Pearson Edexcel

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

November 2022 Exemplar
1MA1-3H Paper 3 (Calculator)
Foundation 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 Foundation 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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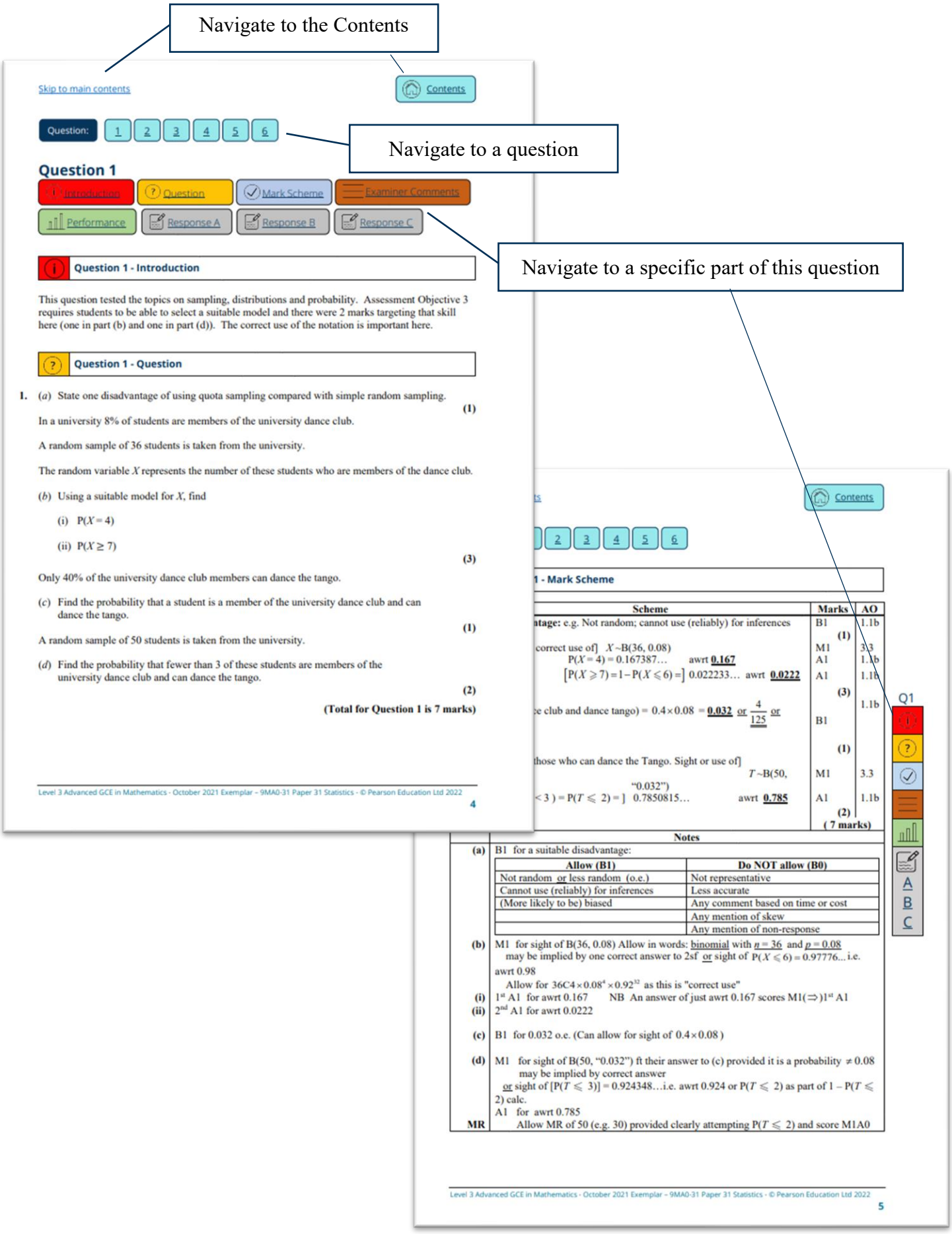
How to use this booklet



General Examiner Feedback

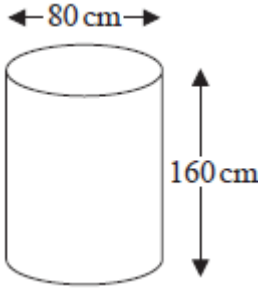
There were many very good scripts from candidates taking this paper. Less able candidates generally found the opportunity to demonstrate positive achievement in the first half of the paper and it appeared that most candidates seemed to have been entered appropriately for the higher tier. Candidates' work was generally clearly and logically presented. Where fully correct answers were not seen, examiners could often award some credit for correct methods and processes shown in working.

All questions were accessible to some candidates. Questions 1, 2, 3, 5, 6, 9 and 14(b) were answered well by most candidates whereas questions 17, 18, 20, 21, 23 - 26 attracted fully correct solutions from only a small proportion of candidates. Questions 4, 7(a), 10, 12 and 18 appeared to challenge a significant number of candidates at the ability levels they were aimed at and candidates are well advised to get more practice with these types of question. To balance this, it was encouraging see more candidates than expected get at least some marks for their answers to questions 9, 14(b), 19, 22 and 25.

Question 4

Question 4 - Question

4 Karina has 4 tanks on her tractor.
Each tank is a cylinder with diameter 80 cm and height 160 cm.



The 4 tanks are to be filled completely with a mixture of fertiliser and water.

The fertiliser has to be mixed with water in the ratio 1 : 100 by volume.
Karina has 32 litres of fertiliser.

1 litre = 1000 cm^3

Has Karina enough fertiliser for the 4 tanks?
You must show how you get your answer.

(Total for Question 4 is 4 marks)

Question 4 - Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
4	Yes (supported)	P1	for a process to find the volume of 1 tank eg $\pi \times 40^2 \times 160$ (= 804247.7… or 804.2...or 256000π)	Values can be truncated or rounded
		P1	for complete process to find the volume of 4 tanks, [volume of tank] × 4 eg $\pi \times 40^2 \times 160 \times 4$ (= 3216990.8… or 3216.9... or 1024000π) **or** for process to find volume of fertiliser available per tank eg 32 × 1000 ÷ 4 (= 8000)	For this mark, [volume of tank] must come from a calculation involving π, r^2, h
		P1	for a process to find the volume of fertiliser needed for 1 tank eg [volume of tank] ÷ 101 (= 7962.8...) or 4 tanks (= 31851.3…) **OR** for a process to find volume of mixture that 32 litres of fertiliser will make eg 32000 × 101 (= 3232000) or 32 × 101 (= 3232)	For this mark, [volume of tank] must come from a calculation involving π, r^2, h or be stated as their volume.
		C1	for Yes supported by correct figures shown eg a comparable figure in the range 31.8 to 31.9 (litres) **or** in the range 31800 to 31900 with 32000 (cm^3) **or** in the range 3216 to 3217 with 3232 (litres) **or** in the range 3216000 to 3217000 with 3232000 (cm^3) **or** in the range 7958 to 7963 with 8000 (cm^3)	There are other possible pairs of values which can be used in the comparison

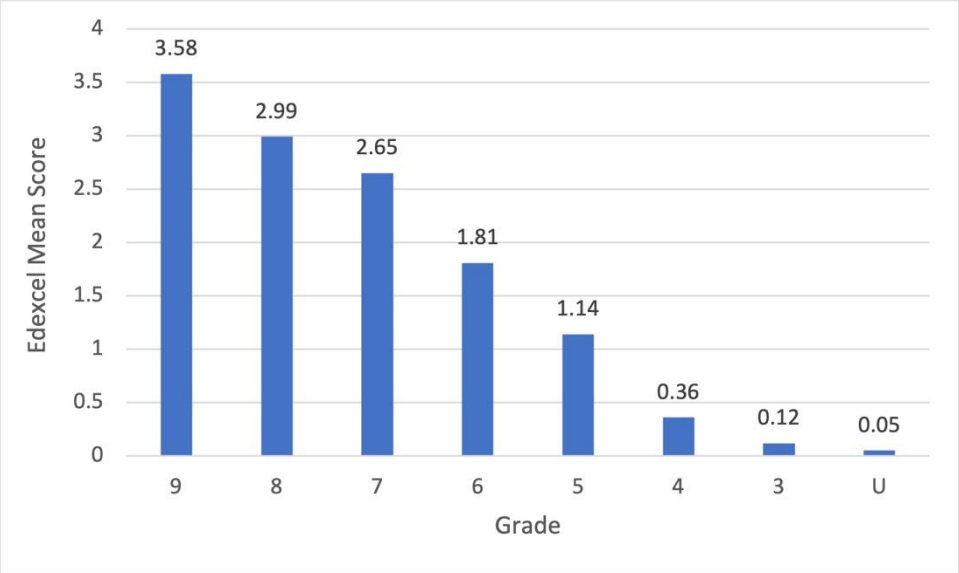
Question 4 - Examiner Comments

A good discriminator, most candidates were able to score at least 2 marks for showing how to get the total volume of 4 tanks. Only the lowest attaining candidates failed to use a correct formula for the volume of a tank. A few candidates used the diameter instead of the radius to work out the volume, in effect working out the value of $\pi d^2 h$ or sometimes πdh instead of $\pi r^2 h$. Some candidates who left their volumes as a multiple of π, for example 256000π, then lost the π in the next step of their working. Correct attempts to use the ratio 1 : 100 were usually restricted to answers from higher attaining candidates and many candidates used 100 where they should have used 101 in their calculations. There was a wide range of possible approaches to answering the question and

responses seen were very varied. The most common successful approach was to compare the volume of the 4 tanks with the amount of mixture that could be made with the available fertilizer.

