



GCSE EXAMINERS' REPORTS

**MATHEMATICS – NUMERACY
GCSE
SUMMER 2023**

Introduction

Our Principal Examiners' reports offer valuable feedback on the recent assessment series. They are written by our Principal Examiners and Principal Moderators after the completion of marking and moderation, and detail how candidates have performed.

This report offers an overall summary of candidates' performance, including the assessment objectives/skills/topics/themes being tested, and highlights the characteristics of successful performance and where performance could be improved. It goes on to look in detail at each question/section of each unit, pinpointing aspects that proved challenging to some candidates and suggesting some reasons as to why that might be.ⁱ

The information found in this report can provide invaluable insight for practitioners to support their teaching and learning activity. We would also encourage practitioners to share this document – in its entirety or in part – with their learners to help with exam preparation, to understand how to avoid pitfalls and to add to their revision toolbox.

Further support

Document	Description	Link
Professional Learning / CPD	WJEC offers an extensive annual programme of online and face-to-face Professional Learning events. Access interactive feedback, review example candidate responses, gain practical ideas for the classroom and put questions to our dedicated team by registering for one of our events here.	https://www.wjec.co.uk/home/professional-learning/
Past papers	Access the bank of past papers for this qualification, including the most recent assessments. Please note that we do not make past papers available on the public website until 6 months after the examination.	www.wjecservices.co.uk or on the WJEC subject page
Grade boundary information	Grade boundaries are the minimum number of marks needed to achieve each grade. For unitised specifications grade boundaries are expressed on a Uniform Mark Scale (UMS). UMS grade boundaries remain the same every year as the range of UMS mark percentages allocated to a particular grade does not change. UMS grade boundaries are published at overall subject and unit level. For linear specifications, a single grade is awarded for the overall subject, rather than for each unit that contributes towards the overall grade. Grade boundaries are published on results day.	For unitised specifications click here: Results, Grade Boundaries and PRS (wjec.co.uk)

Exam Results Analysis	WJEC provides information to examination centres via the WJEC secure website. This is restricted to centre staff only. Access is granted to centre staff by the Examinations Officer at the centre.	www.wjecservices.co.uk
Classroom Resources	Access our extensive range of FREE classroom resources, including blended learning materials, exam walk-throughs and knowledge organisers to support teaching and learning.	https://resources.wjec.co.uk/
Bank of Professional Learning materials	Access our bank of Professional Learning materials from previous events from our secure website and additional pre-recorded materials available in the public domain.	www.wjecservices.co.uk or on the WJEC subject page.

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Subject Officer's Executive Summary

The examination papers in GCSE Mathematics – Numeracy were generally of a similar standard to previous examination series. As is always the case, some questions were more demanding in some topics than in previous series, whereas others were less demanding. What was noticeable this summer was that, despite there being Advance Information for each unit, the performance of the candidates was relatively weak, when compared with examination series prior to the pandemic. It is clear that many candidates in year 11 this year have been severely impacted by the pandemic, and there are gaps in their knowledge and understanding, which then cause problems with more demanding topics and skills. There are some areas of the subject content that are not well-understood year on year. This year was no exception. Topics such as bearings, converting metric and Imperial units, writing numbers as fractions or percentages of other numbers, and perimeter, area and volume have a great need for improvement. Other topics that are specific to units and/or tiers are listed in the individual unit reports.

Similarly, there are skills that are also lacking across tiers, such as non-calculator methods, e.g. multiplying and dividing large numbers and decimals, and calculator methods, especially when working with time.

What is also evident is how little time many candidates spent learning facts and rules in preparation for these examinations. These include metric to Imperial conversions, formulae for perimeter, area and volume of shapes.

There was also evidence of candidates not using the calculators to their full potential on the calculator-allowed papers. There is a difference between showing your working and using non-calculator methods to carry out calculations. Candidates should remind themselves of this difference before taking these examinations.

Candidates are also reluctant to annotate diagrams to help them answer questions, e.g. marking missing lengths on diagrams in perimeter, area and volume questions.

There are some topics and skills that show some improvement compared with previous series. These include ratio (at intermediate and higher tier), reading and interpreting scales on graphs (all tiers), money problems and exchange rates (as long as there is no change of unit involved) and understanding how surveys should be carried out.

