Pearson Edexcel

Pearson Edexcel
Level 1/Level 2 GCSE (9-1)
Mathematics (1MA1)

November 2022 Exemplar
1MA1-2H Paper 2 (Calculator)
Higher Tier

Senior Examiner's feedback on student responses

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About this booklet

This document has been produced to support mathematics teachers delivering the new GCSE (9-1) Mathematics specification.

This document looks at a selection of questions from the November 2022 GCSE (9 - 1) Mathematics Higher tier examination. It shows real student responses to selected questions and how the examining team follow the mark schemes to demonstrate how the students would be awarded marks on these questions.

Our examining team have selected student responses to Higher tier questions and common questions that are in both the Higher tier and Foundation tier from the November 2022 examination.

Following each question, you will find the mark scheme for that question, examiner comment, data on how the question performed and then a range of student responses with accompanying examiner comments on how the mark scheme has been applied, the marks awarded and the common errors for this sort of question.

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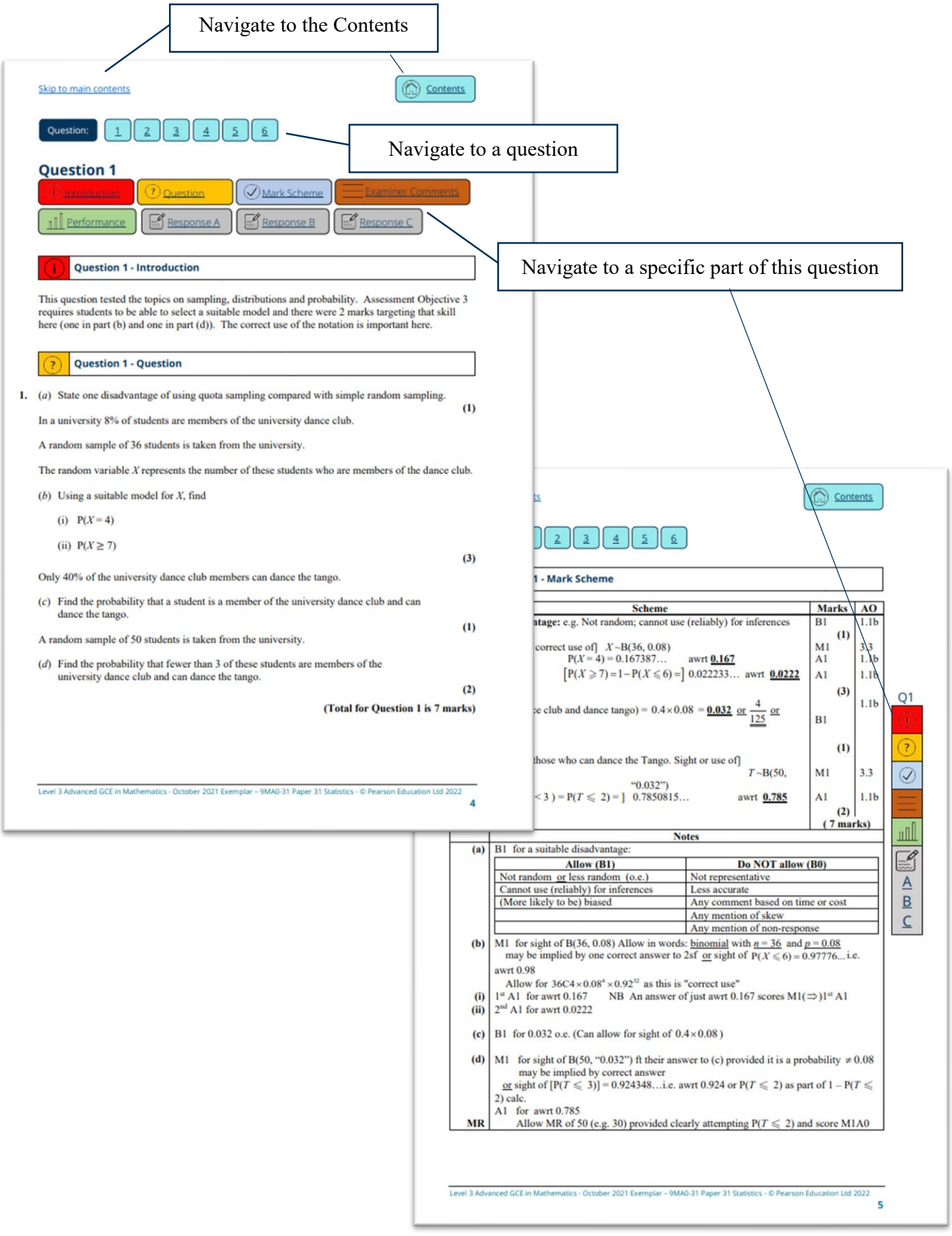
How to use this booklet



General Examiner Feedback

Much like in summer it was pleasing to see candidates being well prepared despite the disruption of previous years. Candidates are clearly well equipped for the exam and there was no evidence of students being impeded by not having equipment such as a calculator. It is worth noting though that candidates don't always take full advantage of their calculators and drop unnecessary marks by using mental methods.

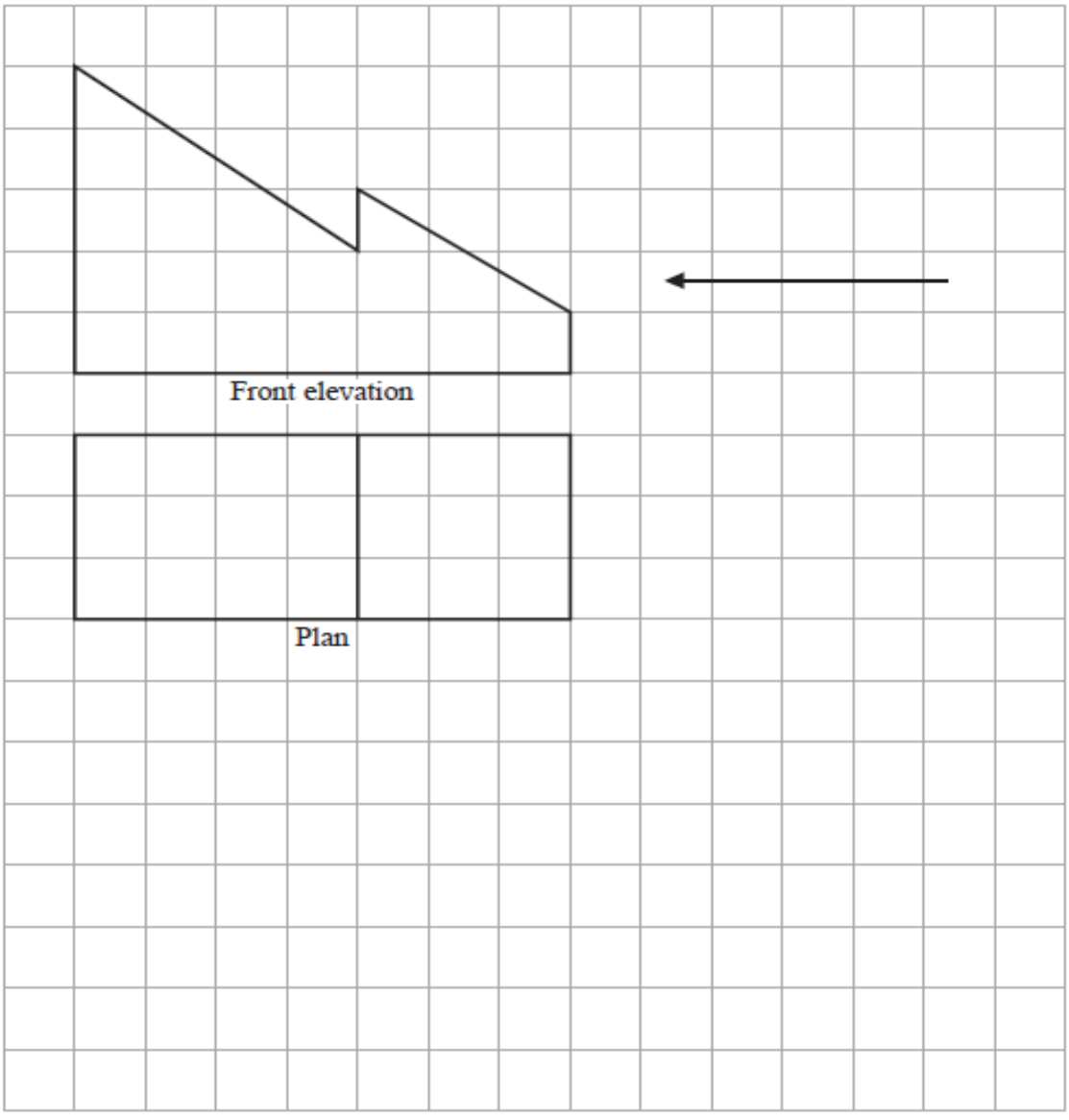
Question 2

Question | Mark Scheme | Examiner Comments | Performance | Response A | Response B | Response C

Question 2 - Question

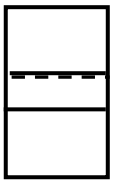
2 The front elevation and the plan of a solid are shown on the grid.

On the grid, draw the side elevation of the solid from the direction of the arrow.



(Total for Question 2 is 2 marks)

Question 2 - Mark Scheme

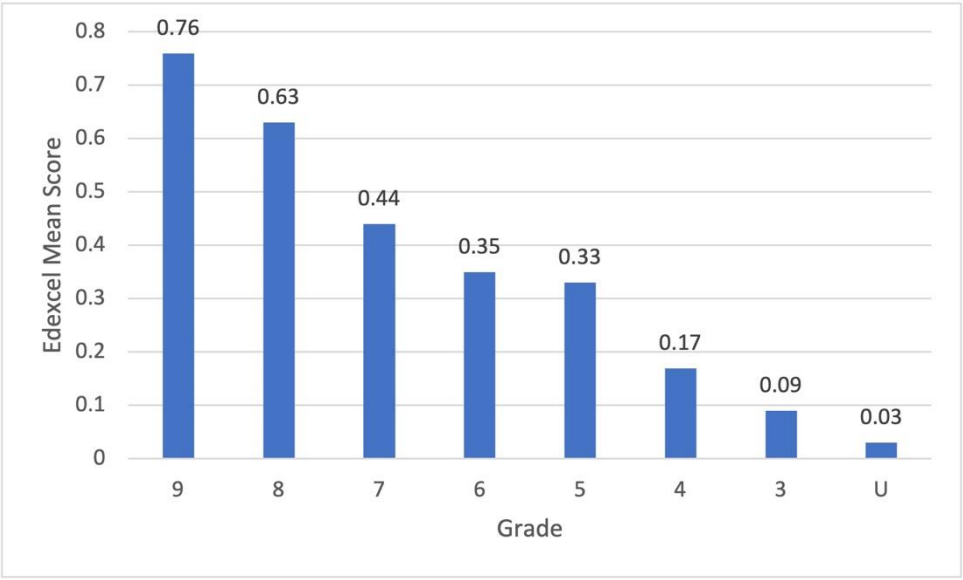
Question	Answer	Mark	Mark scheme	Additional guidance
2	Elevation	B2 (B1	fully correct side elevation 5 high and 3 wide for a rectangle 5 high and 3 wide or correct side elevation in the wrong orientation)	

Question 2 - Examiner Comments

The side elevation on this question was more challenging than many candidates have seen in some time, and very few were able to score full marks. This was normally down to the hidden edge not being indicated with a dashed line which was needed to make the diagram fully correct. That aside many struggled to identify the other edges on the front face and those who scored one it was typically for drawing a rectangle 5 high by 3 wide.

Question 2 - Performance

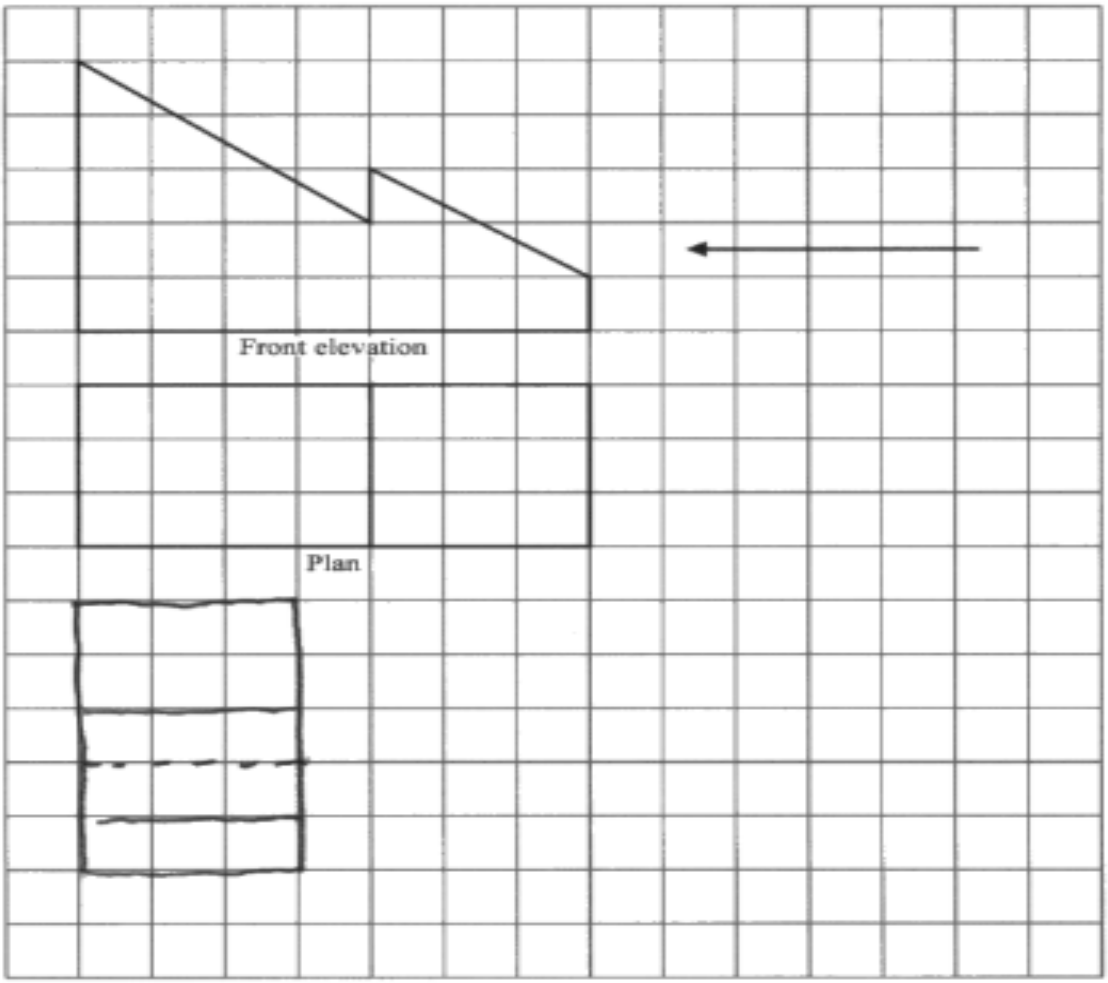
Mean score	Max score	Mean %	Edexcel averages: mean scored by candidates achieving grade:								
			ALL	9	8	7	6	5	4	3	U
0.27	2	14	0.27	0.76	0.63	0.44	0.35	0.33	0.17	0.09	0.03



Question 2 - Response A

2 The front elevation and the plan of a solid are shown on the grid.

On the grid, draw the side elevation of the solid from the direction of the arrow.