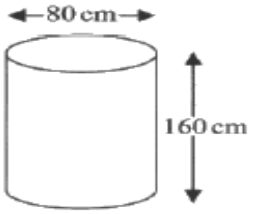
Question 4 - Performance

Mean score	Max score	Mean %	Edexcel averages: mean scored by candidates achieving grade:								
			ALL	9	8	7	6	5	4	3	U
1.10	4	28	1.10	3.58	2.99	2.65	1.81	1.14	0.36	0.12	0.05



Question 4 - Response A

4 Karina has 4 tanks on her tractor.
Each tank is a cylinder with diameter 80 cm and height 160 cm.



The 4 tanks are to be filled completely with a mixture of fertiliser and water.

The fertiliser has to be mixed with water in the ratio 1 : 100 by volume.
Karina has 32 litres of fertiliser.

1 litre = 1000 cm^3

Has Karina enough fertiliser for the 4 tanks?
You must show how you get your answer.

Volume of tank = $\pi r^2 \times h$

$= \pi (\frac{80}{2})^2 \times 160$

$= 804248 cm^3$ ~~or 2560000 π cm^3~~.

$\approx$ ~~8~~ 804000 cm^3 (3 sig. fig.)

Ratio water : fertiliser
100 : 1

3200000 : 32000 ⇆ Total = 3232000

Total volume of tank = 804000 × 4

$= 3216000 cm^3$

∴ Total volume of water and fertiliser > total volume of 4 tanks

∴ Yes, Karina has enough fertiliser.

(Total for Question 4 is 4 marks)

4 /4

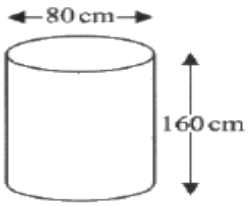
Q4

A
B
C

P1 for a correct process to find the volume of 1 tank (line 2)..
P1 for a correct process to find the volume of 4 tanks (line 8), 804000 × 4.
P1 for a correct process to use the ratio to find the amount of mixture available. Evidence for the award of this mark is the correct value, 3232000 (line 7).
C1 for a correct decision, yes, supported by correct comparable values, 3216000 and 3232000

Question 4 - Response B

4 Karina has 4 tanks on her tractor.
Each tank is a cylinder with diameter 80 cm and height 160 cm.



The 4 tanks are to be filled completely with a mixture of fertiliser and water.

The fertiliser has to be mixed with water in the ratio 1 : 100 by volume.
Karina has 32 litres of fertiliser.

1 litre = 1000 cm³

Has Karina enough fertiliser for the 4 tanks?
You must show how you get your answer.

Volume of a tank = $\pi r^2 h$
= $\pi \times 40^2 \times 160$
= 804247.72^{193} (2 dp) cm^3

Volume of 4 tanks in ℓ = $\frac{804247.27193 \times 4}{1000}$ ℓ
= $\frac{3216990.877}{1000}$ ℓ
= 3216.99 ℓ

∴ Amount of fertilizer she needs = $\frac{3216.99}{100}$
= 32.1699 ℓ

32.1699 > 32

∴ Karina doesn't hasve enough fertilizer.

(Total for Question 4 is 4 marks)

2 /4

Q4

A
B
C

P1 for a correct process for working out the volume of one tank. This can also be awarded for the correct value, 804247.7193 seen.

P1 for a process to find the volume of 4 tanks or for 3216990.877

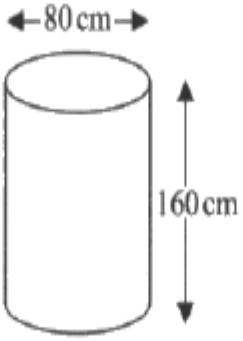
P0 The candidate has correctly converted to litres. However, they have divided by 100 when it should have been by 101 so the third mark cannot be given.

C0 The incorrect division by 100 has led to an incorrect figure which in turn has led to an incorrect conclusion

Question 4 - Response C

4 Karina has 4 tanks on her tractor.
Each tank is a cylinder with diameter 80 cm and height 160 cm.

4 cylinders
each one →



The 4 tanks are to be filled completely with a mixture of fertiliser and water.

The fertiliser has to be mixed with water in the ratio 1 : 100 by volume.
Karina has 32 litres of fertiliser.

1 litre = 1000 cm³

Has Karina enough fertiliser for the 4 tanks?
You must show how you get your answer.

32 L x 1000cm³ = 32000cm³

1:100

Q4

A
B
C

0 /4

P0 There is no attempt to find the volume of the tank made
P0 There is no attempt to find the volume of 4 tanks or to find the volume (in cm³) of fertiliser available for one tank. Though the candidate has done part of this calculation, 32 x 1000, they have not divided by 4.
P0C0 No further progress is made.

Question 6

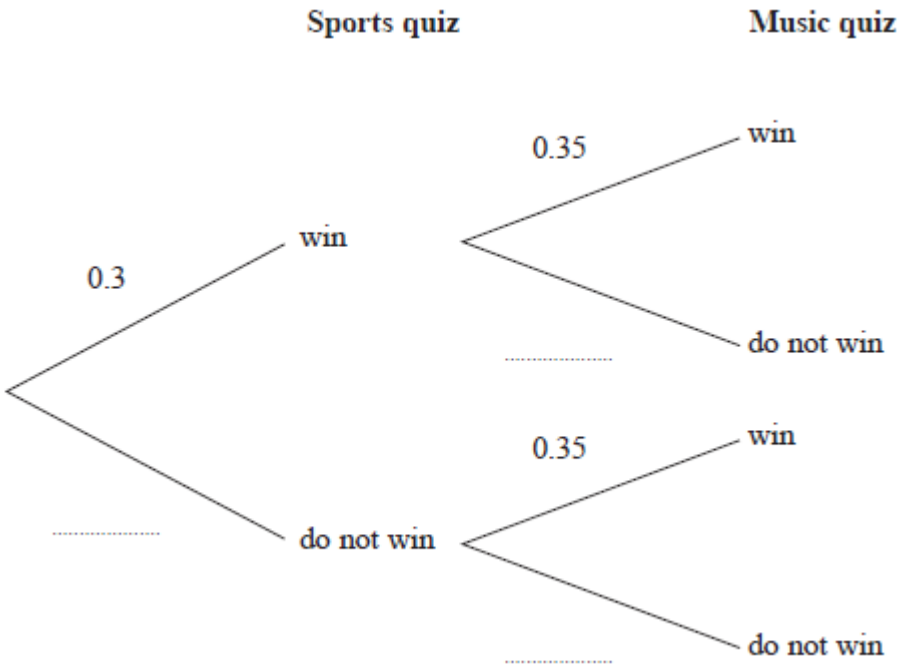
Question | Mark Scheme | Examiner Comments | Performance | Response A | Response B | Response C

Question 6 - Question

6 One weekend the Keddie family is going to do a sports quiz and a music quiz.

The probability that the family will win the sports quiz is 0.3
The probability that the family will win the music quiz is 0.35

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that the Keddie family will win both the sports quiz and the music quiz.

.....

(2)

(Total for Question 6 is 4 marks)

Question 6 - Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
6 (a)	0.7	B1	for 0.7 on the first branch	Accept equivalent fractions or percentages for probabilities
	0.65, 0.65	B1	for 0.65, 0.65 on the second branches	
(b)	0.105	M1	for 0.3 × 0.35	
		A1	oe	

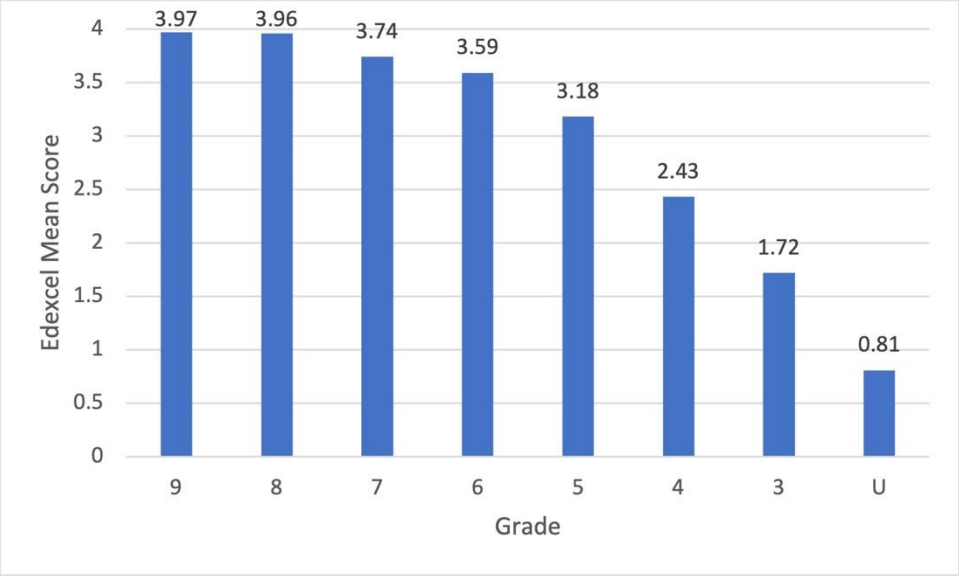
Question 6 - Examiner Comments

In part (a), the great majority of candidates were able to complete the probability tree diagram successfully to score 2 marks. Some candidates gave 2 different probabilities for the probability of a candidate not winning the music quiz when both should have had the same value, 0.65.

Part (b) was also answered well and a majority of candidates scored 2 marks for a fully correct answer. The most common error seen was the addition rather than multiplication of 0.3 and 0.35. Some candidates gave more than one combined outcome and, as a consequence, could not be awarded any marks for this part of the question.

