Award 3/3

Time (months)	Repayment (£)	Interest content of repayment (£)	Capital content of repayment (£)	Loan outstanding (£)
0				5650
1	186.01	39.55	146.46	5503.54
2	186.01	38.52	147.49	5356.05

2. Based on candidate using 0.72% Award 3/3

Time (months)	Repayment (£)	Interest content of repayment (£)	Capital content of repayment (£)	Loan outstanding (£)
0				5650
1	186.01	40.68	145.33	5504.67
2	186.01	39.63	146.38	5358.29

3. Based on candidate using $(9/12) = 0.75\%$ award 2/3

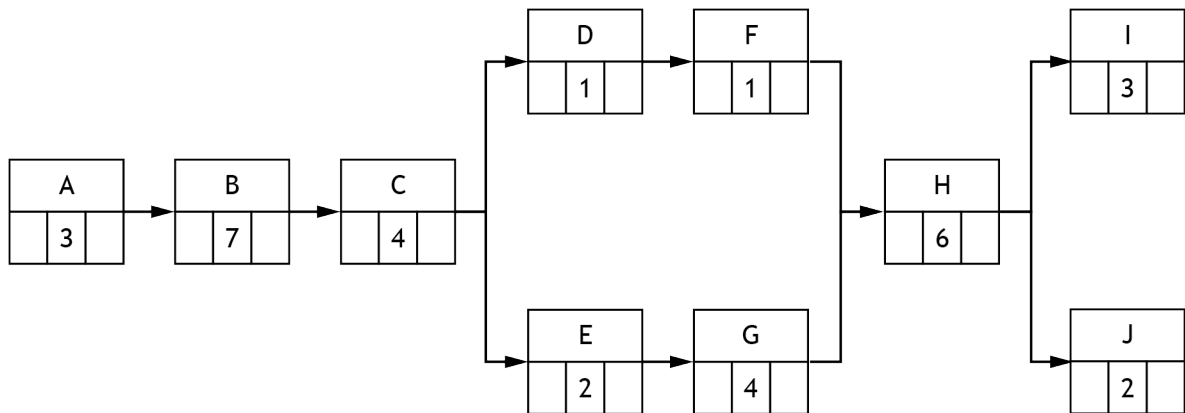
Time (months)	Repayment (£)	Interest content of repayment (£)	Capital content of repayment (£)	Loan outstanding (£)
0				5650
1	186.01	42.38	143.63	5506.37
2	186.01	41.30	144.71	5361.66

Question		Generic Scheme	Illustrative Scheme	Max Mark
2.	(a)	<ul style="list-style-type: none"> •¹ Any six in correct sequence with durations •² Remaining 4 in correct sequence •³ Forward scan A-E correct •⁴ Forward scan for remaining 5 consistent with previous working •⁵ Backward scan I,J,H,F and G correct •⁶ Backward scan for remaining 5 consistent with previous working 	<ul style="list-style-type: none"> •¹ see note 1 •² see note 1 •³ see note 2 •⁴ see note 2 •⁵ see note 3 •⁶ see note 3 	6

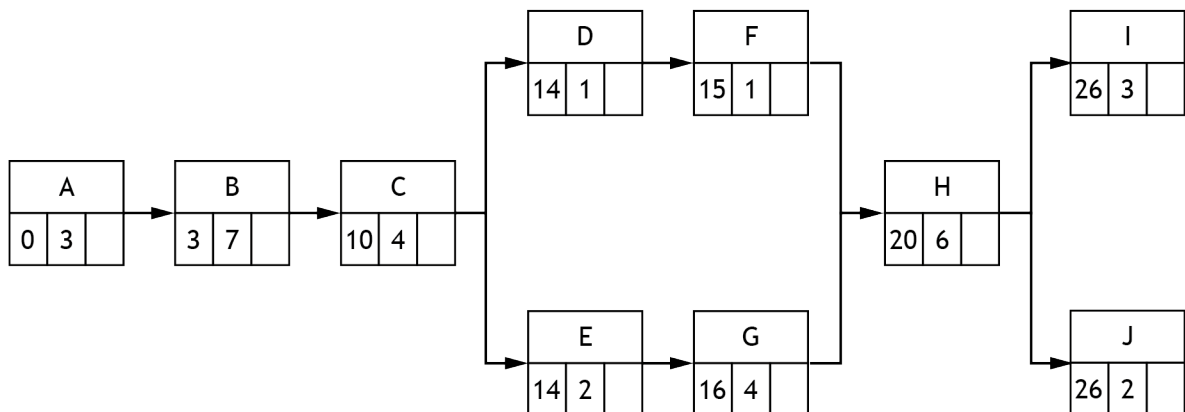
Question		Generic Scheme	Illustrative Scheme	Max Mark
2.	(a)	(continued)		

