GCSE EXAMINERS' REPORTS

GCSE (NEW)
MATHEMATICS

Summer 2022

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MATHEMATICS

GCSE (NEW)

Summer 2022

UNIT 1 FOUNDATION

General Comments

This unit tested a reduced content of the normal specification, following the consequences arising from the Covid-19 pandemic.

Overall, the questions were comparable with those asked on previous papers that have been sat, and the paper was a suitable and fair test for the candidates at the Foundation level. Some questions proved more challenging than others, particularly towards the end of the paper.

Topics which many found difficult included finding a fraction of a number, gathering like terms, finding angles using angle facts, solving equations including two *x* terms, finding the area of a trapezium.

Item level data is available to all centres by centre and for individual candidates with comparison of all candidates sitting these examinations. This report will focus on common errors and misconceptions to aid the interpretation of the data available.

Comments on individual questions/sections

Q.1 Most candidates were able to answer these questions easily apart from (c). This proved challenging as many didn't know that working out one fifth of 335 meant that they should divide 335 by 5.
Part (d) was a subtraction calculation. There are still many candidates who write the numbers upside down, with the smaller number on top of the larger number. Then they subtract the smaller digit from the larger digit, whatever their relative position is.
Part (e) was answered very well.

Q.2 Both parts of this question were difficult for the candidates. As there were two Ts out of six letters altogether, then it was unlikely that Tim would choose this letter. However, very many wrongly thought that it was likely for T to be chosen.
In (b), three of the six letters were the letter A, so there was an even chance of choosing an A. Again, candidates found this difficult and gave the wrong answer.

Q.3 This line symmetry question was answered well.

Q.4 **(a)** The angle *x* is an acute angle but many answers were greater than 90°. It is important to check that the correct side of the protractor is being read.

(b) The angle to be drawn is 147° which means that it must look bigger than a right angle. Frequently, this was not the case.

Q.5 **(a)** To find the time which has passed, candidates could have counted the hours from 8:30 a.m. until 1:30 p.m. and then added the extra 45 minutes until 2:15 p.m. The correct answer is 5 hours 45 minutes but very frequent wrong answers were 4 hours 45 minutes or 6 hours 45 minutes.

(b) The large triangle given in the question is divided into 9 identical equilateral triangles so to shade $\frac{2}{3}$ of it requires 6 small triangles to be shaded. However, very many shaded only three.

Q.6 This question tested knowledge of the difference between the radius and diameter of a circle. A very frequent wrong answer was 15 cm, the radius of the large circle, not its diameter.
To gain the W mark, the calculation needed to be set out in correct mathematical form. The decimal points were not always aligned correctly. The W mark was also lost if the final answer did not include its units, cm.

Q.7 **(a)** The most frequent wrong answer was 17*a*. Candidates worked out 12*a* – 19*a* as 7*a* and wrongly added that to 10*a* instead on subtracting it.

(b) **(i)** More candidates were able to answer this question correctly though a frequent error was to subtract 3 from 189 instead of dividing 189 by 3.

(ii) This question was well answered though sometimes 15 was added to 27 instead of being subtracted from it.

(c) The answer to √36 is 6. Several wrote 6×6 or 6^2 which gained 0 marks.

Q.8 To answer this question, candidates needed to know that 2·2 lb is equal to 1 kg so that the masses of the three sacks of potatoes could be added in the same units. This conversion was forgotten by very many.
A mark was awarded if 5·4 + 3·08 + ‘their conversion’ was calculated correctly. However, many were unable to align the decimal points correctly to do this calculation.

Q.9 Some candidates were able to drawn the three correct rotations of the given shape on the grid but others drew only one, and many wrongly drew the reflection of the given shape. Using a piece of tracing paper should help candidates answer this question correctly.

Q.10 The first step needed to answer this question was writing all the capacities in the same units. The easiest of these was to change 4000 ml to 4 litres; a correct conversion gained the first mark. Then candidates were expected to try different numbers of buckets and jugs to see which combination filled the tank exactly. To gain the OC mark, the steps of the answer must be labelled clearly to say what combinations of jugs and buckets are being considered. This labelling was frequently missing so very many candidates lost this mark, being awarded OC0.

Q.11 The ten numbers given in the question were all even numbers so A (the probability of an even number being chosen) is 1. The candidates were frequently successful in marking A correctly on the given probability scale. Counting how many numbers greater than 8 was less successful and counting the number of square numbers was even more difficult. Many were unable to mark C correctly.

Q.12 **(a)** Very many candidates thought that both 3^2 and 2^3 equalled 6. So there were very many wrong answers of 6 × 6 = 36.
Others knew that $3^2 = 9$ and that $2^3 = 8$, but were unable to calculate 9 × 8 correctly, and some worked out 9 + 8.

(b) Many candidates worked out 124 ÷ 4 = 31 but failed to include – in their answer which should have been −31.

(c) Those candidates who found the correct answer of 42 usually worked out 10% and then 5% of 280, and then added these amounts.

Q.13 To gain full marks in this question, the three quantities had to be expressed in equivalent form using correct working.
Sight of one correct conversion was awarded 1 mark.
Very many candidates were unable to convert $\frac{8}{25}$ to either a decimal or a percentage.
It was easier to change 0·3 to a percentage, and less so to change 31% to a decimal.

Q.14 Many candidates found this question challenging as they had to work first with the angles 220°and 90° sitting at a point, and then with the angles in an isosceles triangle.
Some did find 50°, the vertex or apex angle of the isosceles triangle, but many of those candidates wrongly gave 50° as their final answer.
Some candidates did continue to find the base angles of the isosceles triangle correctly.
A follow through was available here using (180 - 'their 50°') ÷ 2 for a possible 2 marks.

Q.15 Both parts of this question were challenging for the candidates. Very many didn't understand that 7*n* – 9 means 7×*n* – 9 and that 3*n* – 5 means 3×*n* – 5, so were unable to substitute values of *n* and evaluate the expressions correctly. Multiples of 4 were more easily recognised than prime numbers but some didn't realise that each final answer was the value of *n* that had been substituted into the expression and not the expression itself.

Q.16 **(a)** Candidates still persist in giving word answers to questions which asked for a probability. Questions asking for the chance of an event happening expect probability words to be used but a question including the word probability expects a numerical answer. Probability questions later in the exam paper will expect a number answer and not words like 'certain' or 'unlikely'. Many thought that as there were two colours, green and yellow, then the probability of each was 0·5. But the red balls were forgotten. The probability of choosing a yellow ball is (1 − 0·3) ÷ 2.

(b) Writing an explanation to answer this part of the question proved too difficult for most candidates. They needed to explain why it was impossible to have the probability of 0·25 when choosing a ball out of 10 balls.