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
2.79	4	70	2.79	3.97	3.96	3.74	3.59	3.18	2.43	1.72	0.81

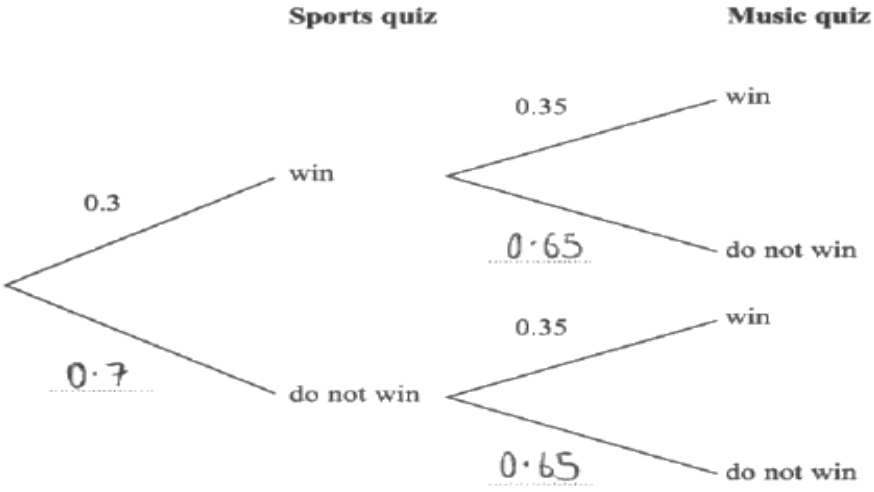


Question 6 - Response A

6 One weekend the Keddie family is going to do a sports quiz and a music quiz.

The probability that the family will win the sports quiz is 0.3
The probability that the family will win the music quiz is 0.35

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that the Keddie family will win both the sports quiz and the music quiz.

win = SQ $\frac{3}{10}$ $\rightarrow$ $\frac{6}{20}$ × mQ $\frac{7}{20}$

$= \frac{21}{200} = 0.105$

21/200

(2)

4 /4

(a)
B1 for 0.7 on the first branch
B1 for 0.65, 0.65 on the second branches

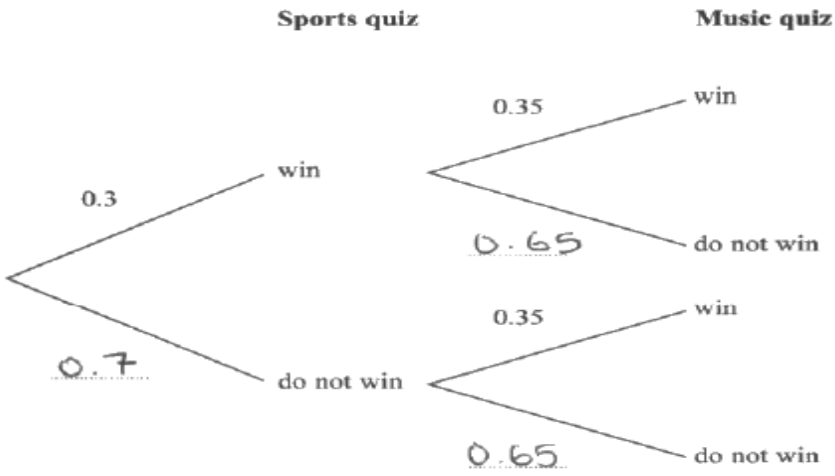
(b)
M1 the candidate has multiplied the correct probabilities (in fraction form).
A1 for 21/200 on the answer line or 0.105 in the working space
Note: the final answer may be given as an equivalent fraction or percentage.

Question 6 - Response B

6 One weekend the Keddie family is going to do a sports quiz and a music quiz.

The probability that the family will win the sports quiz is 0.3
The probability that the family will win the music quiz is 0.35

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that the Keddie family will win both the sports quiz and the music quiz.

0.35 × 0.3 = 0.65 × 100 = 65%.

65%.

(2)

(Total for Question 6 is 4 marks)

2 /4

(a)
B1 for 0.7 on the first branch
B1 for 0.65, 0.65 on the second branches

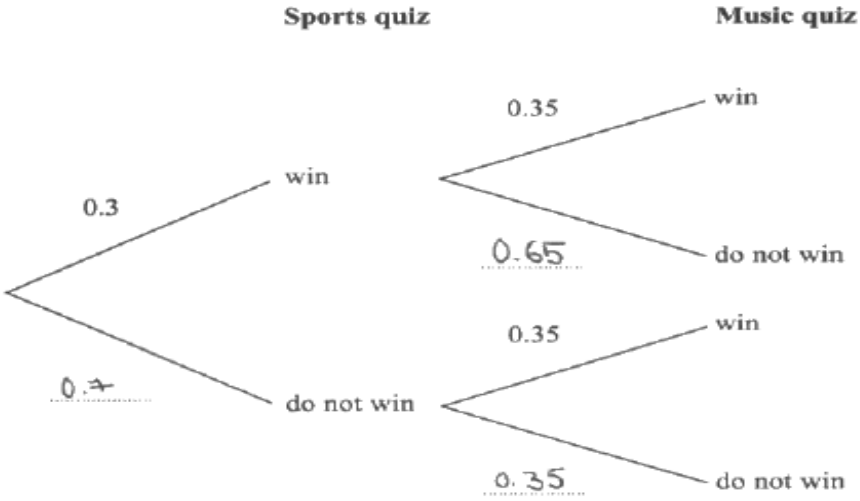
(b)
M0 The candidate has added rather than multiplied the relevant two probabilities
A0 for an incorrect answer

Question 6 - Response C

6 One weekend the Keddie family is going to do a sports quiz and a music quiz.

The probability that the family will win the sports quiz is 0.3
The probability that the family will win the music quiz is 0.35

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that the Keddie family will win both the sports quiz and the music quiz.

3/6

(2)

(Total for Question 6 is 4 marks)

Q6

A B C

1 /4

(a)
B1 for 0.7 on the first branch
B0 only one correct value on the second branches

(b)
M0A0 The answer is incorrect and there is no method shown.

Question 8

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

Question 8 - Question

8 There are 30 women and 20 men at a gym.

The mean height of all 50 people is 167.6 cm
The mean height of the 20 men is 182 cm

Work out the mean height of the 30 women.

..... cm

(Total for Question 8 is 3 marks)

Question 8 - Mark Scheme

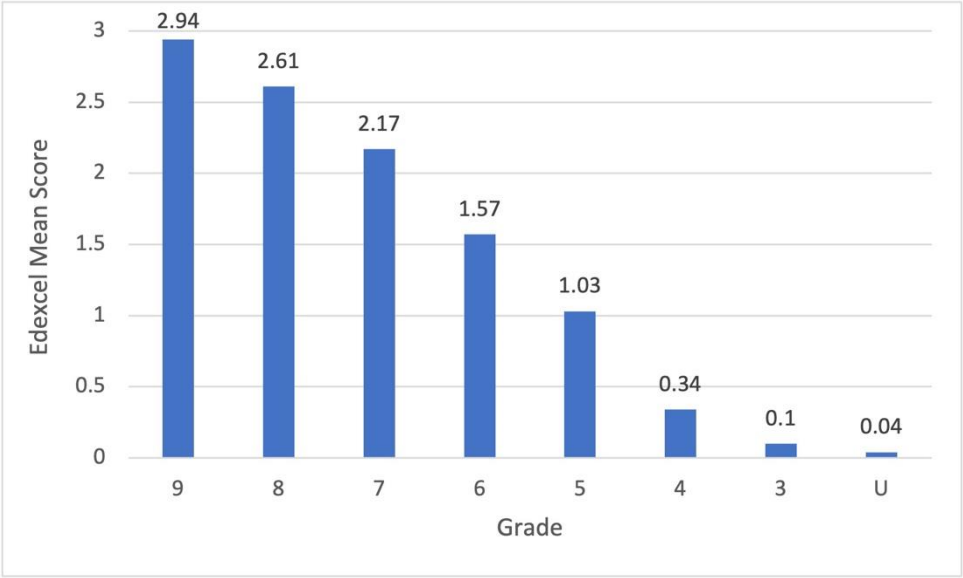
Question	Answer	Mark	Mark scheme	Additional guidance
8	158	P1	for a first step in the process eg 50 × 167.6 (= 8380) or 20 × 182 (= 3640)	8
		P1	for a complete process eg (50 × 167.6 – 20 × 182) ÷ 30 or $\frac{8380 - 3640}{30}$ or 4740 ÷ 30	
		A1	cao	

Question 8 - Examiner Comments

Many candidates found this question to be straightforward and they scored all 3 marks. There were, however, a considerable proportion of candidates who could not be awarded any credit for their answers. Many of these candidates took the mean of all 50 people to be the mean of the women's mean and men's mean and wrote down the equation $\frac{182+x}{2} = 167.6$ thereby assuming there were equal numbers of men and women. Some other candidates tried to work with the difference between 182 and 167.6. This was invariably unsuccessful. Candidates who did gain some but not all of the marks available usually worked out the total of the weights for the 20 men and/or for all 50 people but got no further.

Question 8 - 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	3	32	0.96	2.94	2.61	2.17	1.57	1.03	0.34	0.10	0.04



Question 8 - Response A

8 There are 30 women and 20 men at a gym.

The mean height of all 50 people is 167.6 cm
The mean height of the 20 men is 182 cm

Work out the mean height of the 30 women.

30w 20m

men combined height = 182 × 20 = 3640 cm

all women combined height = 50 × 167.6 = 8380 cm

8380 − 3640 = 4740 cm (combined for all women)

$\frac{4740}{30 \text{ (women)}} = 158$ cm

158 cm

(Total for Question 8 is 3 marks)

3 /3

Q8

A
B
C

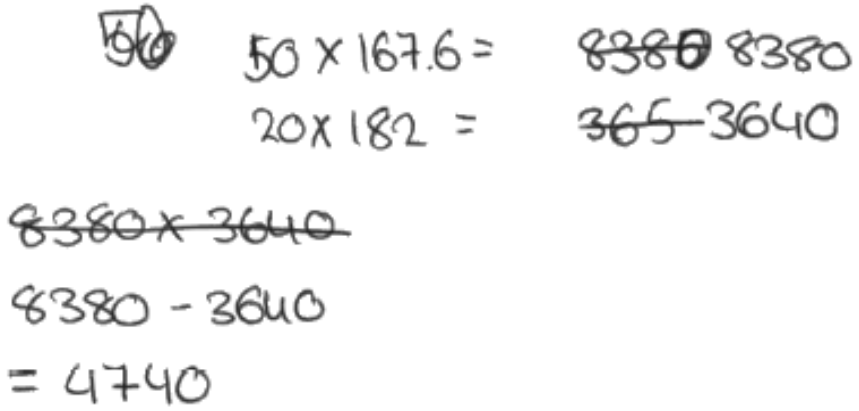
P1P1A1 for a fully correct approach which is accurately executed to score full marks

Question 8 - Response B

8 There are 30 women and 20 men at a gym.

The mean height of all 50 people is 167.6 cm
The mean height of the 20 men is 182 cm

Work out the mean height of the 30 women.