Notes:

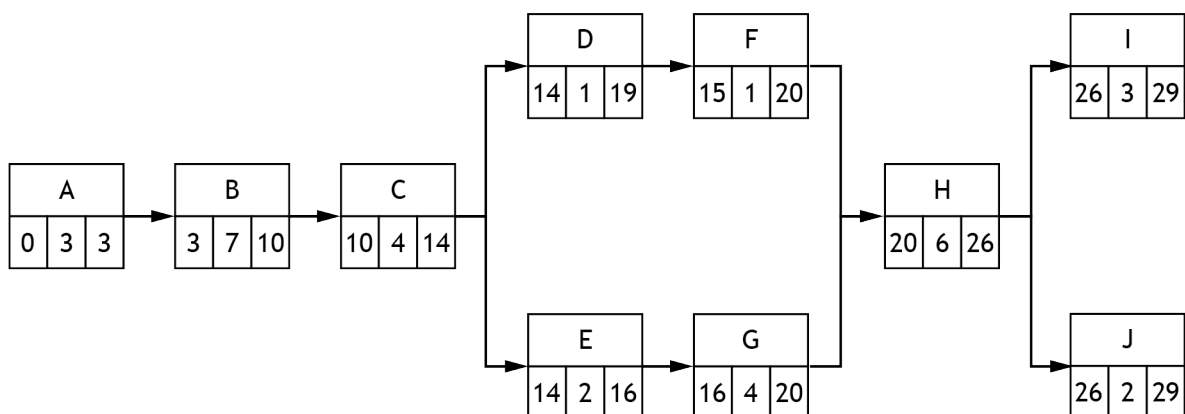
1. Completed Pert Chart



2. Forward Scan



3. Backward Scan



4. Ensure that letter H is checked carefully for the forward scan.
5. Ensure that letters F and J are checked carefully for the backward scan.
6. Ensure D follows from F on the backward scan.
7. If forward scan is incorrect care needs to be taken to check the backward scan.

Commonly Observed Responses:

Question		Generic Scheme	Illustrative Scheme	Max Mark
2.	(b)	• ⁷ State number of days	• ⁷ 4 days	1

Notes:

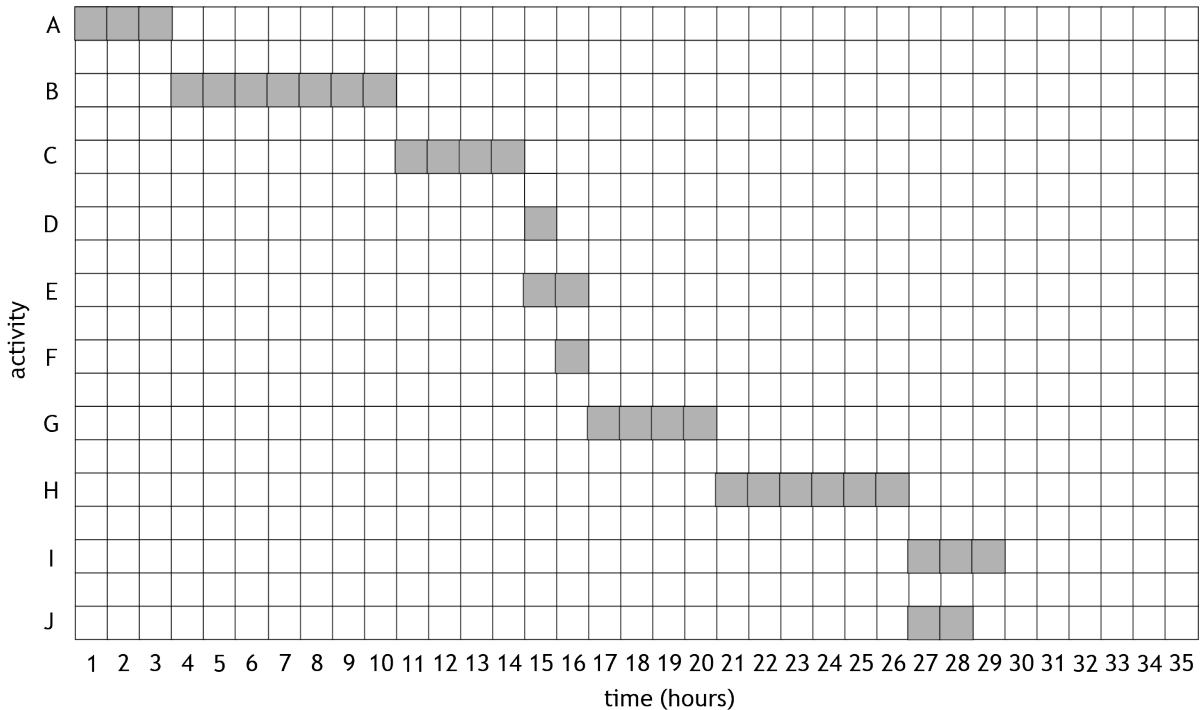
1. Cannot have decimal days or part days or days and hours.
2. Answer must be based on the critical path if working is shown.
3. Answer based on 33 days leading to 4 days, award 0/1.

Commonly Observed Responses:

	(c)	<ul style="list-style-type: none"> •⁸ Add activities labels and plot activities A, B, and C •⁹ Interpret start times of D, E and I, J •¹⁰ Complete Gantt chart 	<ul style="list-style-type: none"> •⁸ see diagram note 1 •⁹ see diagram note 1 •¹⁰ see diagram note 1 	3
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Notes:

1.



1. All labels must be added to Gantt chart for •⁸, no need for the tasks axis to have the label activities but tasks A-J must be clearly labelled.
2. Gantt chart must be consistent with either the candidates PERT chart or the original table of tasks/times.
3. Check for F in correct position.

Commonly Observed Responses:

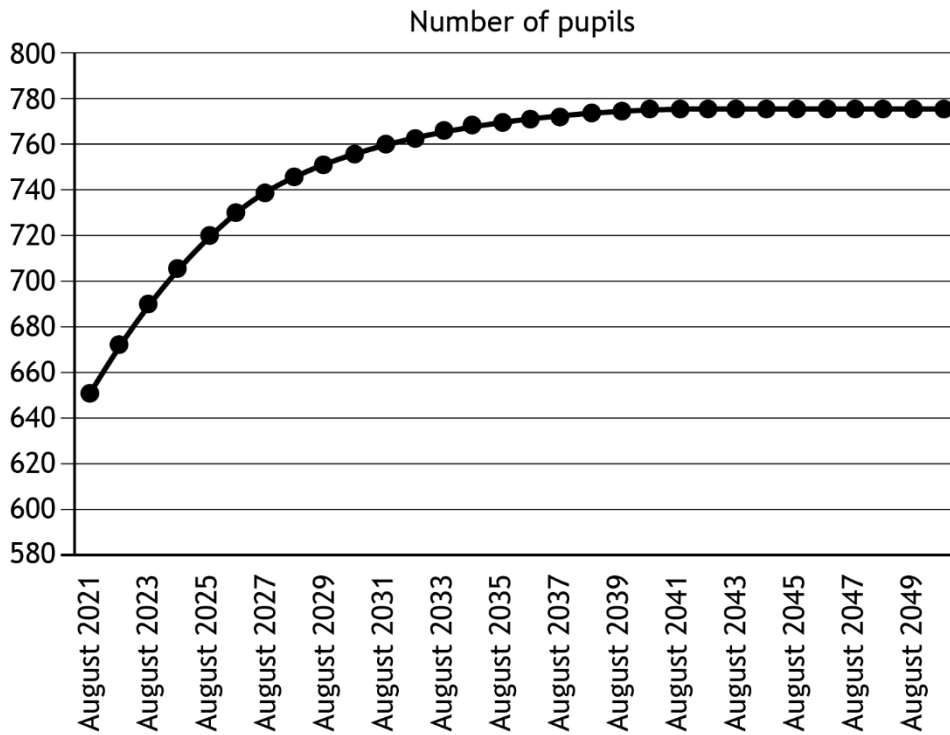
Question		Generic Scheme	Illustrative Scheme	Max Mark
3.	(a)	• ¹ State type of data	• ¹ discrete numerical	1
Notes: 1. Accept 'normally distributed', 'normal' or 'bell-shaped' at • ¹ .				
Commonly Observed Responses:				
	(b)	• ² Valid explanation	• ² eg a claim cannot be made from a graph OR one clinic in Edinburgh is not representative of the UK	1
Notes: 1. Study only completed over a one-year period (not relevant to location), award 0/1				
Commonly Observed Responses:				
	(c)	• ³ State appropriate test	• ³ z-test for two proportions	1
Notes: 1. A chi-squared test is also appropriate for • ³ .				
Commonly Observed Responses:				
	(d)	• ⁴ State an appropriate design condition	• ⁴ eg samples need to be chosen randomly	1
Notes:				
Commonly Observed Responses: 1. Sample size must be the same (not appropriate for proportions) award 0/1				
	(e)	• ⁵ valid explanation	• ⁵ eg they are not comparable as the data is not collected over the same time periods	1
Notes: 1. There must be comparison between months or seasons or time periods or temperature between the two clinics. 2. • ⁵ the seasonable variability could affect the results				
Commonly Observed Responses: 1. The time periods/seasons must be the same (same months), award 1/1				

Question		Generic Scheme	Illustrative Scheme	Max Mark
4.	(a)	<p>Method 1</p> <ul style="list-style-type: none"> •¹ Calculate balance on 1 January 2019 •² Calculate balance 1 January 2020 •³ Calculate balance at end of 2020 	<p>Method 1</p> <ul style="list-style-type: none"> •¹ $(500 \times 1.033 + 500) = 1016.50$ •² $(1016.50 \times 1.024 + 500) = 1540.90$ •³ $(1540.90 \times 1.01) = 1556.30$ 	3
		<p>Method 2</p> <ul style="list-style-type: none"> •¹ Accumulate initial deposit •² Accumulate second deposit •³ Accumulate third deposit and calculate balance at end of 2020 	<p>Method 2</p> <ul style="list-style-type: none"> •¹ $(500 \times 1.033 \times 1.024 \times 1.01) = 534.18$ •² $(500 \times 1.024 \times 1.01) = 517.12$ •³ $(500 \times 1.01 + 534.18 + 517.12) = 1556.30$ 	
<p>Notes:</p> <ol style="list-style-type: none"> If a candidate does not consider the additional £500 each year then only mark 1 in method 2 is available. Final answer must be to 2 decimal places, ignore any rounding errors or truncation 				
<p>Commonly Observed Responses:</p> <ol style="list-style-type: none"> $(500 \times 1.033) + (500 \times 1.024) + (500 \times 1.01) = \text{£}1533.50$, award 0/3 $(500 \times 1.033^3) + (500 \times 1.024^2) + (500 \times 1.01)$, award 0/3 •³ accept £1556.31(rounding) or £1556.29 (truncation) 				
	(b)	<ul style="list-style-type: none"> •⁴ Calculate balance 1 January 2021 •⁵ Calculate interest rate 	<ul style="list-style-type: none"> •⁴ $1556.30 + 500 = \text{£}2056.30$ •⁵ $\left(\left(\frac{2100}{2056.30} - 1 \right) \times 100 \right) = 2.125\% \dots$ 	2
<p>Notes:</p> <ol style="list-style-type: none"> •⁴ still available following from •³ Final answer in the form of 1.02125... •⁵ not available, Final answer must be stated explicitly in percentage form 				
<p>Commonly Observed Responses:</p>				