Q.17 This question was beyond most candidates though some tried to rearrange the given terms. When they tried to collect the *x* terms together, they didn't change the sign of 3*x*. Similarly, when they tried to collect the constants together, they didn't change the signs as necessary.
Wrong answers included expressions like 8*x* – 38 = *x* − 30' and '17 – 3*x* = 14*x*'.
Manipulating equations of this type where both the *x* terms and the constants had to be rearranged, was very difficult and the rules of algebra were followed randomly and creatively.

Q.18 Some candidates successfully found the width, *x*, of the rectangle. Follow-through marks were available to those candidates who incorrectly found the value of x, but then used 2x correctly when finding the area of the trapezium. Some candidates correctly used the formula for finding the area of a trapezium but frequently the numbers given in the question were combined randomly and wrongly.

Q.19 The question stated four conditions which needed to be satisfied by the four numbers given in the answer. One mark was awarded for two conditions being satisfied, and another mark for another satisfied condition, and three marks for all four conditions being satisfied. Almost all candidates who attempted this question chose numbers lying between 1 and 15. The other conditions seemed to be satisfied randomly and not very frequently. Including two 7s to give a unique mode of 7 seemed problematic. Some did realise that if the mean is 9 then the total of the four numbers must be $9 \times 4 = 36$. Choosing two numbers with a median of 8·5 was more difficult.

Summary of key points

Remember to read your protractor using the scale indicated by the question. So, an angle which is obviously smaller than a right angle must be less than 90° when you measure it. Similarly, an angle bigger than 90°must be larger than a right angle when you draw it.

Write the numbers in a subtraction calculation with the larger number above the smaller number. Then always subtract the lower digits from the upper digits.

The decimal points must be aligned in an addition or subtraction calculation.

Use tracing paper to help with completing line or rotational symmetry drawings.

Use words connected with probability (e.g. unlikely) when the question includes the word chance, but when the word 'probability' is used then the answers must be given as numbers in the appropriate form.

MATHEMATICS

GCSE (NEW)

Summer 2022

UNIT 1 INTERMEDIATE

General Comments

This unit tested a reduced content of the normal specification, following the consequences arising from the Covid-19 pandemic.

Overall, the questions were comparable with those asked on previous papers that have been sat, and the paper was a suitable and fair test for the candidates at the Intermediate level. Some questions proved more challenging than others, whilst some candidates lost marks because of incorrect numerical evaluations or giving unsupported incorrect answers. Topics which many found difficult included, finding the area of a trapezium, converting between miles and km, interpreting pie charts, and finding the length of sides in similar shapes.

Item level data is available to all centres by centre and for individual candidates with comparison of all candidates sitting these examinations. This report will focus on common errors and misconceptions to aid the interpretation of the data available.

Comments on individual questions/sections

Q.1 Part (a) was not as well answered as expected. It was pleasing that many candidates evaluated 3^2 and 2^3 as 9 and 8 respectively which gained 1 mark, but many failed to give the correct answer to 9 × 8. Many added the values giving a final answer of 17. 6^5 was also a popular incorrect answer.
Part (b) was well answered.
Many candidates used efficient methods to find 15% of 280 in part (c).
Those who decided to use the method of finding 1% and then multiplying by 15, usually introduced errors into their workings resulting in an incorrect answer.

Q.2 Correct working had to be shown in this question if all three marks were to be gained. To allow for a full comparison, candidates were required to have all three values in an equivalent form. Sight of one correct conversion was awarded 1 mark.
Errors were seen when trying to convert 8/25 into a decimal. Many candidates tried to evaluate 25 ÷ 3 instead of 3 ÷ 25.

Q.3 This question was well answered, with candidates correctly finding 50°, the vertex or apex angle of the isosceles triangle. Some candidates gave 50° as their final answer. Many candidates applied their knowledge of isosceles triangles and continued to find the base angles of the isosceles triangle correctly.
A follow through was available here using (180 - ‘their 50°’) ÷ 2 for a possible 2 marks.

Q.4 This question was answered well with many giving the three correct ages in the correct order. Several different methods were seen.
Candidates are reminded to use answer lines if given in a question.

Q.5 It was pleasing to see many pupils substituting value of n into the expression, which resulted in $7n - 9$ being a multiple of 4. Common errors were evaluating terms in the sequence $7n - 9$ but not identifying a multiple of 4 or substituting a correct value of n in $7n - 9$, but then contradicting their final answer e.g. $7\times3 - 9 = 12$ shown and 12 written on answer line.
Similar issues were seen in part (c). Many candidates thought that 1 was a prime number.

Q.6 Part (a) of the question was very well answered, with candidates realising that P(green or yellow) was 0·7. Some candidates had difficulties halving 0·7 to find P(yellow).
The marking scheme lists the type of valid explanations that were accepted in part (b). A number of candidates found the expected number of blue balls to be 2·5 and then went on to explain that the number of balls needed to be a whole number.

Q.7 Part (a) was well answered.
A number left their answer as 18/4 which gained the 2 marks. A number went on the try and evaluate 18 ÷ 4 incorrectly. Candidates should be reminded that when a final answer or an answer on follow through leads to a whole number answer, it must be shown as a whole number. Otherwise a fraction is accepted.
An embedded answer e.g. $4 \times 4{\cdot}5 + 3 = 15$ was accepted, but not if followed by a contradictory answer of $x \neq 4{\cdot}5$.
Candidates should be discouraged from presenting an embedded answer.
In part (b), common errors seen were seen in the first step of solving the equation. Follow through marks were available if candidates continued to solve their equations correctly.

Q.8 Many candidates successfully found the width of rectangle, x. Some then went on to use 12m as the height of the trapezium and found the area correctly. Many referred to the formula list at the beginning of the paper. Follow through marks were available to those candidates that incorrectly found the value of x, but then used $2x$ correctly when finding the area of the trapezium.
Candidates should be made aware of what is taken into consideration when awarding the OC and W mark. Responses should be structured with explanations that are clear and logical to the reader. Explanations should be given at the point in the solution when they are presented. A series of calculations followed at the bottom of the page with a detailed explanation is not what is expected in order to gain an OC mark.
Those who divide their page into two vertical halves headed ‘Calculations’ and ‘Explanation’, should ensure that the explanations on the right are in line with the calculations on the left-hand side.
Correct mathematical form is required for the W mark.
We do not want to see, for example, ‘Area = 5 + 9 × 12 = 168 ÷ 2 = 84’.

Q.9 Many candidates managed to gain 1 mark, usually from giving 4 numbers that were between 1 and 15 inclusive with a unique mode of 7. Many did not how to deal with the median of 4 numbers being 8·5, or appreciate that if the mean is 9, then the total of the 4 numbers is
9 × 4 = 36.