4740 cm

(Total for Question 8 is 3 marks)

1 /3

Q8

A
B
C

P1 for either a process to find the total of all the weights of the 50 people, 50 x 167.6 (or 8380) or for a process to find the total of all the weights of the 20 men, 20 x 182 (or 3640)

P0 Although the 2 figures 8380 and 3640 are used to find the total of all the weights of the 30 women, 4740, there is no division by 30 and so no complete process to find the mean height of the women.

A0 as the answer is incorrect.

Question 8 - Response C

8 There are 30 women and 20 men at a gym.

The mean height of all 50 people is 167.6 cm
The mean height of the 20 men is 182 cm

Work out the mean height of the 30 women.

men = 182 cm

$$167.6 = \frac{\text{Women's} + 182}{2}$$

..... cm

(Total for Question 8 is 3 marks)

0 /3

Q8

A
B
C

P0 This response shows a frequently seen incorrect approach which inherently assumes there are the same number of men as women. Only in such a case would the mean of all people be equal to the mean of the men's mean and the women's mean.

P0A0 as there is no further working and no answer given.

Question 15

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

Question 15 - Question

15 A pet shop has

7 guppy fish
13 tetra fish
5 angel fish.

David is going to choose one of the following combinations of fish

a guppy fish and an angel fish
or a tetra fish and an angel fish
or a guppy fish, a tetra fish and an angel fish.

Show that there are 555 different ways for David to choose his fish.

(Total for Question 15 is 2 marks)

Question 15 - Mark Scheme

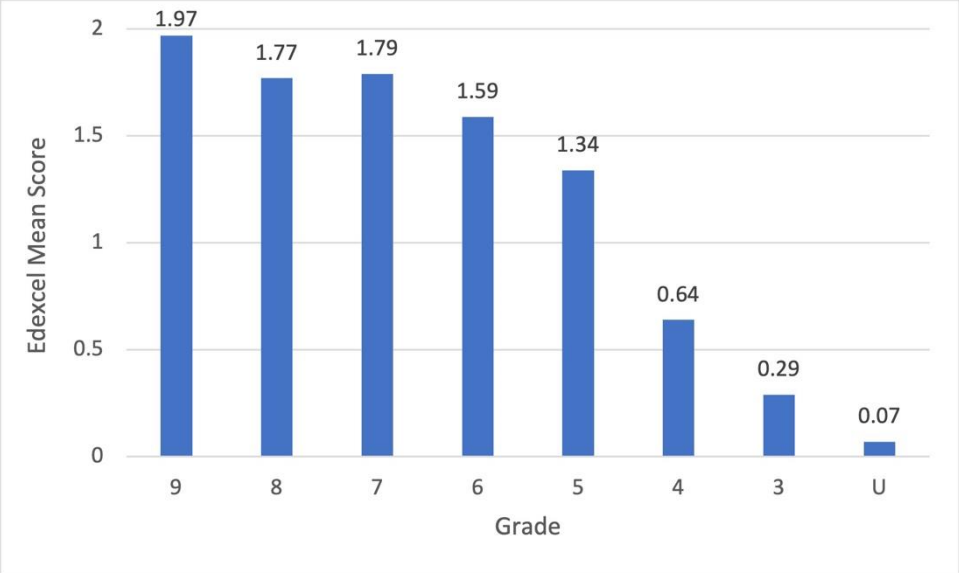
Question	Answer	Mark	Mark scheme	Additional guidance
15	Shown	M1	for one correct product eg 7 × 5 (= 35) or 13 × 5 (= 65) or 7 × 13 × 5 (= 455)	Ignore additional products
		C1	for showing three correct products added eg 35 + 65 + 45	There is no need to show the three products sum to 555

Question 15 - Examiner Comments

Most candidates scored full marks for their answers to this question. The most common error seen was where candidates used 7, 13 and 5 in a sum, for example as 7 + 13 + 5, rather than in correct products. Candidates who gained one of the two marks usually did so for giving the correct product leading to 455 but could not complete the question successfully. Some candidates tried unsuccessfully to work backwards from the 555.

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
1.04	2	52	1.04	1.97	1.77	1.79	1.59	1.34	0.64	0.29	0.07



Question 15 - Response A

15 A pet shop has

7 guppy fish
13 tetra fish
5 angel fish.

David is going to choose one of the following combinations of fish

a guppy fish and an angel fish
or a tetra fish and an angel fish
or a guppy fish, a tetra fish and an angel fish.

Show that there are 555 different ways for David to choose his fish.

$7 \times 5 = 35$

$13 \times 5 = 195$

$7 \times 13 \times 5 = 455$

35 or 195 or 455

(Total for Question 15 is 2 marks)

1 /2

M1 for one correct product, 7 x 5 or 13 x 5 or 7 x 13 x 5
C0 One of the products has been evaluated incorrectly so even if the candidate added here they would not show the answer to be 555 and so cannot score the second mark.

Note: that if the products were all correct and the student showed that they need to be added, they would get full marks whether or not the candidate re-states the 555.

Question 15 - Response B

15 A pet shop has

7 guppy fish
13 tetra fish
5 angel fish.

David is going to choose one of the following combinations of fish

a guppy fish and an angel fish
or a tetra fish and an angel fish
or a guppy fish, a tetra fish and an angel fish.

Show that there are 555 different ways for David to choose his fish.

7 + 13 = 20
13 + 5 = 18
7 + 13 + 5 = 25

(Total for Question 15 is 2 marks)

0 /2

Q15

A
B

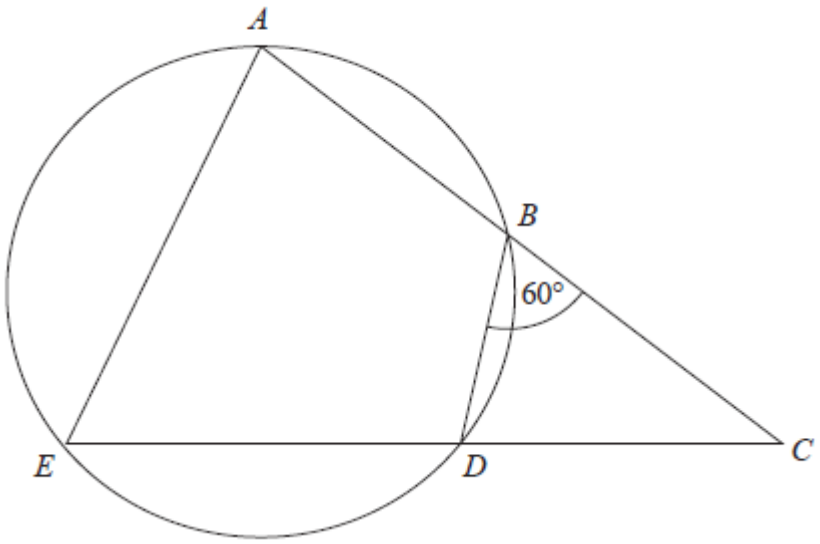
M0C0 No correct product is seen. The candidate mistakenly adds instead of multiplying.

Question 16

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

Question 16 - Question

16



ABDE is a cyclic quadrilateral.
ABC and *EDC* are straight lines.
Angle *DBC* = 60°

Given that

size of angle *EAB* : size of angle *BCD* = 2 : 1

work out the size of angle *BCD*.
You must show all your working.

.....°

(Total for Question 16 is 4 marks)

Question 16 - Mark Scheme

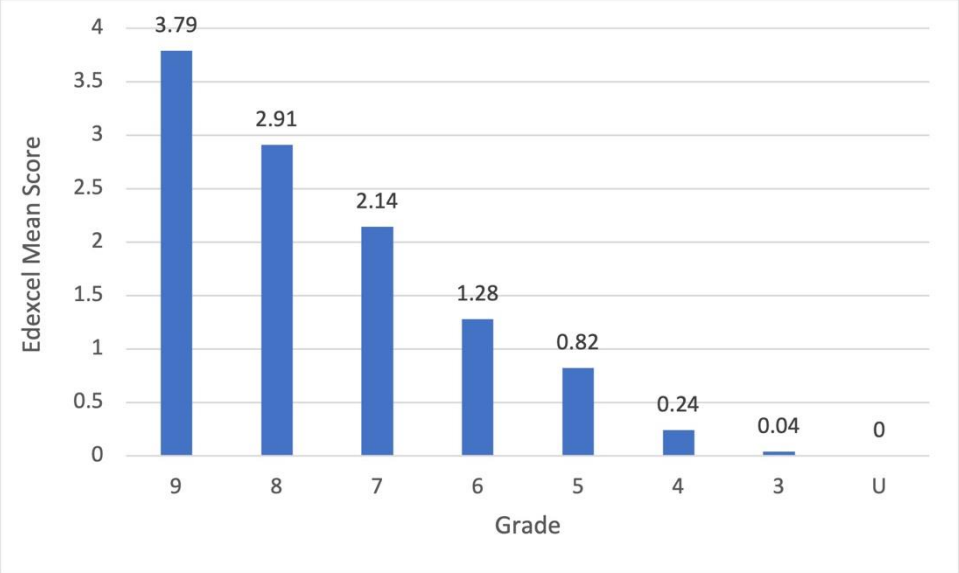
Question	Answer	Mark	Mark scheme	Additional guidance
16	40	M1	for $ABD = 120$ and $AED = 60$ **or** for using the properties of a cyclic quadrilateral eg $EAB + BDE = 180$	Angles may be shown on the diagram
		M1	for using the ratio of 2 : 1 eg showing sizes of angles such that $EAB : BCD = 2 : 1$	May be expressed using algebra eg $EAB = 2x$ and $BCD = x$
		M1	(dep on M1) for linking an angle from the cyclic quadrilateral with angle(s) in the triangle (other than $EAB : BCD = 2 : 1$) eg $BDE = BCD + 60$ or $BDE = 180 - BDC$ or $EAB + BCD + AEC = 180$	Could be expressed using algebra eg $x + 60 = 180 - 2x$
		A1	for $BCD = 40$ from correct working	