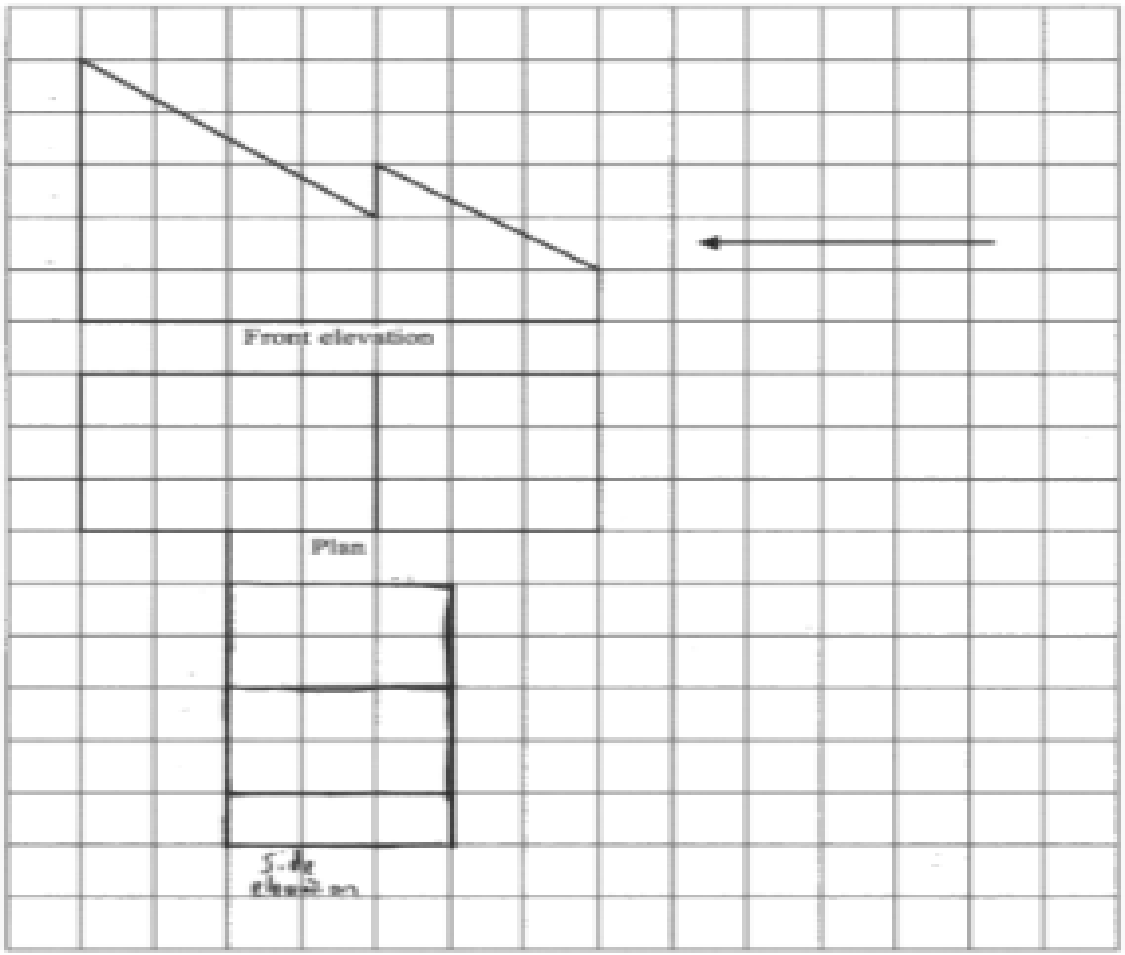
2 /2

B2 fully correct side elevation 5 high and 3 wide

Question 2 - Response B

2 The front elevation and the plan of a solid are shown on the grid.

On the grid, draw the side elevation of the solid from the direction of the arrow.



1 /2

B1 for a rectangle 5 high and 3 wide

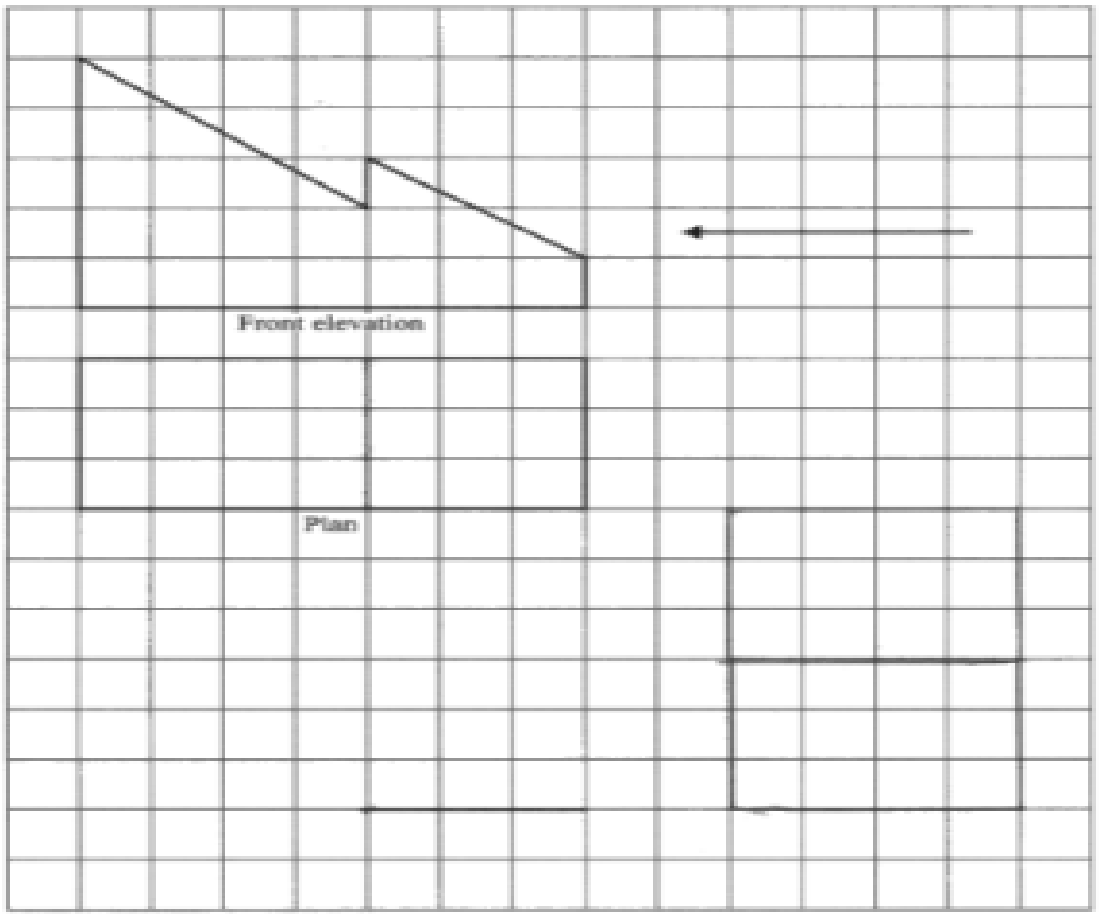
B1 Total 1 mark

Note: the hidden edge does need to be seen to award B2.
A fully correct side elevation (including the hidden edge) in the incorrect orientation will score B1.

Question 2 - Response C

2 The front elevation and the plan of a solid are shown on the grid.

On the grid, draw the side elevation of the solid from the direction of the arrow.



0 /2

B0: shape given is a rectangle but needs to be 5 high and 3 wide to gain B1

B0 Total 0 marks

Question 3b

Question | Mark Scheme | Examiner Comments | Performance | Response A | Response B | Response C

Question 3b - Question

3. The nth term of a different sequence is $8 - 6n$

(b) Is -58 a term of this sequence?
You must show how you get your answer.

(2)

Question 3b - Mark Scheme

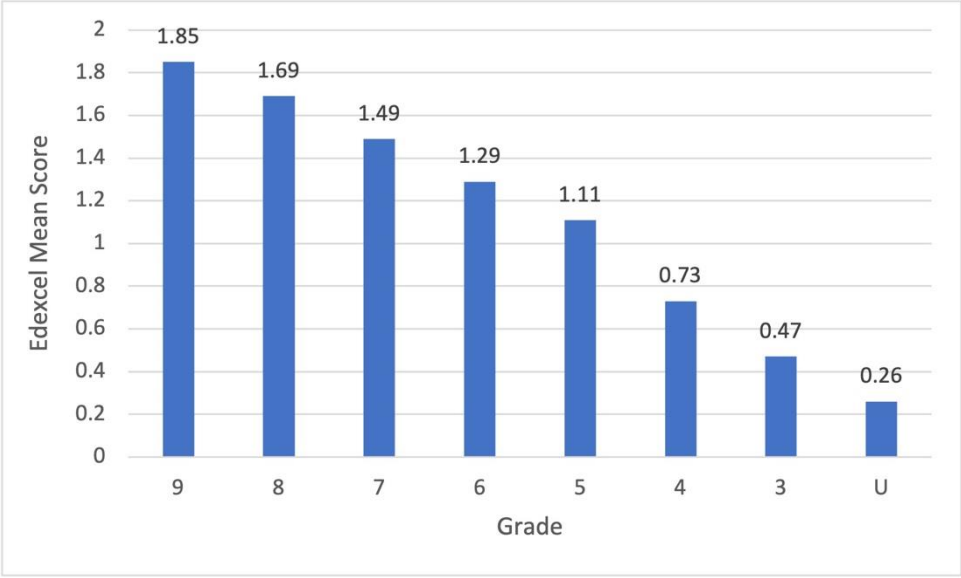
Question	Answer	Mark	Mark scheme	Additional guidance
3 (b)	Shown with supportive working	M1	for $8 - 6n = -58$ or $8 - 6 \times 11$ ($= -58$) **or** starts to list terms of the sequence, with at least 3 correct or any other valid method.	2, −4, −10, −16, −22, −28, −34, −40, −46, −52
		A1	shown with working or an explanation, eg Yes and 11 or 2, –4, –10, –16, ..., –52, –58	May stop at −58 or ring if sequence continues

Question 3b - Examiner Comments

Linear sequences were being tested in this question, and again was a familiar question allowing many to score some good marks. Part (a) was asking for the *n*th term rule of the given sequence. Most candidates scored at least 1 for a sequence in the form $6n + c$ with a good number gaining both marks for a fully correct expression. Common incorrect answers were $n + 6$. $6n - 1$ and $7n + 6$. Part (b) required students to show if a particular number was in the sequence. The negative aspects of this sequence caused some problems, with many students generating a sequence by subtracting 8 rather than 6. A significant number of students on the higher paper used algebra to form and solve an equation, and most who did gained both marks. Incorrect approaches included using $n = 58$ in the formula.

Question 3b - Performance

Mean score	Max score	Mean %	Edexcel averages: mean scored by candidates achieving grade:								
			ALL	9	8	7	6	5	4	3	U
0.96	2	48	0.96	1.85	1.69	1.49	1.29	1.11	0.73	0.47	0.26



Question 3b - Response A

The nth term of a different sequence is $8 - 6n$

(b) Is -58 a term of this sequence?
You must show how you get your answer.

$8 - 6n = -58$

$6n = 66$

$n = 11$

Yes, it is the 11th term.

(2)

2 /2

Q3b

M1 Equation shown as per MS
A1 for Yes and 11

M1A1 Total 2 Marks

Note: forming and solving a correct equation like the one below is sufficient to "show that" -58 is in the sequence, even without the statement.

Question 3b - Response B

The nth term of a different sequence is $8 - 6n$

(b) Is -58 a term of this sequence?
You must show how you get your answer.