Q.10 This question had two parts – using ratios and converting between miles and km. Some candidates found BC first in km, and some converted AC into miles first. The marks were usually gained from using ratios. Many candidates do not know that 8km $\approx$ 5 miles or equivalent and gave their final answer as 32km.

Q.11 Calculating the correct value for y when substituting $x = -1$ into the quadratic proved difficult for some of the candidates. A common error was to evaluate $(-1)^2 + (-1) - 4$ as –1–1–4 = –6. Most plotted their points accurately. There has been an improvement in the drawing of a smooth curve although some candidates lost a mark as not enough care had been taken in making sure the curve went through all of their plotted points within the permitted tolerance. Some candidates still use a ruler to join the plots.
Candidates should be aware of the shape of a quadratic graph and realise that it should not have sharp corners.

Q.12 This question was not answered well.
Interpreting (including measuring angles) and drawing pie charts is a skill that can be assessed on both the GCSE Mathematics and GCSE Mathematics – Numeracy qualifications.
Few candidates engaged with the requirements of the question and engaged only with the bar chart.
Many candidates gained a mark for showing that 9 Year 5 pupils had 1 pet.
Those candidates who only considered 1 pet from Year 5 and 6, or 0 pets from Year 5 and 6, were treated as special cases, and marks were available as outlined in the marking scheme.

Q.13 Sight of $6n + 21$ gained 1 mark, as sight of the +21, meant that candidates were working with the difference between consecutive terms as -6.

Q.14 It was disappointing that so few correctly completed tree diagrams were seen in part (a). Most candidates gained only B1 in part (a), for placing 0·4 on the correct branch. Most candidates assumed that the branches involving event B were be labelled 0·48, 0·52, 0·48, 0·52. In part (b) a follow through answer using their values for P(A does not occur) × P(A does not occur) was allowed for full marks. Unfortunately, some candidates are still not sure on how to deal with independent events. When the correct method was understood a mark was subsequently lost for an incorrect multiplication of 0·4 × 0·2 leading to 0·8 rather than 0·08.

Q.15 Those who knew that in similar shapes, corresponding dimensions are in the same ratio, scored well on this question. Many candidates at the Intermediate level did not use this fact and hence did not gain any marks for this question.
Some misinterpreted the arrows on the diagrams to mean that the sides AB and DE were equal in length and gave 10·5 cm as their answer in (b).
Follow through marks were available to those that used their scale factor from part (a) appropriately in part (b).

Q.16 Several different methods were used by candidates to solve the simultaneous equations. If these methods were valid and algebraic (as the question specified) then marks could be awarded.
The most common method was to eliminate one variable by trying to equate either the x or y coefficients. Some only multiplied the terms in x, only the terms in y, or only the terms on the left-hand side. Furthermore, if candidates did achieve two correct equations with equal coefficients for either the terms in x or y, a significant number of candidates did not know whether to add or subtract to eliminate one variable.
In some cases, the requirement to subtract a negative value ('minus a minus') did lead to arithmetical errors. Working with large numbers such as 92÷23 or 161÷23 also led to difficulties.
The question required the candidates to solve the simultaneous equations using an algebraic method. Only a 'special case' single mark would be awarded to those who used a form of 'trial and improvement' method to find the value of x and the value of y.

Q.17 Neither multiple choice parts of this question were well answered.
One of the important facts that candidates need to know is that $1\text{m}^3 = 1\,000\,000\,\text{cm}^3$.
Many chose $720\,\text{cm}^3$ as their answer in part (a).
Few candidates could interpret the fractional index. 18 was the most common answer in part (b).

Q.18 A common method was to convert $1{\cdot}5 \times 10^5$ correctly to 150 000, which gained B1, but then errors were made when trying to evaluate $\frac{30\,000}{150\,000}$.
Candidates should be reminded to read the requirements of the question. The answer was needed to be given as a decimal.

Summary of key points

Remember to show all your workings. A lot of marks can be lost if unsupported incorrect answers are given.

Take care when undertaking simple arithmetical calculations on the non-calculator paper.

Practise interpreting pie charts including those that involve measuring angles (Q.12).

Practise working with negative numbers whether it is substituting negative values into formulae or equations (Q.11) or adding or subtracting negative values (Q.14).

Facts need to be learnt, for example, km ↔ miles, $\text{cm}^3 \leftrightarrow \text{m}^3$ and others specified in the specification.

MATHEMATICS

GCSE (NEW)

Summer 2022

UNIT 1 HIGHER TIER

General Comments

The number of candidates entered was the highest since this specification was first assessed in November 2016. Due to the Covid pandemic, like in the Autumn series, the adapted examination tested a reduced content of the usual specification; the paper nevertheless provided a fair test at this tier. As is always the case, candidates' performances reflected the increased demand as they progressed through the paper. Very few questions were not attempted, indicating that the entries were mostly appropriate for this tier .

Topics which were found difficult included:

- converting from km to miles
- combining data from two different types of statistical presentation (pie chart and bar chart)
- manipulating fractions
- converting between metric units in 3 dimensions
- sketching trigonometric graphs
- constructing and solving an equation resulting from the use of 'speed=distance/time'
- factorising a quadratic expression
- manipulating surds
- identifying transformations of graphs
- considering all possibilities when calculating probability.

Comments on individual questions/sections

Q.1 The majority of candidates were able to use the given ratio to find the length of BC in km. Many were then successful in converting from km to miles, using a variety of valid methods (e.g., ÷1·6, ×0·625, ÷8×5). Unfortunately, it was common to see 32 miles stated as a final answer. An answer of 32 000 miles was also frequently given, where candidates appeared to confuse miles with metres. A minority of candidates used the alternative method of starting by converting length AC to miles before using the ratio to find BC.
For the OCW requirement, many candidates understood the necessity of labelling their steps e.g., '1 part =', 'total number of parts =' or 'distance in miles ='. There was occasional misuse of the '=' sign within number work (e.g., '56/7=8×4=32'). In some cases, candidates were reluctant to show adequate working e.g., writing '32 km = 20 miles' without offering any explanation or relevant calculation.

Q.2 This question on a quadratic graph was mostly done very well. The missing values in the table were almost always calculated correctly in part (a), which helped in plotting points and sketching the quadratic graph in part (b). There were plenty of excellent curves sketched, usually including a suitable minimum point below y= −4. A mark was sometimes lost for joining all the points with straight lines.

For part (c), most candidates knew that they needed the x-coordinates of the points of intersection of their curve with the x-axis and gave accurate readings to 1 decimal place; some, however, ran into difficulty in attempting to solve the quadratic equation by factorising.