Question 16 - Examiner Comments

The majority of candidates achieved some credit for their answers to this question by showing they could interpret the ratio given or by showing they understood that opposite angles in a cyclic quadrilateral sum to 180°. Many candidates showed they understood the ratio by marking the angles EAC and ACE as $2x$ and x respectively on the diagram. Examiners also accepted values for the size of these two angles, in the given ratio, to award this mark. Similarly, values for the opposite angles in quadrilateral $ABDE$ which added to 180 were accepted as evidence for the use of the result that opposite angles of a cyclic quadrilateral add up to 180. A relatively small proportion of candidates could find a further connection between the angles in the quadrilateral and the angles in the triangle and so score more than 2 marks. Despite the guidance that all working needed to be shown, a number of candidates wrote down 40 as their answer but with a lack of supportive and persuasive working. These candidates could not be given full credit. In particular, examiners were concerned to see some candidates using results incorrectly, for example “angles on a straight line sum to 180°” to state that angles EAB and DBC sum to 180 or that angles ABD and BDC were alternate angles.

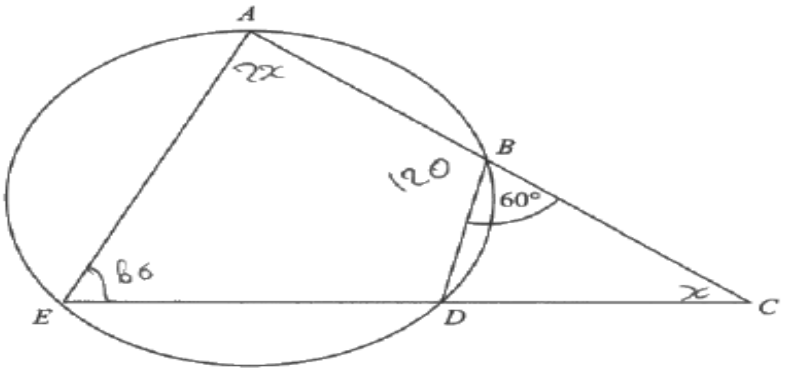
Question 16 - Performance

Mean score	Max score	Mean %	Edexcel averages: mean scored by candidates achieving grade:								
			ALL	9	8	7	6	5	4	3	U
0.85	4	21	0.85	3.79	2.91	2.14	1.28	0.82	0.24	0.04	0.00



Question 16 - Response A

16



ABDE is a cyclic quadrilateral.
ABC and *EDC* are straight lines.
Angle *DBC* = 60°

Given that

size of angle *EAB* : size of angle *BCD* = 2 : 1

work out the size of angle *BCD*.
You must show all your working.

ABD = 120 angles on a straight line add up to 180°
AED = 60° angles in cyclic quadrilateral that are opposite add up to 180

180 − 60 = 120

60 + 2x + x = 180

2x + x = 120

2x = 80

x = 40

BCD = 40

40 °

(Total for Question 16 is 4 marks)

Q16

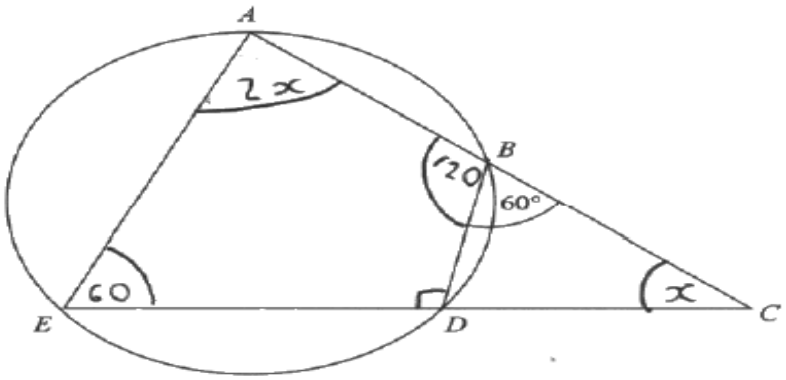
4 /4

M1 for ABD =120 and AED = 60
M1 for the use of the ratio 2:1 shown by the 2x and x marked on the diagram.
M1 for the 60 + 2x + x = 180 which links angle(s) in the cyclic quadrilateral with angle(s) in the triangle by using the sum of angles in the triangle ACE..
A1 for a correct answer from correct working

It should be noted that a student may get the answer 40 from an incorrect method. The answer 40 without correct supportive working scores 0 marks.

Question 16 - Response B

16



ABDE is a cyclic quadrilateral.
ABC and *EDC* are straight lines.
Angle *DBC* = 60°

Given that

size of angle *EAB* : size of angle *BCD* = 2 : 1

work out the size of angle *BCD*.
You must show all your working.

Angle ABD = 120° because angles on a straight line add to 180°.

Angle AED = 60° because opposite angles add to 180°.

Angle EAD = 90° because angles in a quadrilateral sum to 360°

Angle x = 45°
because 2x = 90
so x = 45

45 °

(Total for Question 16 is 4 marks)

Q16

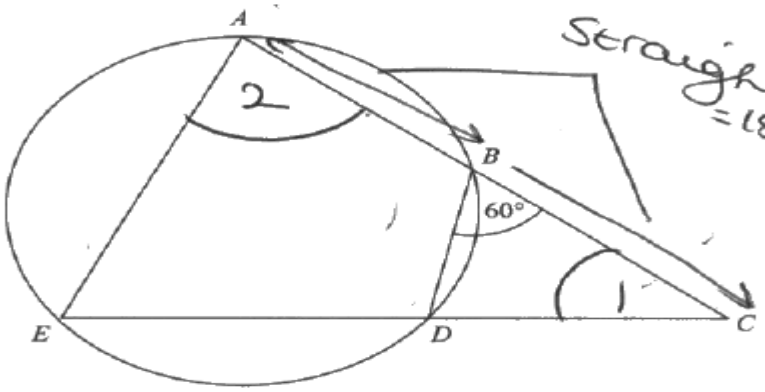
A
B
C

2 /4

M1 for giving the values ABD = 120 and AED = 60
M1 for using the ratio 2:1 shown by the 2x and x in the diagram. Note that this mark is also awarded if the student has marked in numerical values for the sizes of angles EAB and BCD which are in the ratio 2 : 1, eg 90 and 45.
M0 No link is shown between angles in the cyclic quadrilateral and angles in the triangle BCD other than those in the ratio 2 : 1 which have already been rewarded.
A0 for an incorrect answer

Question 16 - Response C

16



ABDE is a cyclic quadrilateral.
ABC and *EDC* are straight lines.
Angle *DBC* = 60°

Given that

size of angle *EAB* : size of angle *BCD* = 2 : 1

work out the size of angle *BCD*.
You must show all your working.

Straight lines = 180°

180 − 60 = 120

120 / 3 = 40

40 × 2 = 80

4 × 1 = 40

Cyclic quad = 360

angle EAB = 2 : 1 → BCD

angles on a straight line = 180°

180 − 60 = 120

120 / 3 = 40

40 × 2 = 80

EAB = 80°

40 × 1 = 40 → BCD = 40°

40°

(Total for Question 16 is 4 marks)

0 /4

M0 The student has not used the property that opposite angles of a cyclic quadrilateral add to 180.
M0 Marking 2 and 1 on the diagram is not enough as evidence that the ratio has been used.
M0 This mark is dependent on a previous M1 so cannot be awarded.
A0 Although the answer is given as 40, a senior examiner made the professional judgement that there was not enough correct working to support the answer and a mark of 0 was awarded.

Q16
A
B
C

Question 19

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

Question 19 - Question

19 There are only blue counters, red counters and green counters in a box.

The probability that a counter taken at random from the box will be blue is 0.4
The ratio of the number of red counters to the number of green counters is 7 : 8

Sameena takes at random a counter from the box.
She records its colour and puts the counter back in the box.
Sameena does this a total of 50 times.

Work out an estimate for the number of times she takes a green counter.