$8-6n$

$8-6=2 \quad -6=-4 \quad -6=10$

$-6=-16 \quad -6=-22 \quad -6=-28$

Yes if -28 is in the sequence then -58 must be (2)

(Total for Question 3 is 4 marks)

Q3b

1 /2

M1 Lists the sequence with 5 correct (would condone 10 here as has clearly been used as -10)
A0 No full explanation

M1A0 Total 1 Mark

Question 3b - Response C

The nth term of a different sequence is $8 - 6n$

(b) Is −58 a term of this sequence?
You must show how you get your answer.

$-58 + 8 = -50$

$-50 \div 6 = 8.3$

No, -58 is not a term in the sequence. (2)

0 /2

M0 no correct equation, list of terms or valid method
A0 incorrect answer

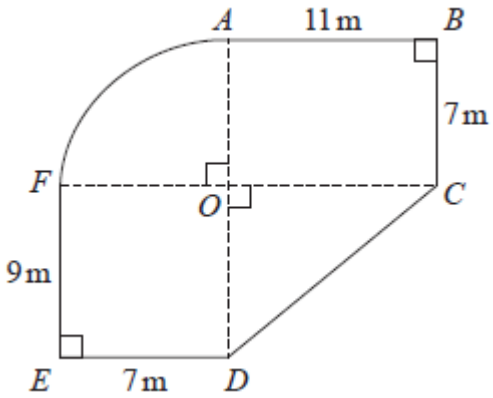
M0A0 Total 0 Marks

Question 4

Question 4 - Question

4 The diagram shows a plan of Jason's garden.

ABCO and *DEFO* are rectangles.
CDO is a right-angled triangle.
AFO is a sector of a circle with centre *O* and angle *AOF* = 90°



Jason is going to cover his garden with grass seed.
Each bag of grass seed covers 14 m^2 of garden.
Each bag of grass seed costs £10.95

Work out how much it will cost Jason to buy all the bags of grass seed he needs.

£.....

(Total for Question 4 is 5 marks)

Question 4 - Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
4	186.15	P1	for correctly finding the area of at least three sections, eg 3 of 11×7 (= 77), **or** 9×7 (= 63), **or** $\frac{1}{2} \times 11 \times 9$ (= 49.5), **or** $\frac{1}{4} \times \pi \times 7^2$ (= 38.4845..)	Note a trapezium for the rectangle and triangle should be classed as two areas. Accept figures rounded or truncated to 1 dp or better throughout.
		P1	for a method to find the number of bags required for one area or a combination of areas eg "77" ÷ 14 (= 5.5) **or** "227.9845.." ÷ 14 (= 16.2846…)	
		P1	for method to work out the total area for all four sections eg "77" + "63" + "49.5" + "38.4845…" (= 227.9845…) or adding the exact number of bags per section for all four sections eg "5.5" + "4.5" + "3.53.." + "2.74.." (= 16.28...)	This mark is dependent upon correct processes seen for all four sections.
		P1	for method to find the cost, eg integer number of bags × 10.95	integer number of bags must come from area ÷ 14 rounded up
		A1	cao	

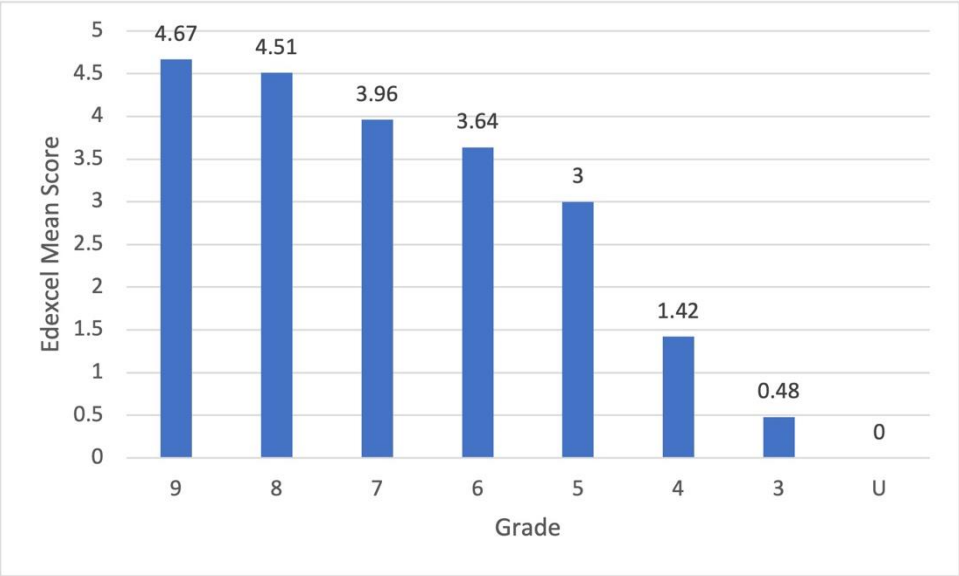
Question 4 - Examiner Comments

This is the first AO3 question on the paper and required 3 main processes. The first of which was to find the total area, and there were two marks assigned to this, the first for correctly finding 3 areas and the second for finding all 4. The second process was to find the number of bags of grass seed that is needed. This could be gained for finding this for a single area or a combination. Finally, the candidates had to round the number of bags up to gain the number needed to buy, and multiply by £10.95 to find the total cost.

Almost all candidates were able to gain some marks, even if just for correct areas. This was as often seen for 2 rectangles and the quadrant, as it was for 2 rectangles and the triangle. Most were then able to gain the mark for dividing by 14. The two major causes of errors were learners not having all four areas correct, as this was needed to gain the 3rd mark. The other common error was for candidates to not round the number of bags up to the nearest integer and so found a cost that was inaccurate.

Question 4 - Performance

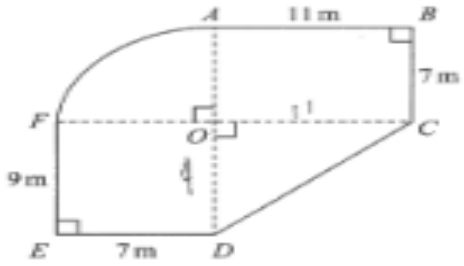
Mean score	Max score	Mean %	Edexcel averages: mean scored by candidates achieving grade:								
			ALL	9	8	7	6	5	4	3	U
2.32	5	46	2.32	4.67	4.51	3.96	3.64	3.00	1.42	0.48	0.00



Question 4 - Response A

4 The diagram shows a plan of Jason's garden.

ABCO and *DEFO* are rectangles.
CDO is a right-angled triangle.
AFO is a sector of a circle with centre *O* and angle *AOF* = 90°



Jason is going to cover his garden with grass seed.
Each bag of grass seed covers 14 m² of garden.
Each bag of grass seed costs £10.95

Work out how much it will cost Jason to buy all the bags of grass seed he needs.

$\frac{1}{2}$ (11×4) = 49.5

$\frac{90}{360}$ × π × 7² = 38.485

9×7 = 63
11×7 = 77

49.5 + 38.485 + 63 + 77
= 227.985

$\frac{227.985}{14}$ = 16.284
= 17

17 × 10.95 = 186.15

£ 186.15

5 /5

P1 for correctly finding the area of at least three sections
P1 for method to work out the area of all four sections
P1 for a method to find the number of bags required for total area
P1 for method to find the cost, eg integer number of bags × 10.95
A1 correct answer

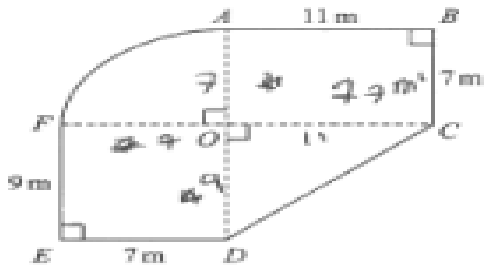
P1P1P1P1A1 Total 5 marks

Q4
A
B
C

Question 4 - Response B

4 The diagram shows a plan of Jason's garden.

ABCO and *DEFO* are rectangles.
CDO is a right-angled triangle.
AFO is a sector of a circle with centre *O* and angle $AOF = 90°$



Jason is going to cover his garden with grass seed.
Each bag of grass seed covers 14 m² of garden.
Each bag of grass seed costs £10.95

Work out how much it will cost Jason to buy all the bags of grass seed he needs.

11 x 7 = 77 m² = ABCO

11 x 4 x ½ = 49.5 m² CDO

9 x 7 = 63 m² DS DEFO

90/360 x π(7²) = 49.785
= 49.79

= 239.29 m² ÷ 14 = 17.09
= 18

18 x 10.95

= 72 + 49.5 + 63 + 49.79

£197.10

4 /5

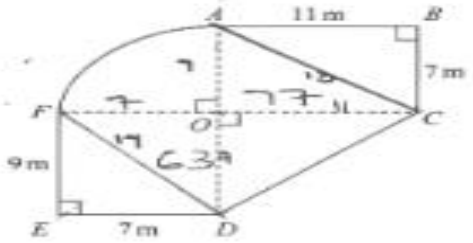
P1 for correct process to find all areas
P1 for process to find the total area (we can award this mark as all processes are correct). There is an arithmetic error here but the process is correct
P1 for a process to find the number of bags, eg their total area divided by 14
P1 they have correctly rounded up their number of bags and multiplied by 10.95
A0 answer is incorrect.

P1P1P1P1A0 Total 4 marks

Question 4 - Response C

4 The diagram shows a plan of Jason's garden.

ABCO and *DEFO* are rectangles.
CDO is a right-angled triangle.
AFO is a sector of a circle with centre *O* and angle *AOF* = 90°



Jason is going to cover his garden with grass seed.
Each bag of grass seed covers 14 m² of garden.
Each bag of grass seed costs £10.95

Work out how much it will cost Jason to buy all the bags of grass seed he needs.

$\sqrt{11^2 + 7^2}$
$= 13$

$63 + 77 = 140$

$\frac{90}{360} \times 14 \times \pi = 10.996$

$\frac{11 \times 9}{2} = 49.5$

$= 200.496$

$\frac{}{14}$

$= 14.32$
$= 15$

$10.95 \times 15 = 164.25$

£ 164.25

3 /5

Q4

A
B
C

P1 for 3 correct areas found (only the quadrant is incorrect)
P1 for a process to find the number of bags (eg divided an area by 14). Here we will condone the fact that the quadrant is not technically an area.
P0 we cannot award this mark as one of the preceding processes (the quadrant) is incorrect.
P1 for a process to find the cost. We can award this mark as they have divided their area by 14, rounded up, and then multiplied by 10.95
A0 incorrect answer

P1P1P0P1A0 Total 3 marks

Note: for the 2nd P1, where you see a combination of areas, at least one of the areas must come from a correct process.

Question 6

Question | Mark Scheme | Examiner Comments | Performance | Response A | Response B | Response C

Question 6 - Question

6 Ella invests £7000 for 2 years in an account paying compound interest.

In the first year, the rate of interest is 3%
In the second year, the rate of interest is 1.5%

Work out the value of Ella's investment at the end of 2 years.

£.....

(Total for Question 6 is 3 marks)

Question 6 - Mark Scheme

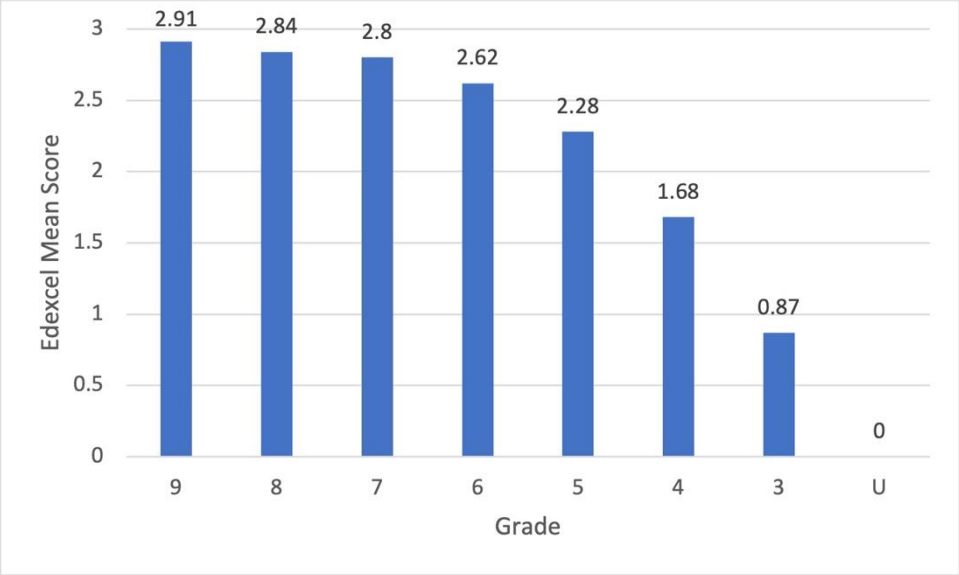
Question	Answer	Mark	Mark scheme	Additional guidance
6	7318.15	M1	for a correct first step eg working out increase for one year 7000 × (100 + 3) ÷ 100 (= 7210) oe **or** 7000 × 3 ÷ 100 (= 210) oe **or** find the multiplier for both years eg (100 + 3) ÷ 100 × (100 + 1.5) ÷ 100 (=1.04545)	7315 or 315 implies M1
		M1	for a compound method, eg 7000 × (100 + 3) ÷ 100 × (100 + 1.5) ÷ 100 oe **or** "7210" × 1.5 ÷ 100 or (= 108.15) oe	318.15 implies M1M1A0
		A1	cao	

Question 6 - Examiner Comments

This was another familiar style of question, the only complication being a different interest rate for each year. As is normal with this question, weaker students struggle to understand fully the compound nature of the question and work with simple interest. Those who did this normally gained 1 mark for finding 3%. Most of those who understood the question fully and worked with compound interest went on to score full marks. The few that didn't normally gave a final answer of £318.15, finding the value of the interest and not the investment.