Q.3 This question was essentially about interpreting the pie chart and combining the data with that of the bar chart. The pie chart was drawn to scale, but not all candidates appreciated the need to measure the angle of the sector representing ‘No pets’ in order to obtain the number of children in that category. More were successful in using the right-angle to obtain the number of children with ‘1 pet’. Once they had obtained the numbers of children in the relevant categories, there were plenty of candidates who proceeded to combine them and produce the required probability of 27/61 (from [13+14]/[36+25]). Unfortunately, many others produced probabilities relating individually to the pie chart and bar chart (namely 13/36 and 14/25) then either added or multiplied them, rather than adding the numerators and denominators to give the correct answer. Other common errors included misinterpreting ‘No more than 1 pet’ to mean ‘exactly 1 pet’ or (less often) ‘No pets’.

Q.4 The majority gained all four marks for completing the tree diagram. Others lost marks for taking 0·48 to be ‘the probability of event B occurring’ (rather than ‘the probability of event A **and** event B occurring’), though they could still access ‘follow through’ marks in part (b). Whilst many stated the appropriate calculation of 0·4 × 0·2 in part (b), it was common for this to lead to 0·8 rather than 0·08.

Q.5 The majority answered part (a) correctly, but in part (b) some multiplied (rather than divided) 10·5 by 1·5. Weaker candidates misunderstood the arrows on the diagram (indicating parallel lines) as meaning equal lengths.

Q.6 For many candidates, this was a straightforward question on simultaneous equations, with secure algebra skills in evidence. Errors were usually associated with the decision to add or subtract in order to eliminate one variable, having multiplied through the equations.

Q.7 **(a)** This proved challenging for most, with many candidates wrongly thinking that $1\,m^3$ is equivalent to $100\,cm^3$. As in previous examination series, those candidates who clearly engaged with the multiple-choice question by using the working space tended to be most successful.

(b) This was answered significantly better than part (a), but it was nevertheless a concern that many thought that $36^{½}$ was 18.

Q.8 Plenty of candidates gained both marks here, though some lost a mark for leaving their answer in standard form rather than giving the required decimal. There were occasional place value errors made in converting from standard form.

Q.9 **(a)** Many candidates showed good knowledge of the shape of a sine curve. Of those who produced the correct shape, not all showed the maximum and minimum values to be 1 and −1 respectively. Some drew a cosine curve or drew multiple cycles (of sine or cosine).

(b) Fewer candidates could draw a satisfactory sketch of the graph of y = tan x, and of those who had some idea, many drew portions with incorrect curvature or incorrect points of intersection with the x axis. Others drew a curve for which the y-values ranged between -1 and 1.

Q.10 Plenty of secure algebra was shown here, with only a few making sign errors in collecting appropriate terms on each side of the equation. However, not all candidates appreciated the need to factorise, and could not then access the second or third marks.

Q.11 In this question on inverse proportion there were two distinct methods widely used, seen in roughly equal proportion. The first involved finding a formula connecting *W* and *f*, then using the formula to find the required value of *f*. The second method involved recognising that if one variable was multiplied by 20, the other variable needed to be divided by 20. A large number of candidates gained all four marks. There were no marks available for those who used direct proportion (since their work was not of equivalent difficulty).

Q.12 This was well-answered, with candidates often awarded both marks. Some only gained one mark, usually for incorrectly locating their enlarged triangle.

Q.13 Some fully correct solutions were seen here, but it was disappointing that many candidates were unable to use 'speed=distance/time' correctly in order to set up the initial equation. Of those who did succeed, many proceeded to rearrange and then solve the resulting quadratic equation. Others, however, did not recognise that the problem should become a quadratic equation, which could be solved by factorising. (Some use of the quadratic formula was seen, with variable success.)

Q.14 Both marks were often gained here, but common incorrect answers included -5 or $-1/5$ or $-125/3$. Poor notation (e.g. $5 = 1/5$ or even $1/5 = 5$) was a concern, and a mark was sometimes lost for writing ambiguous answers.

Q.15 There was a variety of valid methods used in simplifying the first term in this question on surds. (Some made unnecessary hard work of it by expressing 800 as a product of prime factors, in order to eventually give $\sqrt{800}$ as $20\sqrt{2}$.) In squaring the brackets, sign errors were a frequent problem, as were difficulties in combining the two $-3\sqrt{7}$ terms (often becoming 0 or $+6\sqrt{7}$ or $-2\sqrt{21}$ instead of $-6\sqrt{7}$). Even the ablest candidates sometimes lost the final mark for writing $26-6\sqrt{7}$ as $20\sqrt{7}$; it was frustrating that others lost the final mark for ticking the 'rational' box for their otherwise correct answer.

Q.16 Part (a) was answered better than part (b) in this question. Wrong answers included $y=f(-x)$ for part (a) and $y=f(x+4)$ for part (b).

Q.17 Part (a) was usually well-answered, with candidates knowing to multiply three probabilities. It was a concern, however, that some did not know how to multiply their fractions. Part (b) was significantly more challenging, with relatively few candidates using the efficient method of evaluating 1−P(no blue balls). Those who opted to find the probabilities of different combinations of colours often failed to account for all the possible orderings.

Q.18 Those with fluent algebra skills found this to be a straightforward final question. Others, however, did not recognise the difference of two squares, so were unable to progress beyond factorising the numerator.

Summary of key points

- Understand how and when to add, subtract, or multiply fractions
- Know how to convert between metric and imperial units, including checking the reasonableness of the answer
- Understand how to convert between metric units in 2 or 3 dimensions
- Know the essential properties of trigonometric graphs
- Know how to work with surds
- Recognise common transformations of graphs, and express them using appropriate notation
- Understand how and when to factorise a quadratic expression.

MATHEMATICS

GCSE (NEW)

Summer 2022

UNIT 2 FOUNDATION

General Comments

This unit tested a reduced content of the normal specification, following the consequences arising from the Covid-19 pandemic.

Overall, the questions were comparable with those asked on previous papers that have been sat, and the paper was a suitable and fair test for the candidates at the Foundation level.
A calculator paper is designed to assess the use of the calculator. Although non-calculator methods can yield correct responses, they often increase the difficulty of the question and result in unnecessary errors. Candidates should be encouraged to use a calculator as much as possible on Unit 2 but must remember to show their working where appropriate.

Topics which many candidates found difficult included, converting between litres and pints, reflecting shapes, forming expressions, and calculating expected profit.

Item level data is available to all centres by centre and for individual candidates with comparison of all candidates sitting these examinations. This report will focus on common errors and misconceptions to aid the interpretation of the data available.

Comments on individual questions/sections

Q.1 Part (a) required candidates to write a number in figures, with part (b) asking candidates to write a number in words. Both parts were well attempted, with part (a) being answered slightly better than part (b), with just under three quarters of candidates providing a correct response.