(Total for Question 19 is 3 marks)

Question 19 - Mark Scheme

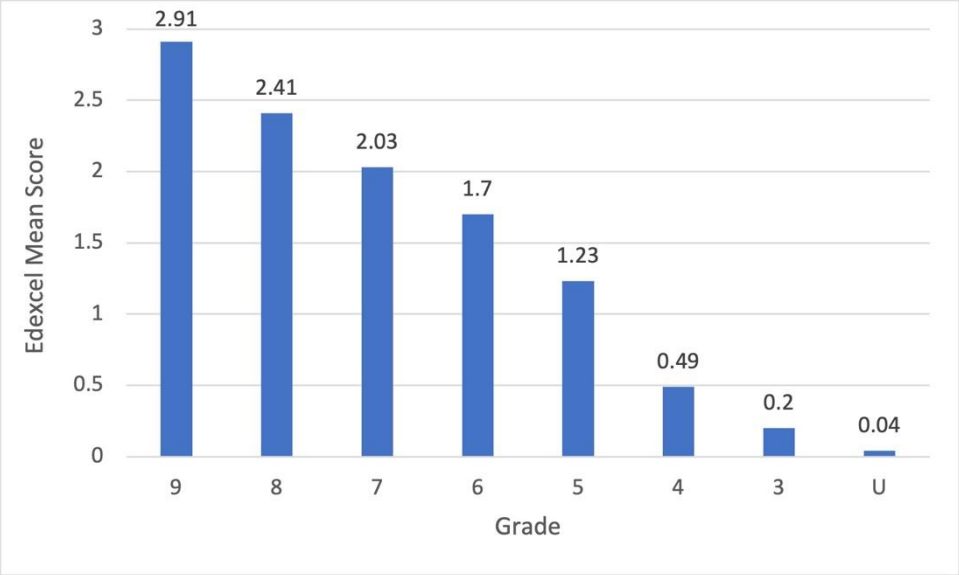
Question	Answer	Mark	Mark scheme	Additional guidance
19	16	P1	for Prob(R or G) = 1 – 0.4 (= 0.6) or for (number of red or green counters) = 50 – 0.4 × 50 (= 30) or for use of ratio, eg [probability] × $\frac{8}{15}$ (= 0.32) or [number of counters] × $\frac{8}{15}$	[probability] may be 0.4 or 0.6 [number of counters] may be 20 or 50
		P1	for a complete process to find number of green counters, eg (1 – 0.4) × $\frac{8}{15}$ × 50 or for $\frac{16}{50}$	
		A1	cao	

Question 19 - Examiner Comments

A small proportion of lower attaining candidates merely added the three numbers 0.4, 7 and 8 given in the question and tried to work with this. In general, however, the question was quite well answered. When it was not completed successfully, examiners could usually award some credit to a candidate for showing a correct process to find the probability that a counter was red or green, (1 − 0.4 or 0.6). Many candidates went on to find the correct probability for picking a green counter (0.32), thus showing an understanding of how to apply the ratio, but were then unable to make the final link to multiply this by the number of trials (50).

Question 19 - 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	3	35	1.05	2.91	2.41	2.03	1.70	1.23	0.49	0.20	0.04



Question 19 - Response A

19 There are only blue counters, red counters and green counters in a box.

The probability that a counter taken at random from the box will be blue is 0.4
The ratio of the number of red counters to the number of green counters is 7 : 8

Sameena takes at random a counter from the box.
She records its colour and puts the counter back in the box.
Sameena does this a total of 50 times.

Work out an estimate for the number of times she takes a green counter.

P(red or green) = 1 − 0.4

= 0.6

P(green) = $\frac{0.6}{7+8}$ × 8

= 0.32

Estimated number of times she takes a green counter

= 50 × 0.32

= 16 //

16

(Total for Question 19 is 3 marks)

3 /3

Q19

A
B
C

P1 for probability of red or green = 1 - 0.4 (line one) or for [probability] × $\frac{8}{15}$ seen (line 3).

P1 for a complete process to find the number of green counters, 50 × 0.32.
A1 for a correct answer

Question 19 - Response B

19 There are only blue counters, red counters and green counters in a box.

The probability that a counter taken at random from the box will be blue is 0.4
The ratio of the number of red counters to the number of green counters is 7 : 8

Sameena takes at random a counter from the box.
She records its colour and puts the counter back in the box.
Sameena does this a total of 50 times.

Work out an estimate for the number of times she takes a green counter.

R + G = 0.6

7+8 = 15

0.6 ÷ 15 = 0.04

0.04 × 8 = 0.32

0.32

(Total for Question 19 is 3 marks)

1 /3

Q19

A
B
C

P1 for 0.6 seen
P0 There is no complete process to find the number of green counters. The student has worked out the probability, 0.32, but has not used this to estimate the frequency of this outcome in 50 trials.
A0 for an incorrect answer

Question 19 - Response C

19 There are only blue counters, red counters and green counters in a box.

The probability that a counter taken at random from the box will be blue is 0.4
The ratio of the number of red counters to the number of green counters is 7 : 8

Sameena takes at random a counter from the box.
She records its colour and puts the counter back in the box.
Sameena does this a total of 50 times.

Work out an estimate for the number of times she takes a green counter.

B : R : G
0.4 : 7 : 8

0.4 + 7 + 8 = 15.4

15.4 ÷ 50 = 3.25

3.25 × 8 = 26

~~G = 26~~

G = 26

26

(Total for Question 19 is 3 marks)

0 /3

Q19

P0 for an incorrect first step, adding 0.4, 7 and 8 with no further evidence of a correct process.
P0 for no complete process to find the number of green counters.
A0 for an incorrect answer.

Question 21

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

Question 21 - Question

21 The equation of a curve is $y = 4x^2 - 56x$
The curve has one turning point.

By completing the square, show that the coordinates of the turning point are $(7, -196)$
You must show all your working.

(Total for Question 21 is 3 marks)

Question 21 - Mark Scheme

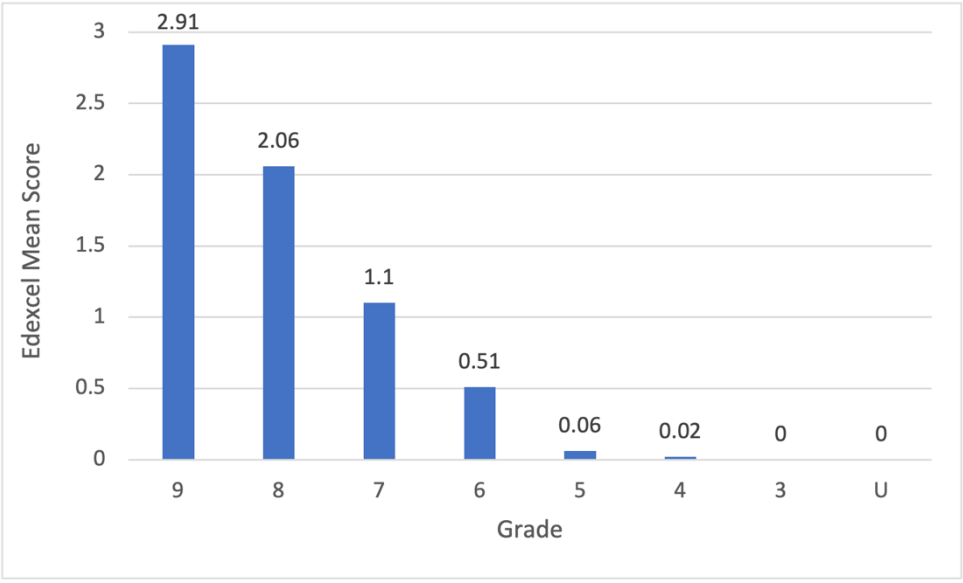
Question	Answer	Mark	Mark scheme	Additional guidance
21	$(7, -196)$ supported	P1	for process as far as $4(x^2 - 14x)$ or $(2x - 14)^2 + c$ or for $(x - 7)^2 - 49$	c may be 0
		P1	for full process to complete the square eg $4((x - 7)^2 - 49)$ or $(2x - 14)^2 - 196$	
		A1	for conclusion from correct use of completing the square	

Question 21 - Examiner Comments

Some candidates gave a very clear, correct and concise answer to this question by first completing the square in the form $4((x-7)^2-49)$ before giving an explanation how this leads to the given result. Examiners expected candidates to show the connection between $4((x-7)^2-49)$ and -196 as well as make a conclusion to gain the last mark. Only a very small proportion of candidates used the alternative form $(2x-14)^2-196$. Many candidates showed a lack of confidence in the process of completing the square and as a result were unable to gain marks because their algebra was full of errors.

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
0.35	3	12	0.35	2.91	2.06	1.10	0.51	0.06	0.02	0.00	0.00



Question 21 - Response A

21 The equation of a curve is $y = 4x^2 - 56x$
The curve has one turning point.

By completing the square, show that the coordinates of the turning point are $(7, -196)$
You must show all your working.

$y = 4x^2 - 56x$

$= 4(x^2 - 14x)$

$= 4(x^2 - 14x + 49) - 49 \times 4$

$= 4(x - 7)^2 - 196$

∴ The coordinates of the turning point are $(7, -196)$.

(Total for Question 21 is 3 marks)

3 /3

Q21

A
B
C

P1 for a correct start, $4(x^2 - 14x)$.
P1 for a full process to complete the square, line 3.
A1 for a correct conclusion supported by the correct expression $4(x - 7)^2 - 196$ obtained from correct working.

Question 21- Response B

21 The equation of a curve is $y = 4x^2 - 56x$
The curve has one turning point.

By completing the square, show that the coordinates of the turning point are $(7, -196)$
You must show all your working.

$y = 4x^2 - 56x = 4(x^2 - 14x)$

$y = 4[(x)^2 - 2x.7 + 7^2 - 49]$

$y = 4[x^2 - 7)^2 - 196$

we have $y = 0$

$\Rightarrow 4(x - 7)^2 - 196 = 0$

$4(x - 7)^2 = 196$

$(x - 7)^2 = 49$

$x - 7 = \pm 7$

$\Rightarrow \begin{cases} x = 0 \end{cases}$

(Total for Question 21 is 3 marks)

2 /3

Q21

A
B
C

P1 for $4(x^2 - 14x)$
P1 for a full process to complete the square (line 3).
A0 The candidate has not concluded that (7, -196) is the turning point

Question 21 - Response C

21 The equation of a curve is $y = 4x^2 - 56x$
The curve has one turning point.

By completing the square, show that the coordinates of the turning point are $(7, -196)$
You must show all your working.

$4(x^2 - 14)$

$= 4((x+7)^2$

$= 4((x+7)^2 + 196)$

∴ coordinates are $(7, -196)$

(Total for Question 21 is 3 marks)

0 /3

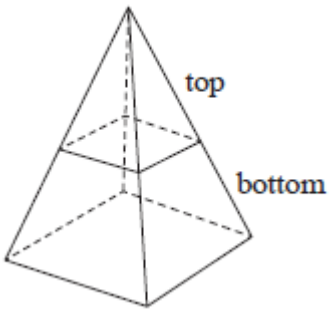
P0 The attempt to factorise out the 4 is incorrect. We will not accept misreads in this question.
P0 The completed square form is incorrect
A0 The coordinates are given but this is not supported by the working shown.