Question 6 - Performance

Mean score	Max score	Mean %	Edexcel averages: mean scored by candidates achieving grade:								
			ALL	9	8	7	6	5	4	3	U
1.93	3	64	1.93	2.91	2.84	2.80	2.62	2.28	1.68	0.87	0.00

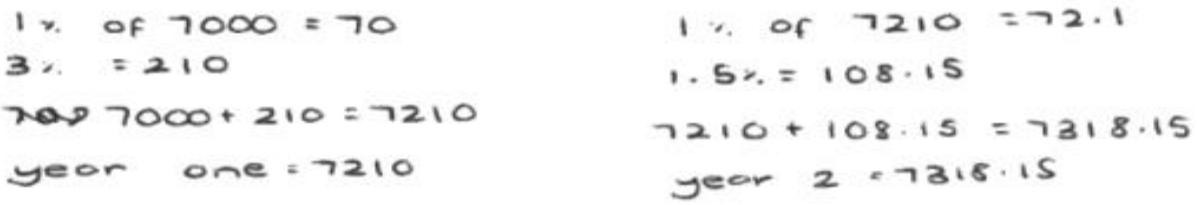


Question 6 - Response A

6 Ella invests £7000 for 2 years in an account paying compound interest.

In the first year, the rate of interest is 3%
In the second year, the rate of interest is 1.5%

Work out the value of Ella's investment at the end of 2 years.



£ 7318.15

3 /3

Q6

M1 Method for the increase in one year
M1 For a compound method
A1 Correct answer

M1M1A1 Total 3 Marks

Note: If a candidate does any kind of % build up working, we must see a full method if their answer is not correct

A
B
C

Question 6 - Response B

6 Ella invests £7000 for 2 years in an account paying compound interest.

In the first year, the rate of interest is 3%
In the second year, the rate of interest is 1.5%

Work out the value of Ella's investment at the end of 2 years.

$\frac{7000}{100} \times 3 = 210$

$\frac{7210}{100} \times 1.5 = 108.15$

£ 108.15

2 /3

M1 Method for the increase in one year (=210)
M1 For a compound method (=108.15)
A0 Incorrect answer

M1M1A0 Total 2 Marks

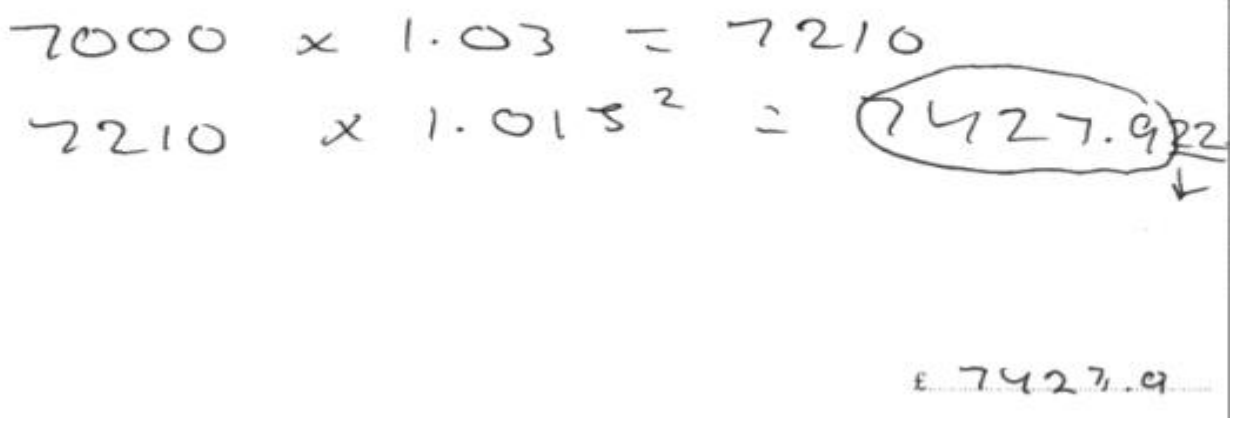
Note - We will accept 7315 and 315 for M1 as it has finding 3% embedded in it. However, we will not accept 7000 x 1.045 oe for M1 unless it is correctly evaluated.

Question 6 - Response C

6 Ella invests £7000 for 2 years in an account paying compound interest.

In the first year, the rate of interest is 3%
In the second year, the rate of interest is 1.5%

Work out the value of Ella's investment at the end of 2 years.



1 /3

M1 Method for the increase after one year (=7210)
M0 Incorrect compound method, 2 years at 1.5% rather than 1 year
A0 Incorrect answer

M1M0A0 Total 1 Mark

Note: if a student starts by increasing by 1.5% and goes no further, we cannot award the M1 for a correct first step. However, if they start by increasing 1.5% and then use a compound method to increase by 3%, we can award M2 or M2A1 if this leads to the correct answer.

Question 10

Question | Mark Scheme | Examiner Comments | Performance | Response A | Response B | Response C

Question 10 - Question

10 Aaliyah bought a car.

In the first year after she bought the car, its value depreciated at a rate of 23% per annum.
In the second year after she bought the car, its value depreciated at a rate of 19% per annum.

At the end of the second year the car was worth £10 914.75

What was the value of the car when Aaliyah bought it?

£.....

(Total for Question 10 is 3 marks)

Question 10 - Mark Scheme

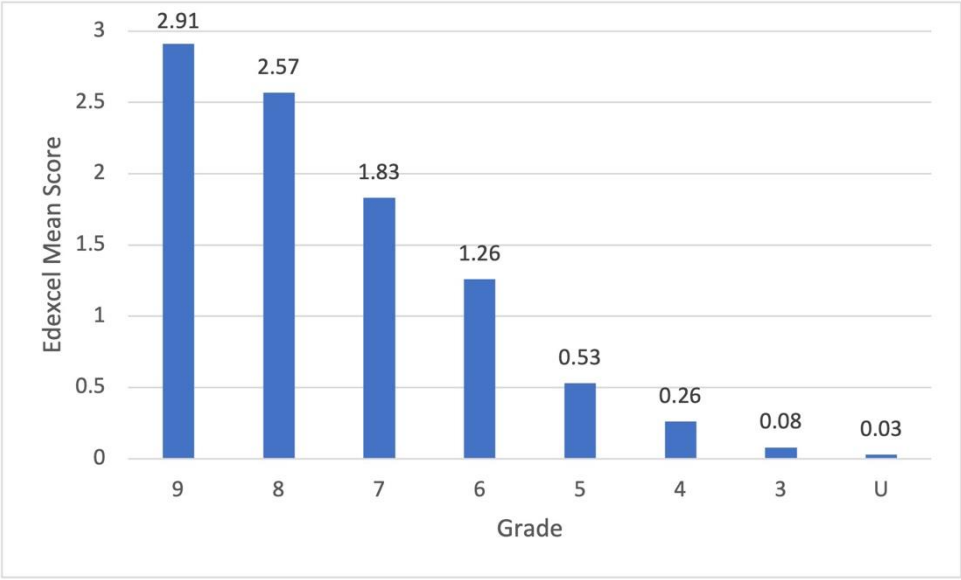
Question	Answer	Mark	Mark scheme	Additional guidance
10	17500	P1	for a process to find the value at the end of year 1, eg 10914.75 ÷ 0.81 (= 13475) **or** 10914.75 ÷ 0.77 (= 14175) **or** for finding the combined multiplier, eg 0.77 × 0.81 (= 0.6237)	
		P1	for a complete process to find the initial value, eg "13475" ÷ 0.77 **or** "14175" ÷ 0.81 **or** 10914.75 ÷ "0.6237"	
		A1	cao	

Question 10 - Examiner Comments

This problem combined reverse percentages with repeated percentage change, and proved a challenge to many, but primarily in relation to the reverse percentage aspect. It was very common to see candidates using multipliers of 1.19 and 1.23 rather than dividing by 0.81 and 0.77. This led to no marks being awarded. Of those who understood the reverse percentage, most then went on to complete the process and gain both P marks, and then normally the accuracy mark also.

Question 10 - Performance

Mean score	Max score	Mean %	Edexcel averages: mean scored by candidates achieving grade:								
			ALL	9	8	7	6	5	4	3	U
0.74	3	25	0.74	2.91	2.57	1.83	1.26	0.53	0.26	0.08	0.03



Q10
A
B
C

Question 10 - Response A

10 Aaliyah bought a car.

In the first year after she bought the car, its value depreciated at a rate of 23% per annum.
In the second year after she bought the car, its value depreciated at a rate of 19% per annum.

At the end of the second year the car was worth £10914.75

What was the value of the car when Aaliyah bought it?

(x) x 23% x 19% = 10914.75

(x) x 0.77 x 0.81 = 10914.75

0.6237x = 10914.75

x = 17500

100 - 23 = 77

100 - 19 = 81

£ 17500

3 /3

P1 for 0.77 x 0.81 (=0.6237)
P1 for 10914.75 / 0.6237
A1 correct answer

P1P1A1 Total 3 marks

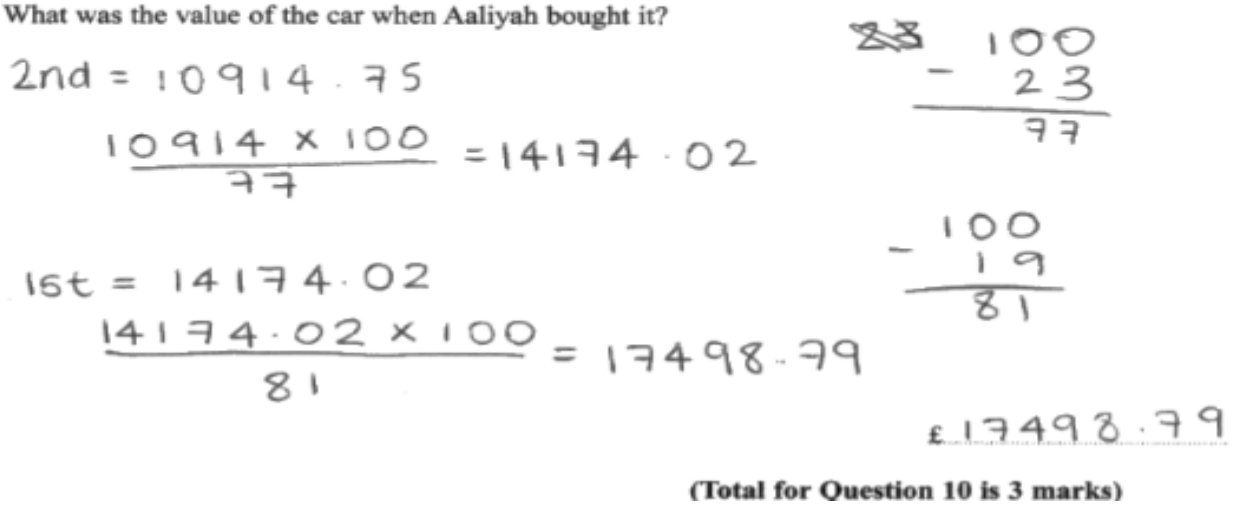
Question 10 - Response B

10 Aaliyah bought a car.

In the first year after she bought the car, its value depreciated at a rate of 23% per annum.
In the second year after she bought the car, its value depreciated at a rate of 19% per annum.

At the end of the second year the car was worth £10914.75

What was the value of the car when Aaliyah bought it?



(Total for Question 10 is 3 marks)

2 /3

P1 for process to find the value at the end of year 1, 10914 × 100 ÷ 77
P1 for a complete process to find the initial value, "14175" × 100 ÷ 81
A0 Answer is incorrect due to candidate not using the fully accurate figure, 10914 rather than 10914.75

P1P1A0 Total 2 marks

Question 10 - Response C

10 Aaliyah bought a car.

In the first year after she bought the car, its value depreciated at a rate of 23% per annum.
In the second year after she bought the car, its value depreciated at a rate of 19% per annum.

At the end of the second year the car was worth £10914.75

What was the value of the car when Aaliyah bought it?

100 - 23 = 77%

original value

£10914.75 ÷ 77 = 141.75 x 100 = £14175

£14175 ÷ 81% = 175

100 - 19 = 81

£ 14175

1 /3

P1 for 10914.75 divided by 0.77
P0 second process is incomplete
A0 incorrect answer

P1P0A0 Total 1 mark

Q10

A
B
C

Question 12

Question 12 - Question

12 The number of insects in a population at the start of the year n is P_n

The number of insects in the population at the start of year $(n + 1)$ is P_{n+1} where

$$P_{n+1} = kP_n$$

Given that k has a constant value of 1.13

(a) Find out how many years it takes for the number of insects in the population to double.
You must show how you get your answer.

.....

(2)

The value of k actually increases year on year from its value of 1.13 in year 1

(b) How does this affect your answer to part (a)?

.....

.....

.....