Question			Generic Scheme	Illustrative Scheme	Max Mark
5.	(a)	(i)	<ul style="list-style-type: none"> •¹ Calculate appropriate school roll at end of year in cell D8 •² Use appropriate formula in C14 •³ Calculate school roll in August 2031 	<ul style="list-style-type: none"> •¹ eg =1-D7 •² eg =ROUND(\$D\$5*C8+\$D\$6,0) •³ 761 (pupils) 	3
		(ii)	<ul style="list-style-type: none"> •⁴ Appropriate comment 	<ul style="list-style-type: none"> •⁴ eg the number of pupils leaving each year is approximate 	1
Notes: <ol style="list-style-type: none"> 1. •¹ Can be implied by •² (answer may not be in cell D9) 2. •² can be found without the need for •¹ eg =ROUND(C14(1-\$D\$8)+\$D\$10,0) 3. •³ is only available for a whole number answer 4. Rounding not needed, final answer will be 760, award 3/3 					
Commonly Observed Responses: <ol style="list-style-type: none"> 1. •¹ and •² accept $(C14 + \\$D\\$10) - (C14 * \\$D\\$8)$ 2. For •² accept the following with/without ROUND <ul style="list-style-type: none"> = $(\\$D\\$9 * C14 + \\$D\\$10)$ = $(0.82 * C14 + \\$D\\$10)$ = $(\\$D\\$9 * C14 + 140)$ = $(0.82 * C14 + 140)$ 3. •³ is available for following a pattern until August 2031 4. For •⁴ accept the following: <ul style="list-style-type: none"> – The precision of the prediction without rounding suggests decimal point pupils – The prediction is not accurate as the number of S1 pupils may change 					
	(b)		<ul style="list-style-type: none"> •⁵ Appropriate comment about roll 	<ul style="list-style-type: none"> •⁵ the school roll gradually increases each year 	1
Notes: <ol style="list-style-type: none"> 1. Accept positive linear relationship 2. Answer must be consistent with candidates working in (a) 					
Commonly Observed Responses:					

Question			Generic Scheme	Illustrative Scheme	Max Mark
5.	(c)	(i)	<ul style="list-style-type: none"> •⁶ Extend spreadsheet to (at least) August 2042 •⁷ Construct graph 	<ul style="list-style-type: none"> •⁶ evidence of 776 in C32 •⁷ see below 	2

Notes:



1. Labels not required as specifically assessed in a separate question.
2. Any graph that shows a trend is appropriate ie line graph or bar chart

Commonly Observed Responses:

1. Award •⁸ for any suitable comment relating to their graph eg the capacity is suitable
2. •⁸ not available if there is no graph for •⁷

	(ii)	• ⁸ Conclusion with justification	• ⁸ Yes, the population is not expected to exceed 800 pupils.	1
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Notes:

Commonly Observed Responses:

Question		Generic Scheme	Illustrative Scheme	Max Mark
6.	(a)	<ul style="list-style-type: none"> •¹ Calculate overall percentage increase 	<ul style="list-style-type: none"> •¹ $(((1.021 \times 1.005 \times 1.02) - 1) \times 100) = 4.66\% \dots$ 	1
Notes: 1. Percentage must be explicitly stated ie $1.021 \times 1.005 \times 1.02 = 1.0466\dots$ award 0/1				
Commonly Observed Responses: 1. $2.1 + 0.5 + 2.0 = 4.6\%$ award 0/1 2. $2.1 \times 0.5 \times 2.0 = 2.1\%$ award 0/1				
	(b)	<p style="text-align: center;">Method 1</p> <ul style="list-style-type: none"> •² Calculate the price of petrol in 2018 •³ Calculate the cost of filling the tank 	<p style="text-align: center;">Method 1</p> <ul style="list-style-type: none"> •² $(136 \div 1.0466\dots) = 130.3$ •³ $(45 \times 1.303) = 58.64$ 	2
		<p style="text-align: center;">Method 2</p> <ul style="list-style-type: none"> •² Calculate cost of tank in 2021 •³ Calculate the cost of filling the tank 	<p style="text-align: center;">Method 2</p> <ul style="list-style-type: none"> •² $(1.364 \times 45) = 61.38$ •³ $(61.38 \div 1.0466\dots) = 58.64$ 	
Notes: 1. Accept 58.63, 58.65 2. Accept answers in pounds or pence				
Commonly Observed Responses: 1. Candidates who correctly use 4.6% from (a) and get an answer of 130.4p leading to £58.68 award • ² and • ³ 2. • ³ can be awarded for a correct follow through from an incorrect answer in • ² in method 1 – $130.13 \times 45 = 5855.85$ – $133.59 \times 45 = 6012$				