Q.2 This question assessed candidates' use of inequality symbols. Candidates who demonstrated understanding of inequality symbols typically gave a fully correct response. There were a few candidates who attempted the calculations using non-calculator methods. It was clear that a few candidates didn't know that the equals symbol could be used, instead writing < > on the 3rd row where the equals symbol should have been inserted.

Q.3 This question assessed candidates' ability to name a selection of 2D and 3D shapes. The correct answer for part (a) was kite – this was answered correctly by approximately half of candidates. The most common incorrect answer was diamond. The correct answer for part (b) was parallelogram – this was answered correctly by less than a quarter of candidates. The common incorrect answers were rectangle and rhombus.
Part (c) was answered most successfully, with just under three-quarters of candidates giving the correct answer of a sphere.

Q.4 In part (a), candidates were required to write the first four multiples of 48. Less than half of candidates gave a fully correct response, with some confusing factors and multiples, whilst others made numerical errors.

In part (b), candidates had to identify 3 as a prime number from the list of five numbers. Just over a quarter of candidates answered this part correctly.

In part (c), candidates had to identify a number after being given three of its four factors. Candidates found this very challenging, with few correct responses of 39 seen.

Q.5 In part (a), candidates had to find two square numbers with a difference of 9 (16 and 25). Some candidates provided two square numbers which didn't have a difference of 9, whilst others were awarded 1 mark for writing two numbers with a difference of 9 where one of the numbers is square.

In part (b), candidates had to explain whether two odd numbers could add up to give an odd answer. Just over a quarter of candidates answered this part correctly, with many saying that the statement was correct because all the numbers were odd.

Q.6 In part (a), candidates had to select the special name given to the perimeter of a circle. Less than half of candidates gave the correct answer of circumference, with many instead selecting diameter or radius.

In part (b), candidates had to identify which of the given angles was a reflex angle. This was answered correctly by just over a quarter of candidates, with the largest angle (470°) the most common incorrect response.

In part (c), candidates had to find two angles on a straight line where the larger angle was 30° greater than the smaller angle. Very few fully correct responses were seen, with 1 mark often being awarded to candidates who gave two angles which added to 180°, demonstrating their knowledge of angles on a straight line.

Q.7 In part (a), candidates had to describe the rule for continuing the given sequence. In part (b), candidates had to write the next term in the sequence. Both parts were well answered by candidates.

Part (c) required candidates to form an expression for the number of grapes which Adrian had after eating 4 of them. Candidates found this very difficult, with less than a quarter of candidates giving the correct answer of $n - 4$. Many gave numerical answers, not engaging with the n at all.

Q.8 In this question, candidates had to complete a table showing equivalent fractions, decimals and percentages.
The first row was already completed. Candidates found the second row, where they had to write the decimals and percentages equivalent to 7/10, to be the most accessible.
The third row, where candidates had to write 5% as a fraction (in simplest form) and as a decimal, was rarely completed fully correctly, with 5/20 and 0.5 the common incorrect answers.

Q.9 This question tested calculator use, with candidates having to find the sum of the square root of 11.56 and the square of 2.5. Less than a half of candidates answered this correctly, with many halving 11.56 or multiplying 2.5 by 2.

Q.10 In this question, candidates were asked to substitute two positive values into a formula written in symbols. Some fully correct responses were seen, but these were sometimes spoilt by candidates who included x, y or $x\,y$ in their final answers. Many candidates obtained 1 mark by substituting one of the values correctly, with a mark awarded for sight of 245 or 58.

Q.11 This was the question where candidates were awarded marks for their organisation, communication and accuracy in writing. Candidates were expected to present their responses clearly, using labels where appropriate and showing any calculations which they did.

The first step in solving the problem to find Geraint's three numbers was to calculate 3/5 of 200. For many candidates, this was all that they could do. However, some lost the W mark for misuse of the equal's sign: 200 ÷ 5 = 40 × 3 = 200 was often seen.

Those who went on to engage with Geraint's numbers having a range of 4, typically went on to get all 3 marks, but this was rarely seen.

Candidates could be awarded two marks for writing three different even numbers with a range of 4. This was occasionally seen, but it was typically the 3/5 of 200 which candidates engaged with before stopping.

Q.12 Part (a) was answered correctly by some candidates, but many gained 1 of the 2 marks for identifying the correct location of point *C* on the grid, but then gave either incorrect (usually reversed) or no coordinates.
Some candidates gave the mid-point of *AB* instead of *AC*.
In part (b), some candidates had a lot of difficulty in locating a possible position of point *D*, usually by creating a triangle that wasn't right-angled. Very few fully correct responses were seen.

Q.13 Candidates at Foundation tier find it difficult to deal with questions involving converting units, whether it is converting between metric units or converting between Imperial and metric units.
As well as understanding and using the relationship between metric units of length, mass, capacity, area and volume, candidates are reminded that they also need to learn the approximate equivalences specified in the specification.
These include 8km ≈ 5 miles, 1kg ≈ 2·2 lb and 1 litre ≈ 1·75 pints.
Most candidates gained their marks from this question for knowledge of the method required to find the mean of three values. Whilst it was expected that converting between litres and pints would be a challenge for candidates on this tier, only a few candidates able to write 1615 ml in litres.

Q.14 Part (a) was well answered. Most candidates who engaged with the question completed the table of values correctly, but some made calculation errors.
In part (b), just over a quarter of candidates could explain that odd × even = even.
Few fully correct answers were seen in part (c), with some candidates writing 7/12 as seven out of 12 instead of as a fraction. Some tried to describe the probability using words such as likely and unlikely.

In part (d), most candidates were able to calculate the money generated by paying to play the game (£570) but few could go much further.
There was some confusion between ‘number of winners’ and ‘amount of prize money’. Those who engaged with this aspect of the question and correctly evaluated 7/12 × 228 as 133, often took this to be £133 rather than 133 players, and subtracted it from the £570.

Q.15 This question was very appealing to candidates as it involves two topics which they are very familiar with – area and perimeter – but many found it difficult, with few fully correct responses seen.
Some candidates did not work with a length that was double their chosen width, but candidates could still be awarded 4 out of the 5 marks for finding an area that was greater than 60 cm^2 and a perimeter that was less than 40 cm.
It was clear that many candidates at their tier still confuse the area and perimeter, with some reversed answers seen on the answer space.

Q.16 Very few fully correct responses were seen in this question, despite it being well attempted by candidates.
A mark was available for those who drew the line $x = 1$, or who reflected in the line $y = 1$ rather than the line $x = 1$. However, many candidates chose to reflect in the y-axis, for which there were no marks awarded, whilst others reflected the shape into each of the four quadrants.