(1)

(Total for Question 12 is 3 marks)

Question 12 - Mark Scheme

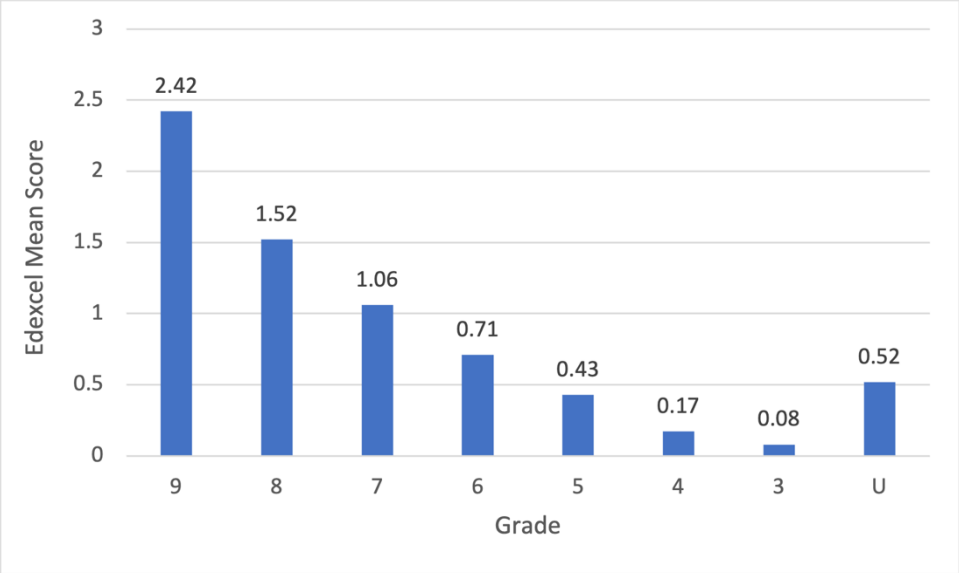
Question	Answer	Mark	Mark scheme	Additional guidance
12 (a)	6	M1	for an attempt to evaluate 1.13^n for at least one value of n (with $n > 1$)	1.13, 1.27…, 1.44…, 1.63…, 1.84…, 2.08… May be used with a value Values rounded or truncated to 2dp or better
		A1	6 years coming from finding n such that $1.13^n > 2$	
(b)	Explanation	C1	for explanation **Acceptable examples** it will decrease the number of years will go down we can't tell (as we don't know how much it is increasing by) it will be an overestimate **Not acceptable examples** it will increase it will be an underestimate	

Question 12 - Examiner Comments

Part (a) proved a real challenge to candidates and it is clear that many didn't really understand iterative processes or how to use an iterative formula. Most tried to multiply 1.13 by the number of years, rather than raising to a power, and thus the majority of candidates scored no marks. The limited number of candidates who used the formula correctly were split into two groups, those who gained 1 mark for using the formula correctly once, and those who went on to gain both marks as they fully understood. In both these groups there were candidates who dealt with the constant alone, and looked to see when this became greater than 2, and candidates who chose a starting value (often 100) and worked till this value doubled. Both approaches were acceptable and seen as regularly as each other. The communication aspect of part (b) was approached well by many, with certainly more success than part (a). Many candidates correctly realised that by increasing the value of k would decrease the time taken.

Question 12 - Performance

Mean score	Max score	Mean %	Edexcel averages: mean scored by candidates achieving grade:								
			ALL	9	8	7	6	5	4	3	U
0.47	3	16	0.47	2.42	1.52	1.06	0.71	0.43	0.17	0.08	0.52



Question 12 - Response A

12 The number of insects in a population at the start of the year n is P_n

The number of insects in the population at the start of year $(n + 1)$ is P_{n+1} where

$$P_{n+1} = kP_n$$

Given that k has a constant value of 1.13

(a) find out how many years it takes for the number of insects in the population to double.
You must show how you get your answer.

start with ten. end with 20.

$P_{n+1} = 1.13(10)$
$= 11.3$

$P_{n+1} = 1.13 \times 11.3$
$= 12.769$

6 years

$P_{n+1} = 1.13 \times 12.769$
$= 14.42897$

$P_{n+1} = 16.3047361$
$P_{n+1} = 18.4235179$
$P_{n+1} = 20.8195175$

6 years
(2)

The value of k actually increases year on year from its value of 1.13 in year 1

(b) How does this affect your answer to part (a)?

It may shorten the amount of years it takes for the population to double.

(1)

(Total for Question 12 is 3 marks)

3 /3

Q12

A
B
C

(a)
M1 1.13n has been evaluated using the value 10
A1 Correct answer

M1A1 Total 2 Marks

(b)
C1 Correct explanation "shorten the years"

C1 Total 1 Mark

Question 12 - Response B

12 The number of insects in a population at the start of the year n is P_n

The number of insects in the population at the start of year $(n + 1)$ is P_{n+1} where

$P_{n+1} = kP_n$ $P_{n+1} = 1.13 \times P_n$

Given that k has a constant value of 1.13

(a) find out how many years it takes for the number of insects in the population to double.
You must show how you get your answer.

P_{n+1} = amount of insects first year
$\times 1.13 = P_{n+2}$ = amount second year
if $n+1 = 1$, $n+2 = 1.13$, $n+3 = 1.2769$, $n+4 = 1.442897$
$n+5 = 1.630473361$, $n+6 = 1.842435179$, $n+7 = 2.081951753$,
$n+8 = 2.352605548$

7.5

(2)

The value of k actually increases year on year from its value of 1.13 in year 1

(b) How does this affect your answer to part (a)?

the answer would be a less number of years

(1)

(Total for Question 12 is 3 marks)

Q12

2 /3

(a)
M1 1.13^n has been evaluated (we can accept the values seen despite the incorrect allocation to the year n)
A0 Incorrect answer

M1A0 Total 1 mark

(b)
C1 Acceptable explanation "less number of years"

C1 Total 1 Mark

Question 12 - Response C

12 The number of insects in a population at the start of the year n is P_n

The number of insects in the population at the start of year $(n + 1)$ is P_{n+1} where

$$P_{n+1} = kP_n$$

Given that k has a constant value of 1.13

(a) find out how many years it takes for the number of insects in the population to double.
You must show how you get your answer.

1 = 1·13 × 1 2·26.
2 = 1·13 × 2.

$P_{n+1} = 1.13\ (1)$.
$P_{n+2} = 1.13\ (2) : 2.26$.

2 years.

(2)

The value of k actually increases year on year from its value of 1.13 in year 1

(b) How does this affect your answer to part (a)?

There will be less years

(1)

(Total for Question 12 is 3 marks)

Q12

A
B
C

1 /3

(a)
M0 1.13n has not been evaluated
A0 Incorrect answer

M0A0 Total 0 marks

(b)
C1 Acceptable explanation "less years"

C1 Total 1 mark

Question 15

Question | Mark Scheme | Examiner Comments | Performance | Response A | Response B | Response C

Question 15 - Question

15 Faiza is studying the population of rabbits in a park.
She wants to estimate the number of rabbits in the park.

On Monday she catches a random sample of 20 rabbits in the park, marks each rabbit with a tag and releases them back into the park.

On Tuesday she catches a random sample of 42 rabbits in the park.
12 of the rabbits are marked with a tag.

(a) Find an estimate for the number of rabbits in the park.

.....

(3)

Albie is studying the population of rabbits in a wood.

One day, he catches 55 rabbits and finds that 40 of these rabbits are marked with a tag.

Albie estimates there are 50 rabbits in the wood.

(b) Explain why Albie's estimate cannot be correct.

.....

.....

.....

(1)

(Total for Question 15 is 4 marks)

Question 15 - Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
15 (a)	70	P1	for $\frac{20}{12}$ (= 1.66..) or $\frac{12}{20}$ (= 0.6) or $\frac{12}{42}$ (= 0.2857..) or $\frac{42}{12}$ (= 3.5)	Decimal values truncated or rounded to 2 dp or more
		P1	for $\frac{20}{n}=\frac{12}{42}$ **or** $\frac{12}{20}=\frac{42}{n}$ **or** $\frac{20\times42}{12}$	
		A1	cao	
(b)	Explanation	C1	for explanation **Acceptable examples** the sample size cannot be greater than the population the population is greater than the sample size there are more than 50 rabbits he catches 55 rabbits **Not acceptable examples** the sample size is too small some of the tags could fall off he has underestimated	

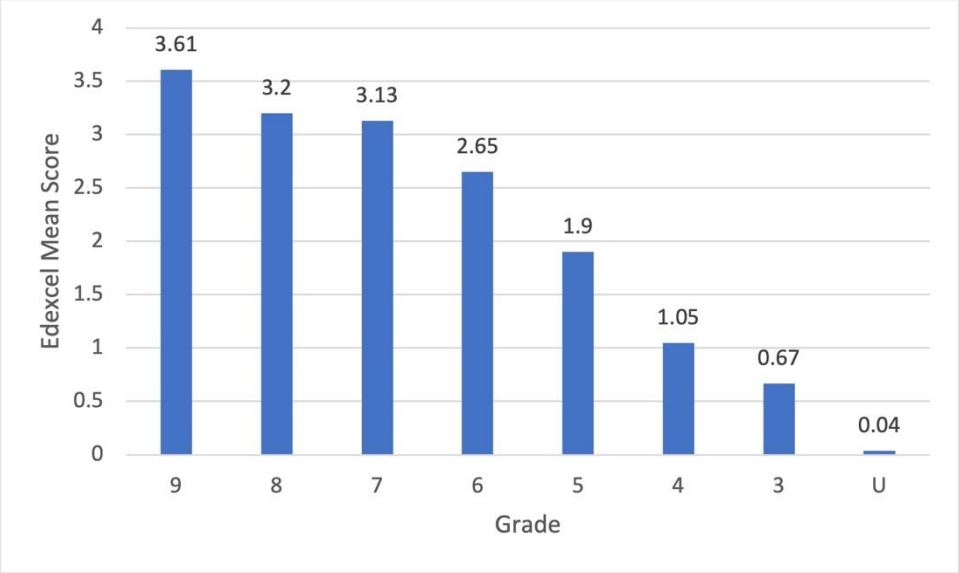
Question 15 - Examiner Comments

This is again a common style of question and one we have seen in recent series. With that in mind it was again unfortunate to see so many candidates with no real idea of how to approach this Peterson Capture Recapture question. A good number scored a single mark for a suitable fraction given, but just as many scored zero. This was normally due to them working with differences rather than ratios. Many were close to scoring the second mark, but often set up the two fractions as a product rather than an equation. Most of those who gained the second, went on to gain the third mark also. Some students gained 2 marks only for setting up a correct equation, but could not then rearrange to gain a correct answer, in particular when their unknown value was the denominator of a fraction.

In part (b), candidates had much greater success. A significant proportion realised that the population must be greater than 50 as Albie had already caught 55. Some of the wrong responses focused on tags falling off, or on the 40 who were tagged.

Question 15 - Performance

Mean score	Max score	Mean %	Edexcel averages: mean scored by candidates achieving grade:								
			ALL	9	8	7	6	5	4	3	U
1.74	4	44	1.74	3.61	3.20	3.13	2.65	1.90	1.05	0.67	0.04



Question 15 - Response A

15 Faiza is studying the population of rabbits in a park.
She wants to estimate the number of rabbits in the park.

On Monday she catches a random sample of 20 rabbits in the park, marks each rabbit with a tag and releases them back into the park.

On Tuesday she catches a random sample of 42 rabbits in the park.
12 of the rabbits are marked with a tag.

(a) Find an estimate for the number of rabbits in the park.

$\frac{12}{42} = \frac{20}{x}$

$12x = 840$

$x = 40$

40

(3)

Albie is studying the population of rabbits in a wood.

One day, he catches 55 rabbits and finds that 40 of these rabbits are marked with a tag.

Albie estimates there are 50 rabbits in the wood.

(b) Explain why Albie's estimate cannot be correct.

He catched 55 rabbits, there cannot be only 50 in the wood.

(1)

(Total for Question 15 is 4 marks)

4 /4

Q15

(a)
P1 12/42
P1 Correct equation as per MS
A1 Correct answer

P1P1A1 Total 3 Marks

(b)
C1 Acceptable explanation

C1 Total 1 Mark

Question 15 - Response B

capture recapture

15 Faiza is studying the population of rabbits in a park.
She wants to estimate the number of rabbits in the park.

On Monday she catches a random sample of 20 rabbits in the park, marks each rabbit with a tag and releases them back into the park.

On Tuesday she catches a random sample of 42 rabbits in the park.
12 of the rabbits are marked with a tag.

(a) Find an estimate for the number of rabbits in the park.

$\frac{x}{20} = \frac{12}{42}$

$\frac{20}{x} \frac{x}{20} = \frac{12}{42}$

$20 = \frac{12}{42} x$

$20 \times \frac{12}{42} = 5.71 : 6$

6

(3)

Albie is studying the population of rabbits in a wood.

One day, he catches 55 rabbits and finds that 40 of these rabbits are marked with a tag.

Albie estimates there are 50 rabbits in the wood.

(b) Explain why Albie's estimate cannot be correct.

Albie only catches a [illegible] fraction of the rabbits he doesn't go back and catch more and see how many are marked with a tag therefore it's an estimate. which isn't correct. (1)

(Total for Question 15 is 4 marks)

2 /4

Q15

A B C

(a)
P1 12/42
P1 Correct equation in x seen, as per MS (method follows the correct equation so not deemed choice)
A0 incorrect answer (failed to manipulate their equation)

P1P1A0 Total 2 Marks

(b)
C0 Unacceptable explanation

C0 Total 0 Marks

Question 15 - Response C

15 Faiza is studying the population of rabbits in a park.
She wants to estimate the number of rabbits in the park.

On Monday she catches a random sample of 20 rabbits in the park, marks each rabbit with a tag and releases them back into the park.

On Tuesday she catches a random sample of 42 rabbits in the park.
12 of the rabbits are marked with a tag.

(a) Find an estimate for the number of rabbits in the park.

$\frac{20}{20} + \frac{12}{42} = \frac{9}{7}$

$\downarrow$

1. 29

< 100

129

129

(3)

Albie is studying the population of rabbits in a wood.

One day, he catches 55 rabbits and finds that 40 of these rabbits are marked with a tag.

Albie estimates there are 50 rabbits in the wood.

(b) Explain why Albie's estimate cannot be correct.