Question			Generic Scheme	Illustrative Scheme	Max Mark
7.	(a)	(i)	<ul style="list-style-type: none"> •¹ Generate scatterplot •² Appropriate title and axis labels 	<ul style="list-style-type: none"> •¹ (see below) •² (see below) 	2
<p>Notes:</p> <div style="text-align: center;"> <p>Jump height v back squat</p> </div>					
<p>Commonly Observed Responses:</p> <ol style="list-style-type: none"> 1. Accept approximately a positive correlation 2. For answers involving linear relationship or correlation, the word 'positive' must also appear 					
		(ii)	• ³ Appropriate comment	<ul style="list-style-type: none"> •³ approximately a positive linear relationship OR as back squat weight increases vertical jump height increases 	1
<p>Notes:</p>					
<p>Commonly Observed Responses:</p>					
	(b)	(i)	<ul style="list-style-type: none"> •⁴ Generate correlation coefficient for back squat and jump height •⁵ State correlation coefficient for back squat and jump height 	<ul style="list-style-type: none"> •⁴ output from software (see below) •⁵ 0.828... 	2
<p>Notes:</p> <div style="text-align: center;"> <p>Pearson's product-moment correlation</p> <pre> data: jump and back t = 7.6944, df = 27, p-value = 2.825e-08 alternative hypothesis: true correlation is not equal to 0 95 percent confidence interval: 0.6638573 0.9167773 sample estimates: cor 0.8287274 </pre> </div> <ol style="list-style-type: none"> 1. For •⁴ the correlation coefficient must be stated explicitly, separate from the output 2. •⁴ is not available for R² value with no further working 3. If a candidate generates an R² value, they must square root it to gain •⁴ and •⁵ 					
<p>Commonly Observed Responses:</p>					

Question			Generic Scheme	Illustrative Scheme	Max Mark
7.	(b)	(ii)	<ul style="list-style-type: none"> •⁶ Generate coefficient and intercept •⁷ Communicate equation 	<ul style="list-style-type: none"> •⁶ output from software (see below) •⁷ jump height = $0.36 \times \text{back squat} + 7.2$ 	2
Notes: <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: left;">Coefficients: (Intercept) 7.2366</div> <div style="text-align: left;">Back 0.3593</div> </div>					
Commonly Observed Responses: <ol style="list-style-type: none"> 1. For a candidate with the axes the wrong way round •⁷ will be: back squat = 1.9...jump height + 7.2... 2. For $y = 0.36x + 7.2$ award 2/2 if both x and y axes have been labelled appropriately 					
	(c)		<ul style="list-style-type: none"> •⁸ Generate estimate •⁹ Appropriate comment 	<ul style="list-style-type: none"> •⁸ output from software (see below) leading to an estimated vertical jump height of 66.5 cm •⁹ since 165kg is within the range of the data used to make the model and the model is a strong linear model <p style="text-align: center;">OR</p> <p>the true value is likely to be between 56.7 and 76.3 cm</p>	2
Notes: <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: left;">fit 66.52568</div> <div style="text-align: left;">lwr 56.72259</div> <div style="text-align: left;">upr 76.32877</div> </div> <ol style="list-style-type: none"> 1. With 66.5(cm) stated explicitly out-with the software output 2. Estimate must be generated from a statistical output and not algebraically 3. •⁹ is available for an appropriate comment based on previous working 4. Comment using 'interpolation' in the context of the question, •⁹ can be awarded 					
Commonly Observed Responses: <ol style="list-style-type: none"> 1. Candidates that input 165 for jump leading to 351.954, •⁸ is not available 					
	(d)		• ¹⁰ Appropriate comment	• ¹⁰ correlation is not causation	1
Notes:					
Commonly Observed Responses:					