Q.17 Some fully correct responses of 37 were seen for this question, but not many. Some candidates at Foundation tier clearly don’t know the appropriate distance/time formula.
For the first mark, any indication of the appropriate time could be used in the distance/time formula, with calculations such as 129·5/3 hours 30 mins or 129·5/3·3 or 129·5/210 awarded this mark.
For the second method mark, the time need to be in a correct format (3·5 hours). Very few candidates were able to do that, so nearly all candidates were awarded 0 marks or 1 mark for this question.

Summary of key points

Remember to show all workings, even if a calculator is being used. A lot of marks can be lost if unsupported incorrect answers are given.

Practise using calculator methods, as it is evident that many candidates are using non-calculator methods to answer questions on this unit, often making numerical errors.

Practise forming expressions, as many candidates are unable to do this and instead provide numerical answers.

The conversions between metric units, and metric and imperial units, need to be learnt.

Practise reflecting shapes in lines such as $x = 1$. A mark is available in these questions for drawing the correct line, but very few candidates were able to do this.

Practise expressing times written in hours and minutes as a decimal fraction of an hour. It was common to see candidates write 3 hours 30 minutes as 3·30 hours.

MATHEMATICS

GCSE (NEW)

Summer 2022

UNIT 2 INTERMEDIATE

General Comments

This unit tested a reduced content of the normal specification, following the consequences arising from the Covid-19 pandemic.
Overall, the questions were comparable with those asked on previous papers that have been sat, and the paper was a suitable and fair test for the candidates at the Intermediate level.
A calculator paper is designed to assess the use of the calculator. Although non-calculator methods can yield correct responses, they often increase the difficulty of the question and result in unnecessary errors. Candidates should be encouraged to use a calculator as much as possible on Unit 2 but must remember to show their working where appropriate.

Topics which many found difficult included, converting between litres and pints, reflecting, and rotating shapes, expressing hours and minutes as a decimal fraction of an hour, finding the volume of a cylinder and factorising expressions.

Item level data is available to all centres by centre and for individual candidates with comparison of all candidates sitting these examinations. This report will focus on common errors and misconceptions to aid the interpretation of the data available.

Comments on individual questions/sections

Q.1 Part (a) was well answered, although some candidates incorrectly thought that 3·5% = 0·35.
In part (b), 1 mark was available for sight of 16·2 or 10·5. 16·2 was seen more frequently than 10·5.
Several candidates did not use their calculator efficiently or introduced BIDMAS errors.

Q.2 Part (a) was a well answered question, with many correct responses seen.
Some candidates gained 1 mark for identifying the correct location of point *C* on the grid, but then gave either incorrect (usually reversed) or no coordinates.
Some candidates gave the mid-point of *AB* instead of *AC*.
In part (b), some candidates had difficulty in locating a possible position of point *D*, usually by creating a triangle that wasn't right-angled.

Q.3 Candidates find it difficult to deal with questions involving converting units, whether it is dealing with metric units or converting between Imperial and metric units.
As well as understanding and using the relationship between metric units of length, mass, capacity, area and volume, candidates are reminded that they also need to learn the approximate equivalences specified in the specification.
These include 8km ≈ 5 miles, 1kg ≈ 2·2 lb and 1 litre ≈ 1·75 pints.
Most gained their marks from this question for knowledge of the method required to find the mean of three values.

Q.4 Part (a) was extremely well answered. Most candidates engaged with the question and completed the table of values correctly.
In part (b), some candidates could explain or imply that odd × even = even.
Part (c) was well answered with many gaining 'follow through' marks from their table of values in part (a).
In part (d). there was some confusion between 'number of winners' and 'amount of prize money'. Having correctly evaluated 7/12 × 228 as 133, they then took this to be £133 rather than 133 players.
Some ignored their probability from part (c) and thought that half of the players won a prize.
Some interesting alternative methods were seen, such as finding the profit for 12 players and then scaling up to 228.
Although many of the candidates gained full marks for this question, a number lost OCW marks. Presentation was poor, as values such as 'probabilities', 'number of winners', 'amount of prize money' and 'profit' were all used with inappropriate mathematical form.
Many gave £104.5 as their final answer. The W mark was lost in this case.

Q.5 This question was well answered with candidates giving values that satisfied the three conditions set out in the question.
Some did not give a length that was double its width, but could still gain marks for an area that was greater than 60 cm^2 and a perimeter that was less than 40 cm.
The question was meant to test whether the candidates not only knew how to calculate the area and perimeter of a rectangle, but also knew which was which. Hence the instruction to use the answer space to clearly identify which is the area and which is the perimeter. Only a few candidates mistook one for the other.

Q.6 In part (a), a mark was available for those who drew the line $x = 1$, or who reflected in the line $y = 1$ rather than the line $x = 1$. Many, however, chose to reflect in the y-axis, for which there were no marks awarded.
In part (c), many rotated the triangle through 90° clockwise about the origin rather than about the point (−1, 1).

Q.7 In part (a), to gain the mark, the final answer had to be the expression $12p - 20$.
The mark was sometimes lost as the candidate had either, shown the $12p$ and -20 as separate entities, or had expressed $12p - 20$ as $-8p$.
In part (b), the first mark in the marking scheme was given for correctly isolating the $8m$ (or $-8m$) term. The second mark was awarded for correctly dealing with the 8 (or -8).
This could be a follow through from their $\pm 8m = \pm w \pm 3$.
Candidates who gave $-m$ rather than $(+)m$ as their subject did not gain the final mark.
Candidates who gave a final answer of $\frac{W+3}{8}$ with '$m =$' missing did not gain the final mark as in this case there is no formula.
Many candidates displayed poor algebra work.
In part (c), several candidates remembered the acronym FOIL (they wrote it in large letters on the page) when expanding the two brackets. However, they were unable to implement the procedure correctly. The most common error was in writing the number term as $+20$ instead of -20 or simplifying $+5y -4y$ as 1.

Q.8 Many candidates gave 'parallel angles' as their answer.

Q.9 A mark was given for use of the appropriate distance/time formula. For this first mark, any indication of the appropriate time could be given.
Calculations such as 129·5/3 hours 30 mins or 129·5/3·3 or 129·5/210 were awarded this first mark.
For the second method mark, the time need to be in a correct format.
Candidates could benefit practising expressing hours and minutes as a decimal fraction of an hour.

Q.10 This question had two parts – using ratios to find the diameter of the cylinder and then finding the volume of the cylinder. Many interpreted the ratio incorrectly and found the diameter by calculating 24·8 ÷ 5 × 3 or equivalent.
Follow through marks were available for a correct volume evaluated using 'their stated radius' OR 'their stated diameter', provided it was halved at the appropriate stage. For those that did find the volume of a cylinder, many lost the final mark for not giving the answer correct to 2 significant figures.