Because Albie originally caught more than 50 rabbits as he first caught 55.

(1)

(Total for Question 15 is 4 marks)

2 /4

Q15

A B C

(a)
P1 for 12/42
P0 incorrect process
A0 incorrect answer

P1P0A0 Total 1 mark

(b)
C1 Acceptable explanation

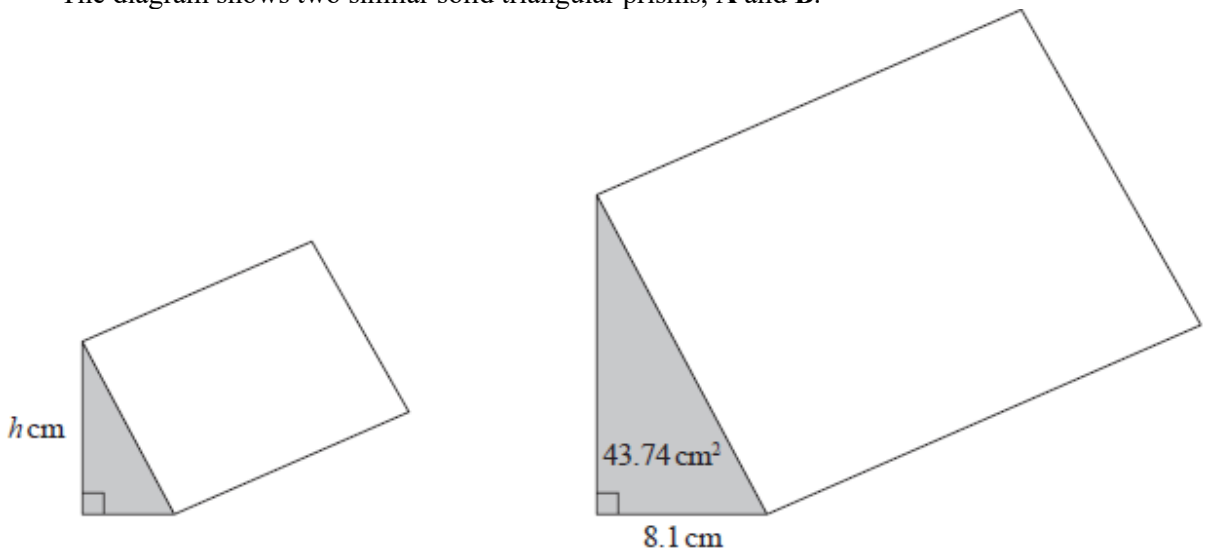
C1 Total 1 Mark

Question 17

Question | Mark Scheme | Examiner Comments | Performance | Response A | Response B | Response C

Question 17 - Question

17 The diagram shows two similar solid triangular prisms, **A** and **B**.



The volume of prism **A** is 58.806 cm^3
The volume of prism **B** is 1587.762 cm^3

The cross section of each prism is a right-angled triangle.

For prism **B**
the length of the base of the triangle is 8.1 cm
the area of the triangle is 43.74 cm^2

The height of the triangle for prism **A** is h cm.

Work out the value of h.

h = ...

(Total for Question 17 is 4 marks)

Question 17 - Mark Scheme

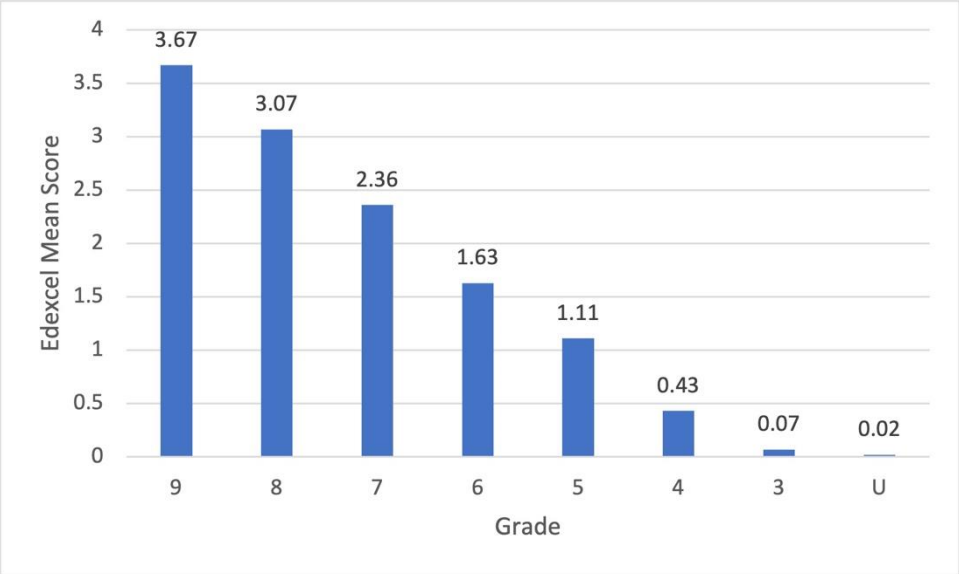
Question	Answer	Mark	Mark scheme	Additional guidance
17	3.6	P1	process to find the volume scale factor, eg 1587.762 ÷ 58.806 (= 27) **or** 58.806 ÷ 1587.762 (= 0.037…)	
		P1	process to find the height of **B**, eg 2 × 43.74 ÷ 8.1 (= 10.8) **or** process to find the area of **A,** eg 43.74 ÷ $(\sqrt[3]{"27"})^2$ (= 4.86) **or** 43.74 × $(\sqrt[3]{"0.037..."})^2$ (= 4.86)	
		P1	complete process to find height of **A**, eg "10.8" ÷ $\sqrt[3]{"27"}$ **or** "4.86" × 2 ÷ (8.1 ÷ $\sqrt[3]{"27"}$)	
		A1	cao	

Question 17 - Examiner Comments

A similar solids question, but with an added layer of difficulty. It was pleasing to see so many candidates get some credit. This was normally for either finding the volume scale factor (by dividing the two volumes) or for a process to find the height of **B**, or in a good number of cases, both scoring 2. However, very few candidates were able to take this further. Typically candidates tried to use a scale factor of 27 when working with areas and lengths and gained no further credit e.g. 10.8 ÷ 27. There were also occasions where more marks could have been scored had candidates been able to deal with the half in the area of a triangle. A shame that such a low level skill was denying candidates high grade marks.

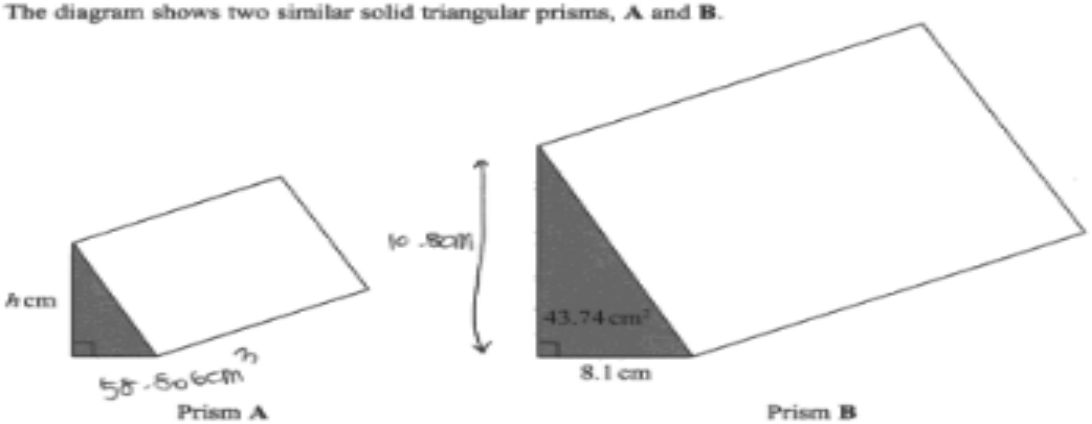
Question 17 - Performance

Mean score	Max score	Mean %	Edexcel averages: mean scored by candidates achieving grade:								
			ALL	9	8	7	6	5	4	3	U
1.05	4	26	1.05	3.67	3.07	2.36	1.63	1.11	0.43	0.07	0.02



Question 17 - Response A

17 The diagram shows two similar solid triangular prisms, **A** and **B**.



Prism A

Prism B

The volume of prism **A** is 58.806 cm³
The volume of prism **B** is 1587.762 cm³

LSF = 3
VSF = 27

1587.762.

$\frac{8.1 \times 10.8}{2} = 43.74$

The cross section of each prism is a right-angled triangle.

For prism **B**
the length of the base of the triangle is 8.1 cm
the area of the triangle is 43.74 cm²

The height of the triangle for prism **A** is h cm.

Work out the value of h.

3.6

LSF = 3
VSF = 27

$\frac{10.8}{3} = 3.6$

$h =$ 3.6

4 /4

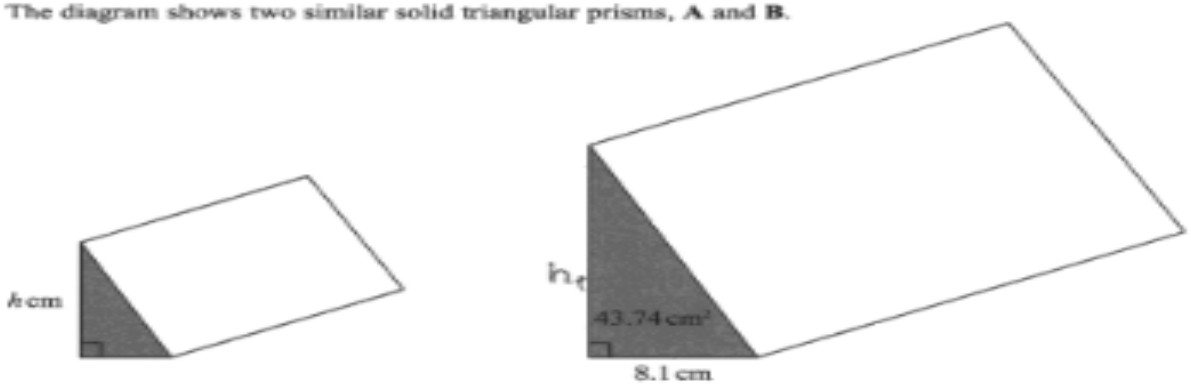
P1 for volume scale factor (= 27)
P1 height of B found
P1 for complete process to find height of A
A1 correct answer

P1P1P1A1 Total 4 marks

Note: if no process to find the scale factor but process to find height of B, award P0P1

Question 17 - Response B

17 The diagram shows two similar solid triangular prisms, **A** and **B**.



Prism **A** Prism **B**

The volume of prism **A** is 58.806 cm³
The volume of prism **B** is 1587.762 cm³

The cross section of each prism is a right-angled triangle.

For prism **B**
the length of the base of the triangle is 8.1 cm
the area of the triangle is 43.74 cm²

The height of the triangle for prism **A** is h cm.

Work out the value of h.

$S = \frac{1}{2} \cdot h_t \cdot 8.1$ $h_t = \frac{2S}{8.1} = \frac{87.48}{8.1} = 10.8$ cm

$V_A : V_B = 58.806 : 1587.762 = \frac{58.806}{1587.762} = 0.037$

$h : h_t = \sqrt[3]{0.037} = 0.333$

$h = h_t \cdot 0.333 = 10.8 \cdot 0.333 =$

$h = 3.596$ cm

Q17

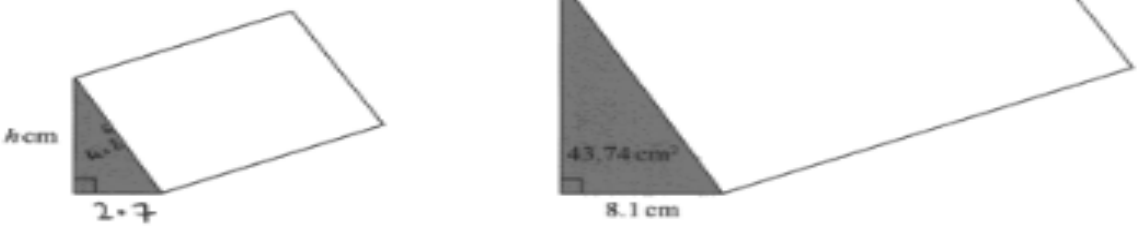
3 /4

P1 for process to find scale factor, 58.806 ÷ 1587.762 (=0.037)
P1 for process to find height of **B**
P1 for complete process to find height of **A** $10.8 \times \sqrt[3]{0.037}$
A0 Answer is incorrect due to premature rounding of $\frac{1}{3}$ to 0.333

P1P1P1A0 Total 3 marks

Question 17 - Response C

17 The diagram shows two similar solid triangular prisms, **A** and **B**.



Prism **A** Prism **B**

The volume of prism **A** is 58.806 cm³
The volume of prism **B** is 1587.762 cm³

The cross section of each prism is a right-angled triangle.

For prism **B**
the length of the base of the triangle is 8.1 cm
the area of the triangle is 43.74 cm²

The height of the triangle for prism **A** is h cm.

Work out the value of h.