Question		Generic Scheme	Illustrative Scheme	Max Mark
8.	(a)	<ul style="list-style-type: none"> •¹ Calculate taxable income •² Calculate taxable income for each band •³ Calculate tax for each band and total tax payable 	<ul style="list-style-type: none"> •¹ 3900 (per month) or 46 800 (per year) •² see table •³ see table (7667.67) 	3

Notes:

1. Table of taxable income and tax

Mark 2

Mark 3

Taxable Income (£)	Tax Band	Tax Payable (£)
12570	0%	0
2097	19%	398.43
10629	20%	2125.80
18366	21%	3856.86
3138	41%	1286.58
	Total	7667.67

2. For •² taxable incomes must be stated
3. •² can be awarded when taxable incomes are not stated but working is shown eg $(14667-12570) \times 0.19$
4. •² is awarded for correctly working out tax in each band **and** total

Commonly Observed Responses:

1. If •¹ is not awarded then •² and •³ can be awarded as follow through
 - 4000 (per month) or 48000 (per year) leading to 8159.67 award 2/3
 - 3640 (per month) or 43680 (per year) leading to 6388.47 award 2/3

Question		Generic Scheme	Illustrative Scheme	Max Mark
8.	(b)	<p>Method 1</p> <ul style="list-style-type: none"> •⁴ Calculate monthly pension contribution •⁵ Calculate value of fund after second pension contribution •⁶ Calculate value of fund after third pension contribution 	<p>Method 1</p> <ul style="list-style-type: none"> •⁴ 360 •⁵ $360 \times 1.1^{12} + 360 = 722.87$ •⁶ $\left(722.87 \times 1.1^{12} + 360 \right) = 1088.63$ 	3
		<p>Method 2</p> <ul style="list-style-type: none"> •⁴ Accumulate initial pension payment •⁵ Accumulate second pension payment •⁶ Calculate value of fund after third pension contribution 	<p>Method 2</p> <ul style="list-style-type: none"> •⁴ $\left(360 \times 1.1^{12} \right) = 365.76$ •⁵ $\left(360 \times 1.1^{12} \right) = 362.87$ •⁶ $(365.76 + 362.87 + 360) = 1088.63$ 	
Notes:				
Commonly Observed Responses:				
1. For a monthly pension incorrectly calculated in • ⁴ , marks • ⁵ and • ⁶ can still be awarded: <ul style="list-style-type: none"> – 100 leading to 304.81 award 2/3 – 260 leading to 786.24 award 2/3 				

Question			Generic Scheme	Illustrative Scheme	Max Mark
8.	(c)		<ul style="list-style-type: none"> •⁷ State reason 	<ul style="list-style-type: none"> •⁷ one reason from the following: <ul style="list-style-type: none"> • It is important to save to provide an income in retirement when Sophie is not working. • The employer's pension contribution is an extra part of the financial package which Sophie will not receive if she does not join the scheme. 	1
Notes:					
Commonly Observed Responses:					

Question		Generic Scheme	Illustrative Scheme	Max Mark
9.	(a)	<ul style="list-style-type: none"> •¹ Calculate monthly interest rate •² Create formula for interest, repayment and balance •³ Complete remainder of loan schedule for 48 months •⁴ Calculate monthly repayment, and adjust final repayment 	<ul style="list-style-type: none"> •¹ $(1.095)^{\frac{1}{12}} - 1 = 0.76\dots\%$ per month •² D16, E16, F16 (see spreadsheet) •³ check cells D63, E63 and F63 •⁴ 374.06, 373.99 	4

Notes:

1. For marks •¹ •² and •³ see below

	Formula view	Numerical view
• ¹	$(1+C8)^{(1/12)}-1$	0.76%
• ²	D16= ROUND(F15* $\$C\9 ,2), E16=C16-D16, F16= F15-E16	D16=113.87, E16=260.19, F16=14739.81
• ³	D63= ROUND(F62* $\$C\9 ,2), E63=C63-D63, F63= F62-E63	D63=2.82 E63=371.17, F63= 0

2. If ROUND function has not been used •² is not available

Commonly Observed Responses:

1. For an incorrect monthly interest rate, mark •1 is not available but follow through working to award marks 2, 3 and 4
 - 0.79...% ($9.5 \div 12$) leading to 376.70 and 376.87 award 3/4
 - 9.5% leading to 1443.52, 1439.05 award 3/4

Question		Generic Scheme	Illustrative Scheme	Max Mark
9.	(b)	<ul style="list-style-type: none"> •⁵ Populate spreadsheet with payments £300pm plus £5000 in month 48 to buy car •⁶ Set up formulae in in D16, E16, F136 and copy down to use Goalseek to solve for monthly interest rate •⁷ Calculate annual effective interest rate 	<ul style="list-style-type: none"> •⁵ spreadsheet •⁶ 0.87...% •⁷ 11.04...% 	3

Notes:

1. •⁶ and •⁷ may be solved in reverse order but need both to get correct answer.
2. Check cells C16 and C63 for •⁵
3. For •⁶ see below

	Formula view	Numerical view
• ⁶	D16= ROUND(F15*\$C\$9,2), E16=C16-D16, F16= F15-E16	D16=131.55, E16=168.45, F16=14831.55

leading to 0.87...%

Commonly Observed Responses:

1. When 5000 is inserted in month 48 (cell C63), leading to 0.83% and 10.42% for marks 6 and 7 mark
•⁵ is not available award 2/3

Question		Generic Scheme	Illustrative Scheme	Max Mark
9.	(c)	<ul style="list-style-type: none"> •⁸ State an appropriate reason •⁹ State a second appropriate reason 	<ul style="list-style-type: none"> •^{8,9} eg: <ul style="list-style-type: none"> • Maria will own the car outright after 48 months without needing to find lump sum of £5000 • The finance deal is risky- if Maria does not intend to keep the car but travels more than 24,000 miles she will pay more due to the penalty payment required • The effective annual interest rate is higher on the finance deal if she does wish to keep the car. 	2
Notes:				
Commonly Observed Responses:				

Question		Generic Scheme	Illustrative Scheme	Max Mark
10.	(a)	<ul style="list-style-type: none"> •¹ Find multiplying factor •² Calculate the population in 2032 and state conclusion 	<ul style="list-style-type: none"> •¹ $\frac{1004}{680}$ •² $\left(\text{eg } 1004 \times \frac{1004}{680}\right) \approx 1482$ The expert is incorrect since $1482 < 1600$. 	2
Notes: 1. $(1600/680) \times 1004$ leading to 2032 and the expert is correct since $2032 > 1600$ award $\frac{1}{2}$ 2. • ² can only be awarded for relating a calculated answer to the expert's prediction, no need for a numerical comparison				
Commonly Observed Responses:				
	(b)	<ul style="list-style-type: none"> •³ Estimate total amount of food eaten in adulthood •⁴ State assumption about maximum amount of termites and ants in diet •⁵ Estimate amount of termites and ants eaten based assumption 	<ul style="list-style-type: none"> •³ eg $30 \text{ kg} \times 365 \text{ days} \times 25 \text{ years} = 273\,750 \text{ kg}$ •⁴ eg assume 49% as a maximum percentage of diet (since mainly vegetarian). •⁵ eg $(49\% \times 273\,750) \approx 134\,000 \text{ kg}$ 	3
Notes: 1. Accept answers between 130 000 and 140 000 since the data in the question is given two significant figures.				
Commonly Observed Responses:				
1. •4 can only be awarded for assumptions between 49% - 49.9999...% 2. •5 can be awarded for correctly using any percentage multiplied by their answer to •3				

[END OF MARKING INSTRUCTIONS]