Question 25

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

Question 25 - Question

25 The pyramid **P** is formed from two parts made of different materials.



The top part of **P** has a mass of 92.8 g and is made from material with a density of 2.9 g/cm^3
The bottom part of **P** has a mass of 972.8 g
The average density of **P** is 4.7 g/cm^3

Calculate the volume of the top part of **P** as a percentage of the total volume of **P**.
Give your answer correct to 1 decimal place.
You must show all your working.

.....%

(Total for Question 25 is 5 marks)

Question 25 - Mark Scheme

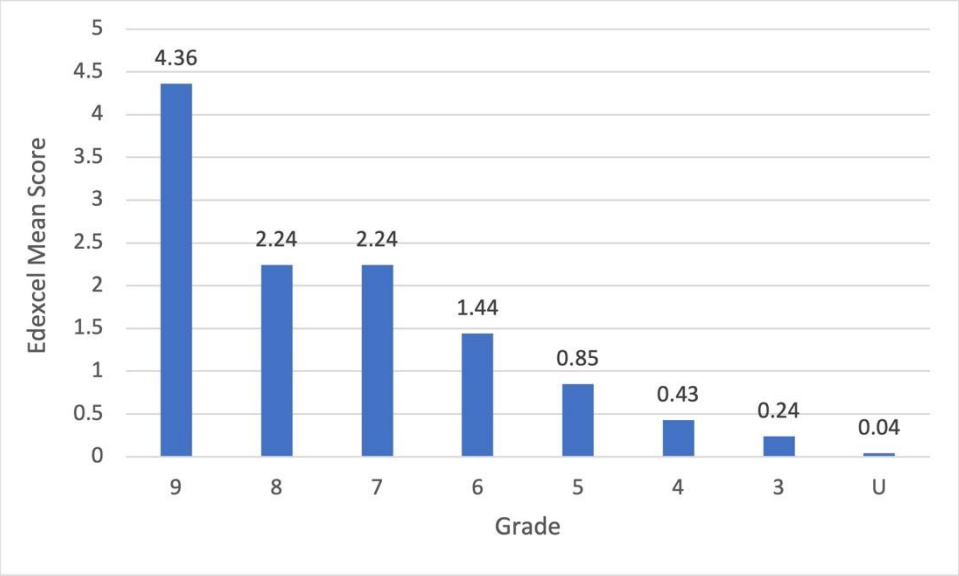
Question	Answer	Mark	Mark scheme	Additional guidance
25	14.1	P1	for a process to find the volume of the top eg 92.8 ÷ 2.9 (= 32)	Values can be truncated or rounded
		P1	for finding total mass of P eg 92.8 + 972.8 (= 1065.6)	
		P1	for finding total volume of P eg $\frac{"1065.6"}{4.7}$ (= 226.7234)	
		P1	(dep P2) for $\frac{"32"}{[\text{total volume}]} \times 100$	For this mark, [total volume] does not have to come from a correct process but is the value that the student believes is the total volume of the pyramid.
		A1	for answer in the range 14.1 to 14.2	

Question 25 - Examiner Comments

Many candidates could make a successful start on the question by using a correct process to find the volume of the top part of the pyramid and so scored the first mark available. This was often the limit to any credit which examiners could give candidates. A common mistake was for candidates to use the average density in a misguided attempt to work out the volume of the bottom part of the pyramid. This was, by design, a challenging question and so, as expected there were only a small number of completely successful solutions seen.

Question 25 - Performance

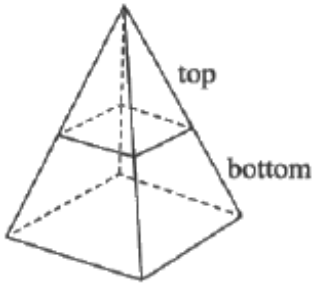
Mean score	Max score	Mean %	Edexcel averages: mean scored by candidates achieving grade:								
			ALL	9	8	7	6	5	4	3	U
0.96	5	19	0.96	4.36	2.24	2.24	1.44	0.85	0.43	0.24	0.04



Q25
A
B
C

Question 25 - Response A

25 The pyramid **P** is formed from two parts made of different materials.



The top part of **P** has a mass of 92.8 g and is made from material with a density of 2.9 g/cm^3
The bottom part of **P** has a mass of 972.8 g
The average density of **P** is 4.7 g/cm^3

Calculate the volume of the top part of **P** as a percentage of the total volume of **P**.
Give your answer correct to 1 decimal place.
You must show all your working.

$d = \frac{m}{V}$

$V = \frac{m}{d}$

Volume of top part = $\frac{\text{mass}}{\text{density}}$

$= \frac{92.8}{2.9}$

$= 32\ \text{cm}^3$ ← Set volume of bottom P be y,

average density = $\frac{\text{total mass}}{\text{total volume}}$

$4.7 = \frac{92.8+972.8}{32+y}$

$32+y = \frac{92.8+972.8}{4.7}$

$32+y = \frac{72.8+972.8}{4.7} - 32$

$y = 194.7\ \text{cm}^3$

$\frac{\text{Volume top part P}}{\text{total volume P}} \times 100\%$

$= \frac{32}{32+194.7} \times 100\%$

$= 14.1\%$

14.1 %

(Total for Question 25 is 5 marks)

Q25
A
B
C

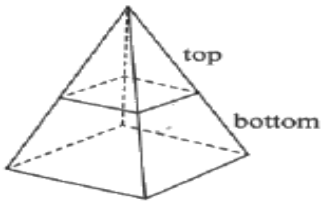
5 /5

P1P1P1P1A1 scored for a correct answer.

P1 for the process to find the volume of the top part of the pyramid, 92.8/2.9 (or 32)
P1 for the process to find the total mass of the pyramid, 92.8 + 972.8
P1 for a process to find the total volume, 32 + 194.7, seen in the denominator of the fraction in the penultimate line of working.
P1 for the expression to find the percentage in the penultimate line of the working.
A1 for a correct answer in the range 14.1 to 14.2. Note that the 1 decimal place requested in the question is for guidance only and any answer in the range is acceptable for full marks.

Question 25- Response B

25 The pyramid **P** is formed from two parts made of different materials.



The top part of **P** has a mass of 92.8 g and is made from material with a density of 2.9 g/cm³
The bottom part of **P** has a mass of 972.8 g
The average density of **P** is 4.7 g/cm³

Calculate the volume of the top part of **P** as a percentage of the total volume of **P**.
Give your answer correct to 1 decimal place.
You must show all your working.

density = mass / vol

vol of P (top) = 92.8 / 2.9 = 32 cm³

whole (P) / bottom (P) = (972.8 + 92.8) / 4.7

= 10656 / 47 cm³

10656/47 − 32 = 9152/47 cm³

(32 ÷ 9152/47) × 100

= 16.433566

= 16.4 (1 dp)

16.4 %

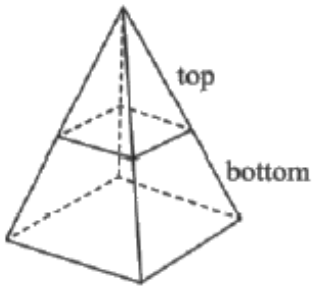
(Total for Question 25 is 5 marks)

3 /5

P1 for the process to find the volume of the top part of the pyramid, 92.8/2.9 (or 32)
P1 for the process to find the total mass, 972.8 + 92.8
P1 for a process to find the total volume, (972.8 + 92.8)/4.7 or 10656/47 which is equivalent to 1065.6/4.7
P0 as the student works out the volume of the top part as a percentage of the volume of the bottom part, not as a percentage of the whole pyramid. Examiners did not accept the volume of the top part or the volume of the bottom part as [total volume] as seen in the mark scheme.
A0 for an incorrect answer.

Question 25 - Response C

25 The pyramid **P** is formed from two parts made of different materials.



The top part of **P** has a mass of 92.8 g and is made from material with a density of 2.9 g/cm³
The bottom part of **P** has a mass of 972.8 g
The average density of **P** is 4.7 g/cm³

Calculate the volume of the top part of **P** as a percentage of the total volume of **P**.
Give your answer correct to 1 decimal place.
You must show all your working.

$m \quad D \quad V$

top part $92.8 \quad 2.9 \quad V \qquad V = \frac{2.9}{92.8} = 0.03125$

bottom part $972.8 \quad 4.7 \quad V \qquad V = \frac{4.7}{972.8} = 0.00483$

0 /5

Q25

A
B
C

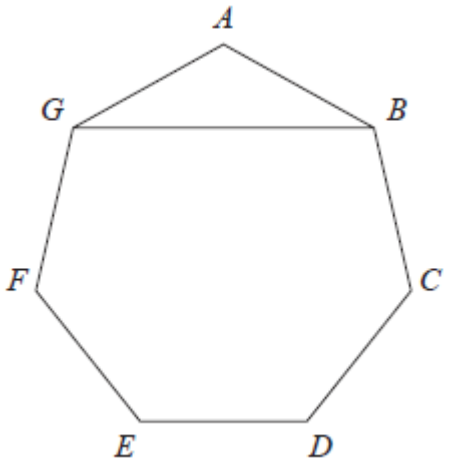
P0 for the process to find the volume of the top part of the pyramid. 2.9/92.8, not 92.8/2.9 is seen
P0 There is no process to find the total mass, 92.8 + 972.8 (or 1065.6)
P0 This mark for a process to find the total volume cannot be given as it relies on the previous process mark having been awarded, i.e. it relies on a correct process to find the total mass, 1065.6
P0 As P2 has not been scored, this mark cannot be awarded.
A0 There is no correct answer in the range 14.1 to 14.2.

Question 26

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

Question 26 - Question

26 *ABCDEFG* is a regular heptagon.