LSF
ASF
VSF =

Prism A : Prism B
Vol 58.806 : 1587.762
Area : 43.74
Length : 8.1

Scale factors: LSF = 3
ASF = 9
VSF = 27

8.1 ÷ 3 = 2.7 cm

4.86 ÷ 2.7 = 1.8

43.74 ÷ 9 = 4.86

2.7 × ___ = 4.86

4.86 ÷ 2.7 = 1.8

h = 1.8 cm

(Total for Question 17 is 4 marks)

2 /4

P1 for volume scale factor
P1 for process to find area of A
P0 process is not complete, they haven't multiplied by 2
A0 incorrect answer

P1P1P0A0 Total 2 marks

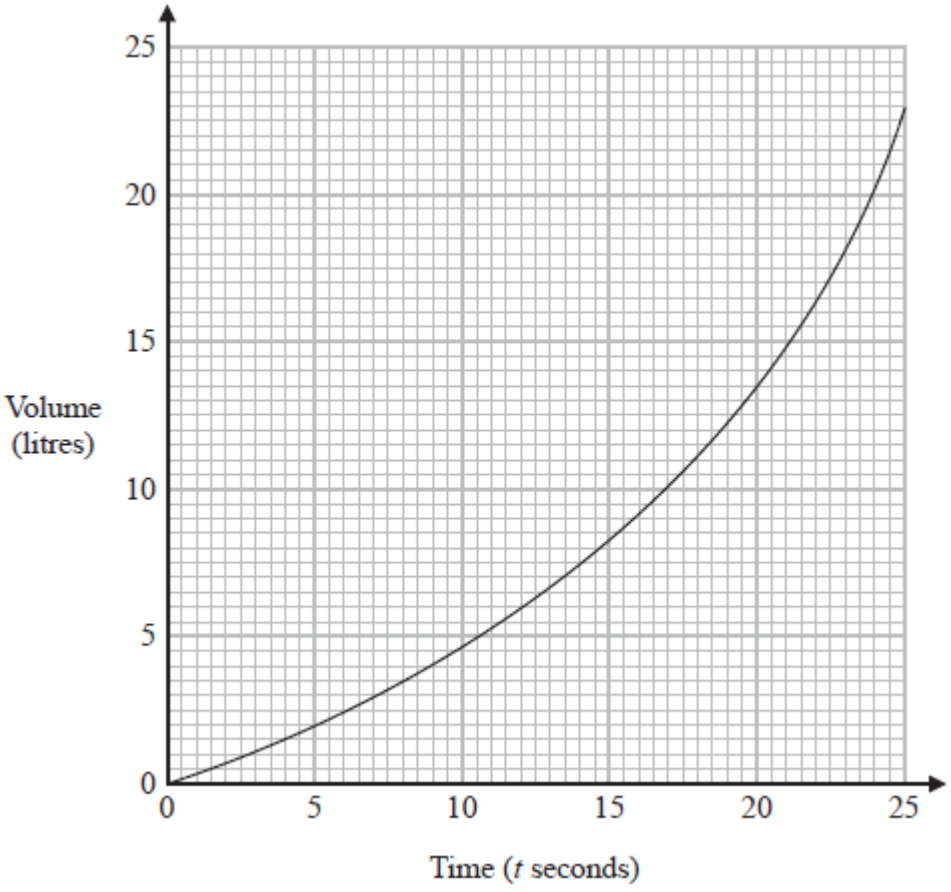
Q17
A
B
C

Question 21

Question | Mark Scheme | Examiner Comments | Performance | Response A | Response B | Response C

Question 21 - Question

21 The graph below gives the volume, in litres, of water in a container t seconds after the water starts to fill the container.



(a) Calculate an estimate for the gradient of the graph when $t = 17.5$
You must show how you get your answer.

.....

(3)

(b) Describe fully what the gradient in part (a) represents.

(1)

(Total for Question 21 is 4 marks)

Question 21 - Mark Scheme

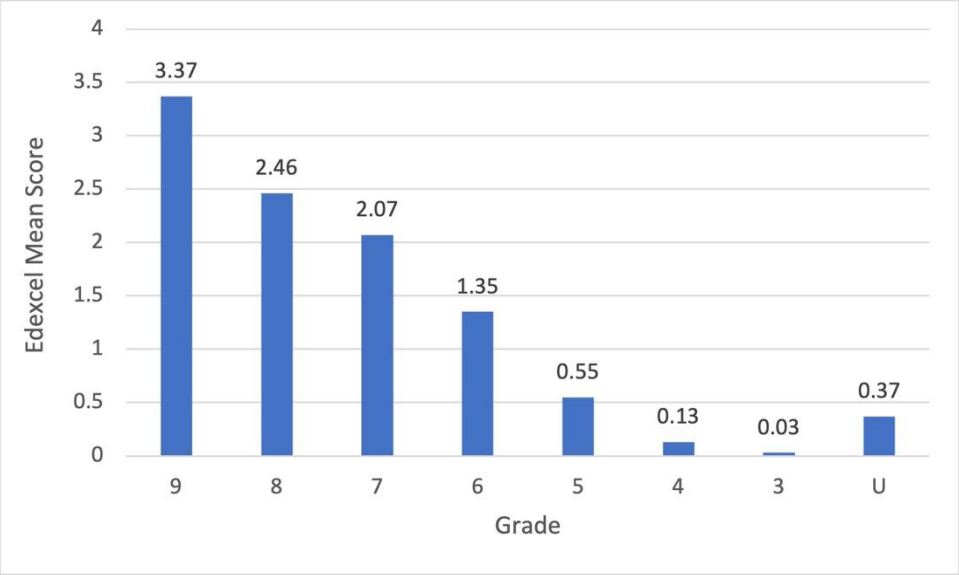
Question	Answer	Mark	Mark scheme	Additional guidance
21 (a)	1.06	M1	for tangent drawn at t =17.5	No tangent drawn at t=17.5 scores zero marks
		M1	for a complete method to find the gradient, eg tangent drawn at t = 17.5, and 18.5 ÷ 17.5	Use of change in y over change in x Working may be seen on the diagram
		A1	answer in the range 0.9 to 1.2	Answer of $\frac{10.5}{17.5}$ oe scores no marks Accept answers in the form a/b where a and b are integers
(b)	Explanation	C1	suitable explanation, eg the rate of change of volume	If units are given they must be correct.

Question 21 - Examiner Comments

Well into the Grade 8 questions on the paper and it is not surprising that fewer candidates are now scoring marks. For part (a), failure to draw a tangent at t = 17.5 meant that no marks could be scored at all. It was very common to just see $\frac{10.5}{17.5}$ which came from reading the volume at t = 17.5, and this scored zero. Those who drew a suitable tangent often then went on to score full marks for an answer in range. However, some were unable to use the scale correctly and then lost marks for their method to find the gradient. Part (b) showed improvements on previous series, and there were many suitable descriptions of what the gradient represented although students still relate this answer to a correlation type response. 'Acceleration' was a commonly seen incorrect answer.

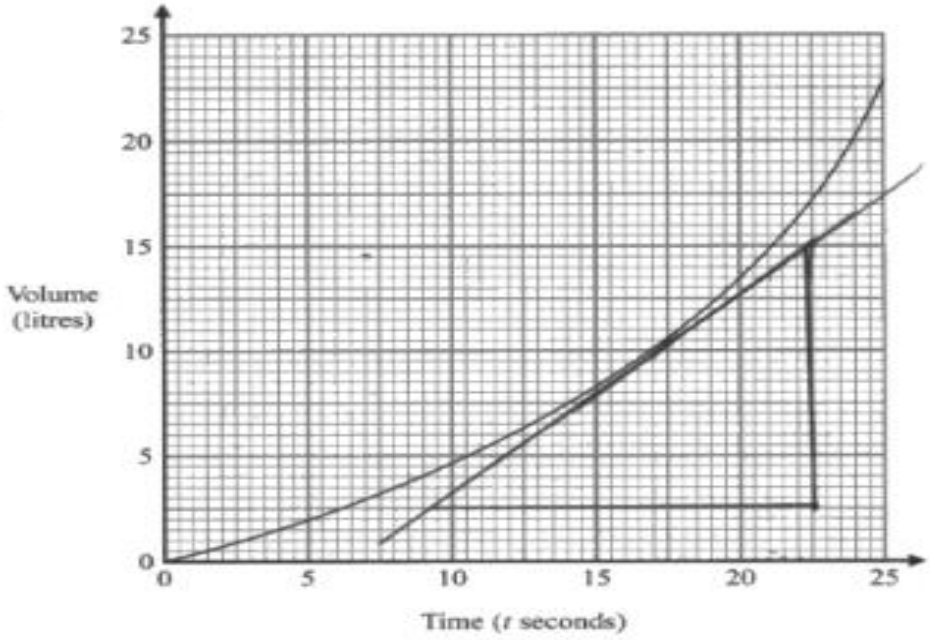
Question 21 - Performance

Mean score	Max score	Mean %	Edexcel averages: mean scored by candidates achieving grade:								
			ALL	9	8	7	6	5	4	3	U
0.74	4	19	0.74	3.37	2.46	2.07	1.35	0.55	0.13	0.03	0.37



Question 21 - Response A

21 The graph below gives the volume, in litres, of water in a container t seconds after the water starts to fill the container.



(a) Calculate an estimate for the gradient of the graph when $t = 17.5$
You must show how you get your answer.

$\frac{\Delta y}{\Delta x} = \frac{15-2.5}{22.5-9} = \frac{12.5}{13.5}$

0.926

(3)

(b) Describe fully what the gradient in part (a) represents.

The rate at which water fills the container in litres per second

4 /4

(a)
M1 A tangent has been drawn at t = 17.5
M1A1 Answer in range
M1M1A1 Total 3 marks

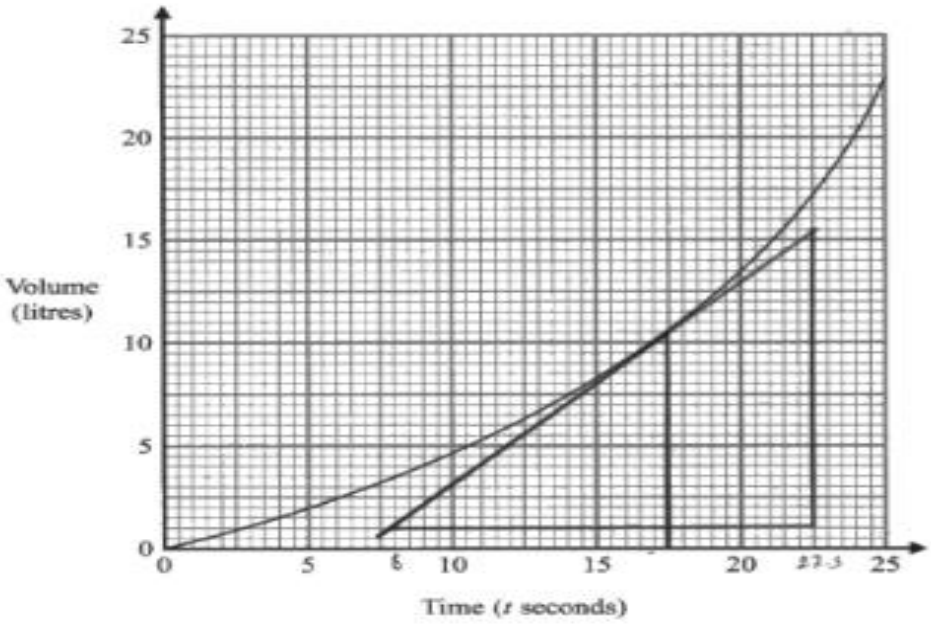
(b)
C1 Acceptable explanation (if units are given they must be correct, as here)

C1 Total 1 mark

Q21
A
B
C

Question 21 - Response B

11 The graph below gives the volume, in litres, of water in a container t seconds after the water starts to fill the container.



(a) Calculate an estimate for the gradient of the graph when $t = 17.5$
You must show how you get your answer.

$$\frac{-(15.5-1)}{-(27.5-8)} = 0.74358$$

0.74

(3)

(b) Describe fully what the gradient in part (a) represents.

rate of change of volume across time

3 /4

(a)
M1 for a tangent drawn at $t = 17.5$
M1 for a complete method to find the gradient
A0 answer not in range

M1M1A0 Total 2 marks

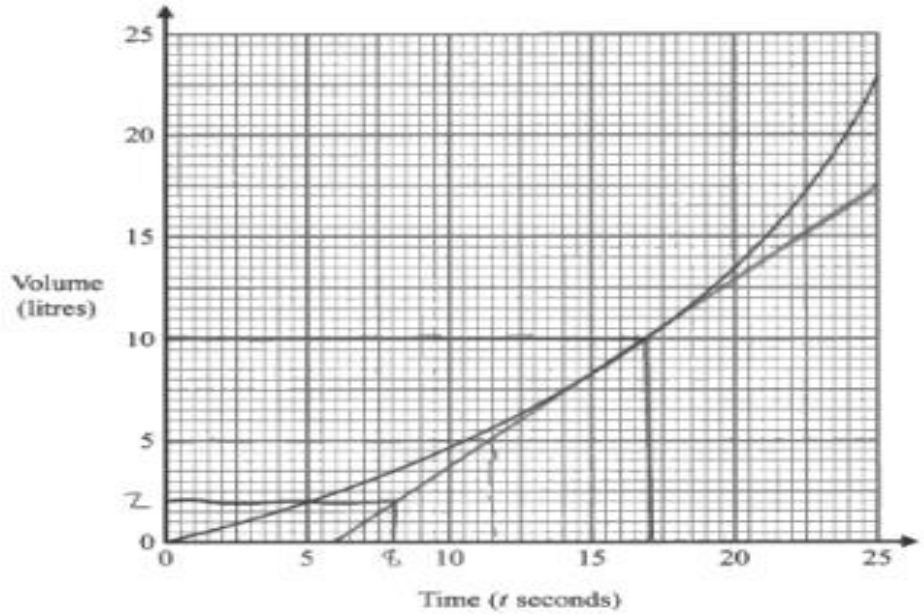
(b)
C1 for a suitable explanation

C1 total 1 mark

Q21
A
B
C

Question 21 - Response C

21 The graph below gives the volume, in litres, of water in a container t seconds after the water starts to fill the container.