Q.11 It was pleasing to see that many candidates realised that Pythagoras's Theorem needed to be used as a first step. Although many found a correct solution for the length of side *BC*, some then used an incorrect formula for the area of a triangle (usually forgetting to divide by 2) or getting in a muddle trying to rearrange the formula after stating $60 = \frac{16 \times CD}{2}$.

Q.12 Those candidates who were familiar with the topic in part (a) usually gained full marks. A few lost a mark as they only partially factorised the expression, e.g., giving $2(4x^2 + 3xy)$ or $x(8x + 6y)$ as their final answer. Most candidates, however, were unable to meaningfully engage with the question.
It appeared that many of the candidates were unaware of how to factorise the type of quadratic equation in part (b)(i).
The marking scheme lists the type of valid explanations that were accepted in part (b)(ii). Accepted answers included showing or describing a method of expanding brackets.

Q.13 A very accessible six marks for those who were familiar with using trigonometric relationships in right-angled triangles. It appeared, however, that many candidates had not covered this part of the specification.
A few candidates adopted a 'round the houses' multi-step approach in both parts which, although correct, was not necessary. This approach has more potential of possible arithmetical errors arising, and marks are not awarded for a partial method.
In part (a), some candidates wrote $x = \sin 42° \times 14·5$ rather than the correct mathematical form of $x = 14·5 \times \sin 42°$. Whilst there was no penalty for this, it did lead to some incorrect answers when the values were inputted into the calculator as $x = \sin (42 \times 14·5)$.
In part (b), some candidates calculated 13·5 ÷ 15·8 and then worked with $\cos y = 0·85$, leading to $y = 31·78°$. This response was awarded 2 out of the 3 possible marks.
Candidates should be encouraged not to approximate prematurely within a calculation as this will often result in losing at least 1 mark.

Q.14 Part (a) was not well answered with many substituting values into the formula. Some candidates did use length × width × height = 132, however brackets were usually omitted.

In part (b), the marking scheme allowed:
1 mark (B1) for any correct substitution and evaluation.
1 mark (B1) for two correct evaluations using x in the range $2·55 \leq x \leq 2·75$, but crucially one answer has to be less than 132 and one answer has to be greater than 132.
1 method mark (M1), that has to be seen, for two correct evaluations using x in the range $2·55 \leq x \leq 2·65$, but again crucially, one answer has to be less than 132 and one answer has to be greater than 132. If this is not shown, then no further marks were permitted.
1 mark (A1) for a final correct answer BUT only if the previous M1 mark awarded.

Some candidates substituted $x = 2·6$ and $x = 2·7$ into the expression and then simply looked at which evaluation was the closest to 132.
This does not gain a method mark (M1) nor the final mark (A1) even if 2·6 given as an answer.
Others not only lost the final A1 mark but wasted valuable time by giving an answer to a greater degree of accuracy than was asked for.

It was pleasing to see many engaging with the final part of this question by referring back to the stem of the question or diagram and substituting their value of x into the expression given for the height of the cuboid.

Summary of key points

Remember to show all your workings, even if a calculator is being used. A lot of marks can be lost if unsupported incorrect answers are given.

Remember to read the question carefully. Sometimes marks are lost for not expressing the final answer correctly. For example, in question 10, it was expected that the answer was given correctly to 2 significant figures.

Facts need to be learnt, for example, litres ↔ pints and others specified in the specification (Q.3).

Practise reflecting shapes in lines such as $x = 1$. A mark is available in these questions for drawing the correct line (Q.6a).

Practise expressing practising expressing hours and minutes, such as 3 hours 30 minutes, as a decimal fraction of an hour (Q.9).

Practise finding the volume of cylinders (Q.10).

MATHEMATICS

GCSE (NEW)

Summer 2022

UNIT 2 HIGHER

General Comments

This unit tested a reduced content of the normal specification, following the consequences arising from the Covid-19 pandemic.

Overall, the questions were comparable with those asked on previous papers that have been sat, and the paper was a suitable and fair test for the candidates at the Higher level.

Candidates should be encouraged to be as accurate as possible when using a calculator, especially when there are multiple steps to a calculation. They must appreciate the importance of retaining the whole value of an answer on the calculator to be passed to the later parts of the solution to get the most accurate final answer. Some candidates unfortunately lost final accuracy marks due to premature approximations within their solutions. However, it was encouraging to see most candidates write out their solutions to questions, even though a calculator could be used.

There is a feeling that some candidates had possibly been entered at the Higher tier without having completed all of the Higher tier syllabus, and hence failed to attempt some of the later questions.

Areas of the syllabus that require attention include:

- Setting up quadratic equations,
- Knowing when to use right angle trigonometric ratios rather than the Sine rule, the Cosine rule or the formula A = ½abSinC,
- Calculating the lengths of 3D shapes, from knowing the ratio of their volumes,
- Using upper and lower bounds in order to find the maximum or minimum values,
- Changing the subject in order to find the angle when using the Cosine rule.

Item level data is available to all centres by centre and for individual candidates with comparison of all candidates sitting these examinations. This report will focus on common errors and misconceptions to aid the interpretation of the data available.

Comments on individual questions/sections

Q.1 This question was well answered, but quite a few candidates did get it wrong completely by possibly not using their tracing paper correctly. The common number of marks awarded were either the full 2 marks or zero marks. B1 was occasionally awarded, usually for rotating the shape about the point (1, -1). Rarely did candidates turn the shape in the wrong direction.

Q.2 **(a)** This question was very well answered. If the candidates did not gain full marks they were more often than not able to gain a B1 for a correct FT, from a slip with the sign as the first step. If the first step was correct, candidates invariably gained full marks.

(b) This was also very well answered, with only a few candidates gaining zero marks. The most common misconception was incorrectly manipulating the signs and the subsequent simplification of the y terms correctly.

Q.3 Although many candidates were able to correctly evaluate the diameter or radius of the cylinder, a significant number of candidates were unable to deal with the ratio, as given in the question. Many of these candidates employed the method of dividing a quantity by a given ratio and therefore initially divided the height by 5 (from 3+2). Other candidates were not able to use the correct formula for the volume of a cylinder, either by employing a wrong formula, or by substituting the diameter into the correct formula.
Finally, a significant number of candidates had either ignored the instruction to round their answer to 2 significant figures, or more often mistaken 2 significant figures for 2 decimal places.

Q.4 This was the OCW question.
Although the question was meant to test Pythagoras' Theorem in the first triangle, a number of candidates did employ a two-step method using right-angle trigonometry ratios to evaluate the length of the hypotenuse.
The second part was to evaluate the length CD, which was the side perpendicular to BC, within the second triangle. Although candidates simply needed to employ the area of the triangle using A = ½ base x height, a number of candidates made errors whilst attempting to use the formula A = ½ abSinC.
As regards to the OCW marks, candidates are still making errors within their mathematical form, such as BC = 9·62 + 12·82 = √256 = 16 or √ANS = 16cm having previously written the sum of the two squares = 256.