The area of triangle *ABG* is 30 cm^2

Calculate the length of *GB*.
Give your answer correct to 3 significant figures.
You must show all your working.

..... cm

(Total for Question 26 is 5 marks)

Question 26 - Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
26	15.8	P1	starts process by finding an angle, eg exterior angle = 360 ÷ 7 (= 51.42...) or interior angle = $\frac{900}{7}$ or 180 – (360 ÷ 7) (= 128.57…) oe	Accept values to 3 figures rounded or truncated
		P1	start of process to find length of side by using area, eg $\frac{1}{2} \times AB \times AG \times \sin GAB = 30$ oe or $\frac{1}{2} \times a \times b \times \sin [128.5 \ldots] = 30$ oe or $\frac{1}{2} \times x \times x \times \sin [128.5 \ldots] = 30$ oe **or** $\frac{1}{2} \times AG \times \frac{1}{2}GB \times \sin AGB = 15$ oe **or** for a relationship linking GB and h, $\frac{1}{2} \times GB \times h = 30$ oe	Any symbols used in formulae must be consistent with any labels on the diagram. For this mark, [128.5...] does not have to come from a correct process but is the value that the student believes is the interior angle.
		P1	for process to find the length of a side of the polygon eg $\sqrt{\frac{2\times30}{\sin "128.5\ldots"}}$ oe (= 8.76…) **or** for process to get a second relationship linking AG and $\frac{1}{2}GB$, eg $AG \times \cos$ "25.7..." $= \frac{1}{2}GB$ oe **or** for process to get a second relationship linking GB and h, eg tan"25.7..." $= \frac{h}{\frac{1}{2}GB}$ oe	
		P1	for complete process to find GB eg $\frac{"8.76\ldots"\times\sin"128.5\ldots"}{\sin"25.7\ldots"}$ oe or $\sqrt{"8.76"^2 + "8.76"^2 - 2 \times "8.76"^2 \times \cos "128.5\ldots"}$ oe or 2 × "8.76..." × sin "64.2..." or 2 × "8.76..." × cos "25.7..." oe or $\sqrt{\frac{2\times60}{\tan "25.7\ldots"}}$ oe	
		A1	for answer in the range 15.7 to 15.8	

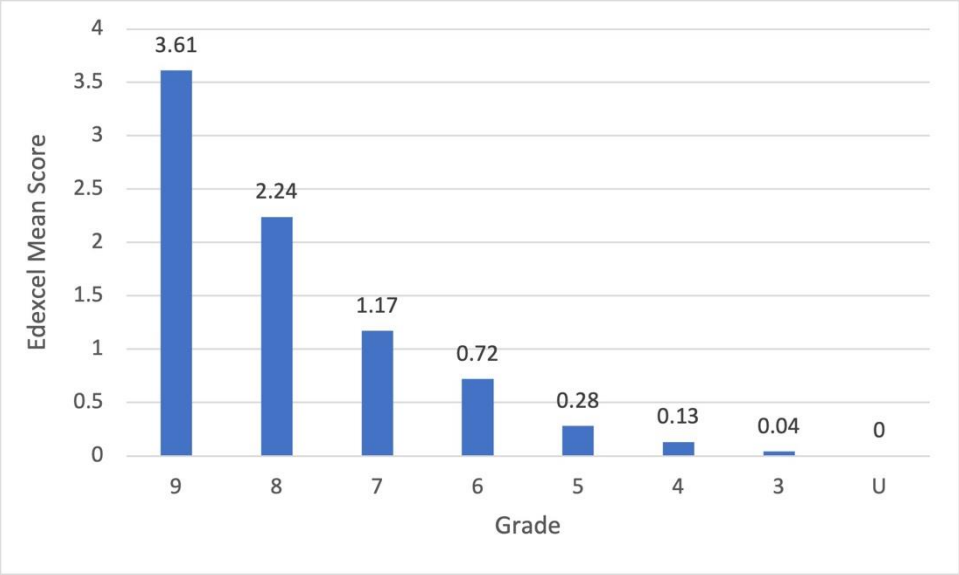
Q26
A
B
C

Question 26 - Examiner Comments

This question, not surprisingly attracted only a small proportion of fully correct answers. However, it is encouraging to report that a much higher proportion of candidates scored some credit for their attempts. Many candidates identified the need to use the angles of the heptagon and scored a mark for a correct process to find the size of each interior angle or the size of each exterior angle. A small number of candidates worked out the size of an angle but wrongly assigned it, for example marking 51.4° on the diagram as an interior angle. A good number of candidates also realised that they needed to form an equation by using the area of the triangle, given as 30 cm² in order to make progress towards finding the length of GB. Some candidates did this successfully but few candidates were able to get any further.

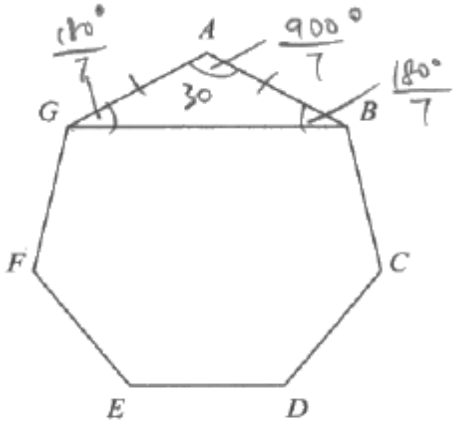
Question 26 - Performance

Mean score	Max score	Mean %	Edexcel averages: mean scored by candidates achieving grade:								
			ALL	9	8	7	6	5	4	3	U
0.49	5	10	0.49	3.61	2.24	1.17	0.72	0.28	0.13	0.04	0.00



Question 26 - Response A

26 *ABCDEFG* is a regular heptagon.



The area of triangle *ABG* is 30 cm²

Calculate the length of *GB*.
Give your answer correct to 3 significant figures.
You must show all your working.

$\angle GAB = \frac{(7-2)\times 180^\circ}{7} = \frac{5\times 180^\circ}{7} = \frac{900^\circ}{7}$

$\because GA = AB$

$\therefore \angle AGB = \angle ABG = (180^\circ - \frac{900^\circ}{7}) \div 2$

$= \frac{180^\circ}{7}$

Let GA and AB be x.

$\frac{1}{2}(x)(x)\sin\frac{900^\circ}{7} = 30$

$x^2 = 76.74288\ldots$

$x = 8.76030\ldots$

A

$GB^2 = GA^2 + AB^2 - 2(GA)(AB)\cos\angle GAB$

$GB^2 = (8.76030)^2 + (8.76030)^2 - 2(8.76030)(8.76030)\cos\frac{900^\circ}{7}$

$GB^2 = 249.18256\ldots$

$GB = 15.8$

15.8 cm

(Total for Question 26 is 5 marks)

Q26

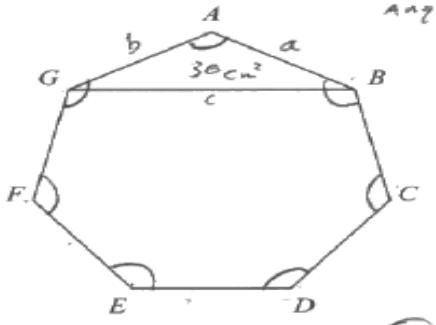
A
B
C

5 /5

P1 for a correct process to find an interior angle (line 1)
P1 for a correct process to use the area of triangle ABG to find the length of a side (line 6).
P1 for a complete process to find the length of a side of the polygon. The correct value 8.76... is evidence of this.
P1 for a complete process to find GB, using the cosine rule.
A1 for an answer in the range 15.7 to 15.8

Question 26 - Response B

26 *ABCDEFG* is a regular heptagon.



Interior Angles: 900°

$c^2 = b^2 + a^2 - 2ba\cos C$

The area of triangle *ABG* is 30 cm²

Calculate the length of *GB*.
Give your answer correct to 3 significant figures.
You must show all your working.

(3) $8.760301391^2 + 8.760301391^2$
$= 153.4857609$

(1) $\frac{900}{7} = 128.571428$

(2) Area of triangle $= \frac{1}{2} a b \sin C$ ← $a = b$

$30 = \frac{1}{2} a^2 \sin(128.571428)$

$60 = a^2 \sin(128.571428)$

$\frac{60}{\sin(\frac{900}{7})} = a^2$

$76.74289046 = a^2$

$8.760301391 = a$

..... cm

(Total for Question 26 is 5 marks)

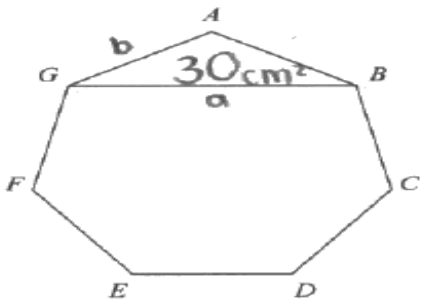
3 /5

P1 for a process to find an interior angle, 900/7 or 128.6.
P1 for the start of the process to find the length of a side by using the given area.
P1 for a complete process to find the length of a side, 8.76
P0 The student has written down the cosine rule but then calculates $8.76^2 + 8.76^2$. This is not a complete process to find the length of GB.
A0 for an incorrect answer.

Q26
A
B
C

Question 26 - Response C

26 *ABCDEFG* is a regular heptagon.



The area of triangle *ABG* is 30 cm²

Calculate the length of *GB*.
Give your answer correct to 3 significant figures.
You must show all your working.

$\frac{1}{2}$ ab sin C = 30

ab sin C = 15

$\frac{1}{2} \times b \times h = 30$

$\frac{1}{2} \times 12 \times 5 = 30$

12.1 cm

(Total for Question 26 is 5 marks)

0 /5

P0 The student makes no attempt to find either an interior or exterior angle
P0 A start is made to use area formulae but the expressions are general and do not make clear which angle is to be used or which "b"/"h" is to be used.
P0P0 The student makes no further progress.
A0 The answer is incorrect.

Q26
A
B
C