(a) Calculate an estimate for the gradient of the graph when $t = 17.5$
You must show how you get your answer.

(8, 2)
(17.5, 10)
$y = x$

(3)

(b) Describe fully what the gradient in part (a) represents.

The rate of volume of water filling up per second at 17.5 seconds

Q21

A
B
C

2 /4

(a)
M1 for tangent drawn at $t = 17.5$
M0A0 no method to find the gradient and answer is incorrect.

M1M0A0 total 1 mark

(b)
C1 for a suitable response - 'Volume per second' acceptable for rate of change.

C1 total 1 mark.

Question 23

Question | Mark Scheme | Examiner Comments | Performance | Response A | Response B | Response C

Question 23 - Question

23 A race is measured to have a distance of 10.6 km, correct to the nearest 0.1 km.
Sam runs the race in a time of 31 minutes 48 seconds, correct to the nearest second.

Sam's average speed in this race is V km/hour.

By considering bounds, calculate the value of V to a suitable degree of accuracy.
You must show all your working and give a reason for your answer.

(Total for Question 23 is 5 marks)

Question 23 - Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
23	20	B1	stating bound, eg 10.65 **or** 10.55 **or** 31 min 48.5sec **or** 31 min 47.5sec **or** 1908.5sec **or** 1907.5sec	
		P1	(dep on B1) for a correct bound for time in hours, eg 0.5301(38…) **or** 0.5298(61…) **Or** a correct process to find one bound for speed in km per minute eg [UB of S] = [UB of D]÷[LB of T] or [LB of S] = [LB of D]÷[UB of T] **or** a correct process to find one bound for speed in km per second eg [UB of S] = [UB of D]÷[LB of T] or [LB of S] = [LB of D]÷[UB of T]	Bound rounded or truncated to 4 dp Where 10.6 < [UB of D] ≤ 10.65 **and** 31 min 47.5 sec ≤ [LB of T] < 31 min 48 sec **Or** 10.55 ≤ [LB of D] < 10.6 **and** 31 min 48 sec < [UB of T] ≤31 min 48.5 sec Where 10.6 < [UB of D] ≤ 10.65 **and** 1907.5 sec ≤ [LB of T] < 1908 sec **Or** 10.55 ≤ [LB of D] < 10.6 **and** 1908 sec < [UB of T] ≤ 1908.5 sec
		P1	(dep on P1) for correct process to find one bound for speed in km per hour, eg [UB of S] = [UB of D]÷ 0.5298(61…) **or** [LB of S] = [LB of D]÷ 0.5301(38…) **OR** Correct process to convert a bound for speed in km per minute to km per hour eg [UB of S] = [UB of D]÷[LB of T] × 60 **or** [LB of S] = [LB of D]÷[UB of T] × 60 **OR** Correct process to convert a bound for speed in km per second to km per hour eg [UB of S] = [UB of D]÷[LB of T] × 60 × 60 **or** [LB of S] = [LB of D]÷[UB of T] × 60 × 60	Time used in hours Where 10.6 < [UB of D] ≤ 10.65 **and** 31 min 47.5 sec ≤ [LB of T] < 31 min 48 sec **Or** 10.55 ≤ [LB of D] < 10.6 **and** 31 min 48 sec < [UB of T] ≤31 min 48.5 sec Where 10.6 < [UB of D] ≤ 10.65 **and** 1907.5 sec ≤ [LB of T] < 1908 sec **Or** 10.55 ≤ [LB of D] < 10.6 **and** 1908 sec < [UB of T] ≤ 1908.5 sec
		A1	for both correct bounds from correct working, 20.099… **and** 19.900…	Figures rounded or truncated to 3 sf or better
		C1	for 20 correct to 2 significant figures as both bounds agree.	

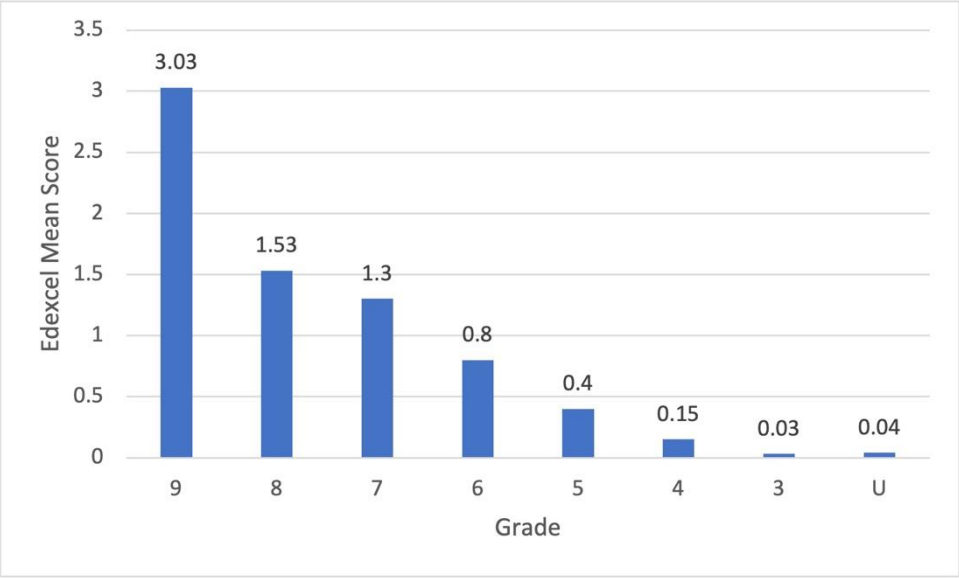
Q23
A
B
C

Question 23 - Examiner Comments

Candidates really struggled to gain full marks with this question, and it was primarily down to time conversion that was required.
A pleasing proportion had enough of an understanding of bounds to gain at least one mark for one correct bound either for distance, or for time in minutes and seconds, or just in seconds.
The second mark was for either correctly finding a bound for time in hours, or for a correct process to find a bound in kilometres per minute or kilometres per second. Those working in minutes often struggled here as they gave their time as 31.485 or 31.475, which is clearly incorrect.
The final process mark was for working in kilometres per hour, but was normally only seen when candidates had found the time in hours first. Due to premature rounding in the question, many who had gained the first 3 marks could not then gain the accuracy mark as their answer was outside of the acceptable range.
The C mark was only awarded to a handful of candidates as so few were able to communicate that the value of V was 20 correct to 2 significant figures as both bounds agree.

Question 23 - Performance

Mean score	Max score	Mean %	Edexcel averages: mean scored by candidates achieving grade:								
			ALL	9	8	7	6	5	4	3	U
0.50	5	10	0.50	3.03	1.53	1.30	0.80	0.40	0.15	0.03	0.04

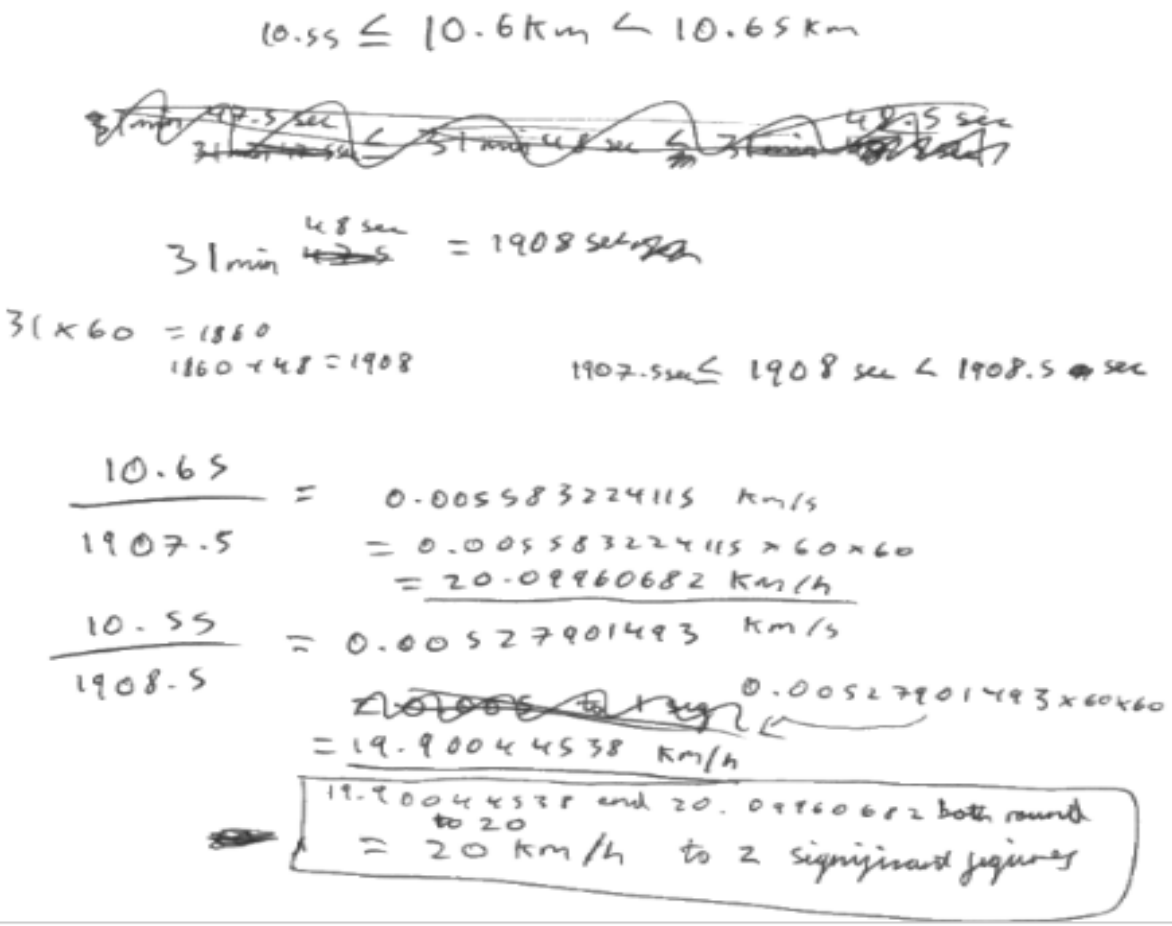


Question 23 - Response A

23 A race is measured to have a distance of 10.6 km, correct to the nearest 0.1 km.
Sam runs the race in a time of 31 minutes 48 seconds, correct to the nearest second.

Sam's average speed in this race is V km/hour.

By considering bounds, calculate the value of V to a suitable degree of accuracy.
You must show all your working and give a reason for your answer.



5 /5

B1 for a starting bound
P1 for a correct speed in km per minute
P1 for converting speed in km per minute to km per hour
A1 for both correct bounds from working
C1 for 20 correct to 2 significant figures

B1P1P1A1C1 Total 5 marks

Question 23 - Response B

10.65 − 10.55

23 A race is measured to have a distance of 10.6 km, correct to the nearest 0.1 km.
Sam runs the race in a time of 31 minutes 48 seconds, correct to the nearest second.
Sam's average speed in this race is V km/hour.

By considering bounds, calculate the value of V to a suitable degree of accuracy.
You must show all your working and give a reason for your answer.

31 47.5 − 48.5

~~10.65~~

Upper bound

10.65 km = ~~10,650~~

31 m · 47.5 s = ~~1897.5~~ s = $\frac{763}{1440}$ h

$\frac{10.65}{\frac{763}{1440}}$ = 20.005242 46

~~10,650~~ / ~~(907.5~~ = 5.583224113 m/s × $\frac{1009}{3600}$ = ~~1.550895588~~ K/h

Lower bound

10.55 km = ~~10550~~ m

~~5~~ $\frac{48.5}{60} = \frac{97}{120}$

$\frac{31+\frac{97}{120}}{60} = \frac{3817}{7200}$

$\frac{10.55}{\text{ans}}$ = 19.900 44338 km/h

$\frac{20.005242 46 + 19.900 44338}{2}$

= 19.9528 = 20.0 (3SF) – I took the higher average speed and the lower average speed using bounds and found the average

(Total for Question 23 is 5 marks)

3 /5

B1 for correct bounds for distance or speed
P1P1 correct process find upper or lower bound for speed in km per hour
A0 inaccurate bounds
C0 incorrect conclusion

B1P1P1A0C0 Total 3 marks

Q23
A
B
C

Question 23 - Response C

23 A race is measured to have a distance of 10.6 km, correct to the nearest 0.1 km.
Sam runs the race in a time of 31 minutes 48 seconds, correct to the nearest second.

Sam's average speed in this race is V km/hour.

By considering bounds, calculate the value of V to a suitable degree of accuracy.
You must show all your working and give a reason for your answer.

LB UB

10.55 10.6 10.65

~~11m, 47.5s 11m, 48s 31 mins, 48.5s~~

$S = \frac{D}{T}$

From km/s to km/hr you divide by 3600 as 3600s in an hour

LB UB

10.5km 10.6km 10.65km

1907.5s 1908s 1908.5s

UB of speed $= \frac{10.65}{1907.5}$

$= 5.583.. \times 10^{-3}$ km/s

$= 1.55089 \times 10^{-6}$ km/hr

So 1.53×10^{-6} km/hr

LB of speed $= \frac{10.55}{1908.5s}$

$= 5.5017a \times 10^{-3}$ km/s

$= 1.528 \times 10^{-6}$ km/hr

(Total for Question 23 is 5 marks)

Q23

A B C

2 /5

B1 for correct bound of time (in seconds) or distance
P1 process to find a bound for speed in km per second. This mark is dependent on B1
P0 No process to find a bound for speed in km per hour
A0 bounds are not correct
C0 incorrect conclusion

B1P1P0A0C0 Total 2 marks