Q.5 **(a)** This part of the question was generally well answered with candidates more often than not factorising completely for B2, and, if not, gaining B1 for factorising the $\boldsymbol{x}$ only. It was less often the case that candidates gained 1 mark for the other possible alternatives. A notable number of candidates attempted to factorise the expression into two brackets.

(b) **(i)** This part of the question was very well answered. Candidates appear to be more confident with factorising into two brackets in part (b), than part (a). The vast majority of candidates were able to state in (ii) that they needed to expand the brackets, or showing the correct steps required in order to expand the brackets.

Q.6 This was the only multiple-choice question on the paper and was very well answered.

Q.7 **(a)/(b)** Although both parts were answered well, there are still many candidates who do not use the basic right-angled trigonometric ratios. Instead, they employ multi-step methods (usually combining Pythagoras' Theorem and the Sine/Cosine rules) which occasionally leads to the loss of a final accuracy mark by prematurely approximating a result which is used for the final answer. For example, in (b) some evaluated the third side to be 8·21 cm, using Pythagoras' Theorem, and then employed the Sine rule. However, some candidates rounded the third length to 8·2 cm. This resulted in $\boldsymbol{y}$ equalling 31·26° which was outside of the tolerance allowed.

Q.8 **(a)** Many candidates did not appear to understand the concept of proof. Therefore, if they attempted the question, they either substituted their final answer in 8(b)(i) into the equation given in the question or multiplied the terms together which described the dimensions but failed to show '=132'. Candidates were penalised for incorrect algebra by omitting the brackets within $5 \times x \times (x^2 + 3)$.

(b) The majority of candidates were familiar with using trial and improvement and scored well on this part of the question. Some still did not carry out the necessary check required in order to find whether the answer was 2·6 or 2·7 (the best and easiest way was to look at 2·65) – these candidates only gained two marks. However, it is pleasing to note that a greater proportion of candidates knew to test x = 2·65 than had done so on previous papers. However, it must be noted that candidates need to be careful in keying in their values on the calculator, as if they incorrectly evaluated the value for x = 2·6, they invariably gained B1 only.

(c) This part was generally very well answered.

Q.9 Quite well answered with a fair number gaining all 4 marks. Most candidates could access at least one of the method marks, either by correctly using πr^2 or $2\pi r^2$ or $4\pi r^2$. Some candidates unfortunately incorrectly used the formula to work out the volume of a sphere.

Q.10 This question was not answered as well as expected.
Many candidates failed to appreciate that min ÷ max was required and simply divided the two maxima. Candidates would be best advised to write both the upper and lower bounds for each of the values and then consider all four possible calculations in order to identify the least value.
Candidates also failed to identify that the upper bound is at the midpoint of two values; here the upper bound for 0·5 is 0·55, and not 0·54, etc.
Finally, a significant number of candidates, having correctly evaluated the least value, failed to round their answer correct to 1 decimal place.

Q.11 This was an AO3 problem-solving question which many candidates found more challenging. Candidates needed to appreciate that they had sufficient information in order to calculate the sector angle BAC, by using A = ½abSinC. More candidates could access the second part of the calculation however by correctly finding the sector area using their value for angle BAC, whether it was correctly derived or not.

Q.12 Many candidates had an idea of what they were meant to do in order to answer this question, for example, showing arrows from the two denominators to the numerator of the other fraction, but often not getting the method completely correct.
Some candidates went on to lose a mark having found the correct answer, by incorrectly expanding the denominator, even though this was unnecessary.

Q.13 The majority of candidates knew that the probability of showing an even number on one spinner was 2/5. Unfortunately, there were some candidates who did not employ the multiplication law for independent events and added the probabilities instead (albeit incorrectly).

Q.14 The majority of candidates who answered this question correctly used the alternative method of calculating the area of three separate trapezia and a triangle. The trapezium rule was rarely seen. However, many candidates did not work out the areas of these shapes correctly. Also, some candidates misread the y values of the ordinates believing them to have a decimal part (e.g., 12·2 instead of just 12) whereas, in fact, they were all integer values as described by the equation of this curve.

Q.15 Candidates who first attempted to rearrange the cosine rule before substitution were more inclined to make a mistake. The candidates who did substitute the values in first found themselves with a simpler equation to solve and therefore gained full marks. However, some candidates still made mistakes when solving the simpler equation to isolate the cosine of angle XYZ by not following the basic order of arithmetic operations.

Q.16 This question was marked in two stages – firstly setting up the quadratic equation, and then solving it.
Although most candidates gained the first mark by equating the two areas, or correctly expanding the expression for one of the areas, some errors were made in expanding one or both expressions.
If making one error, it was usually whilst attempting to expand $(7 - 2x)^2$. Common errors included seeing 14, rather than 49 or seeing $4x$ rather than $4x^2$. There were fewer errors in expanding the other expression with the single bracket, but many candidates failed to realise that they needed to collect all the terms to one side of the equation, so it was equated to zero. A quadratic equation equated to zero was necessary in order to access the final 3 marks for solving the quadratic equation.
For the candidates who had set up a quadratic equation set to zero, be it correct or not, a significant number of candidates lost marks for not employing the formula correctly.

Q.17 The majority of candidates did attempt the question, even though it was the last question on the paper. The vast majority of candidates did consider the ratio or multiplier for the volumes, 8000/4913, but then incorrectly believed this to be the linear scale factor. If they simply multiplied this value with the height of the larger solid, 30 cm, they gained no marks. However, if they found the cube root of the value they thought to be the volume scale factor and used it with the 30 cm, they gained B1 by showing that the linear scale factor is the cube root of the volume scale factor.
Candidates who worked out either the cube root of 8000/4913 or 4913/8000 sometimes either incorrectly multiplied it or divided it into 30 when it should have been the other way around. This cost them the method mark.
For the candidates that gained the M1 along with the B1, the final A1 was for a correct answer found without any premature approximation. Candidates often did not get this final accuracy mark if they gave the linear scale factor as a rounded decimal. The exact answer was 25·5.

Summary of key points

- ensure intermediate results are kept in their entirety on a calculator to avoid premature approximation
- use basic right-angled trigonometry for calculating sides or angles
- appreciating the range of values within bounds of measurements
- a quadratic equation, in general, must be equated to zero before it can be solved
- ensure calculators are set to degrees and not radians or gradians

WJEC
245 Western Avenue
Cardiff CF5 2YX
Tel No 029 2026 5000
Fax 029 2057 5994
E-mail: exams@wjec.co.uk
website: www.wjec.co.uk