Areas for improvement	Classroom resources	Brief description of resource
Fractions, decimals and percentages	Mathematics - Educational Resources - WJEC	Number – knowledge organisers
	percentages.pdf (wjec.co.uk)	Knowledge organiser
	Fraction and percentage of an amount - Blended Learning	Blended learning lessons
Area, perimeter and volume	Mathematics - Educational Resources - WJEC	Geometry and Measures – knowledge organisers
	area-perimeter-dimensions-and-volume.pdf (wjec.co.uk)	Knowledge organiser

	Area and perimeter, dimensions and volume - Blended Learning	Blended learning lessons
Units of measurement	Mathematics - Educational Resources - WJEC units-of-measurement.pdf (wjec.co.uk)	Geometry and Measures – knowledge organisers Knowledge organiser
	Units of Measurement - Blended Learning	Blended learning lessons

MATHEMATICS – NUMERACY

GCSE

Summer 2023

UNIT 1 FOUNDATION TIER

Overview of the Unit

Many candidates attempted most questions. Performance was generally as expected from the candidates at foundation level. As candidates cannot use a calculator in this unit, errors in basic number work hindered many candidates. Candidates were more successful with the earlier questions than with the later questions in the paper, as is expected. However, some candidates did manage to gain a few marks in the later questions.

Key areas for improvement include the following:

- Finding a percentage of a quantity.
- Expressing a quantity as a fraction of another quantity.
- Working with units of money without place value errors.
- Non-calculator methods of subtraction, division and multiplication, including where numbers are multiples of 1000, 10 000 or similar.
- Determining a common amount for comparison in a best buy context.
- Working with comparing and converting metric and imperial units.
- Working with perimeter and area.

The following topic areas were generally well-understood or well-answered:

- Reading and interpreting scales on graphs
- Understanding the size of numbers.
- Understanding the importance of location, distribution and the target audience when carrying out surveys.

Comments on individual questions/sections

When a question or part-question is not listed, there are no areas to highlight.

Question 1

It was evident in Question 1(a) that some candidates do not fully understand place value. Errors in reading the number 1300000 ranged from thirteen million to one million three thousand.

Although Question 1(b) was generally well answered, the most common incorrect answer was 25, where candidates had counted the year 1999.

In Question 1(c)(i), many candidates rounded to the nearest 1000 or even nearest 10000 rather than the nearest 100.

In Question 1(c)(ii), many candidates thought that $1\text{m} = 10\text{cm}$ or $1\text{m} = 1000\text{cm}$ and those who did know the correct conversion did not multiply correctly.

In Question 1(c)(iii), many candidates knew that they needed to multiply 90 by 60 but basic numerical errors dealing with zeros meant that they did not gain the accuracy mark. Some multiplied 90 by 6 instead of multiplying by 60.

Even though the conversion was given in Question 1(c)(iv), many candidates failed to work with it. Some candidates only wrote 10 miles is about 16 km and did not compare to the 18km, very few candidates stated that 24kms are approximately equal to 15 miles or even found how many miles were approximately equal to 18kms. A small proportion of candidates just multiplied 8 and 5 and gave the answer of 40. Comparing and converting both metric and imperial units is an area for improvement.

Question 2

In Question 2(a)(i), many candidates were able to calculate $40 \times 5 = \text{£}200$ but errors in basic multiplication were evident with some candidates. Many candidates struggled with finding 25% of $\text{£}200$ and, those who did, sometimes did not subtract it to find the cost of the boxes with the discount. Several candidates just subtracted 25 from 200 to give a final answer of $\text{£}175$.

In Question 2(a)(ii), many candidates only gained 1 mark for $\text{£}160$. Errors occurred with the interpretation of buying 20 boxes with the special offer of 2 boxes for $\text{£}13$. A frequent common error was to state that these boxes cost $\text{£}260$ rather than $\text{£}130$. Follow through marks were available to candidates but some did not find the profit and gave their final answer as the total cost of the 40 boxes.

Many candidates gained at least one mark in Question 2(b). The most common errors were only selecting one panel with dimensions equivalent to 35cm by 40cm and selecting 2 panels equivalent to 180cm by 40cm, even though candidates were told the cuboid did not have a lid. Some candidates did not engage with the dimensions equivalent to 40cm by 35cm at all, only selecting panels that had a measurement equivalent to 180cm.

Many candidates engaged well with Question 2(c). However, errors were made with only counting the area within the shape and not multiplying by 4 or counting some of the area but not engaging with parts of the squares, which meant that their area was outside of the given range, but they then did multiply by 4. Some candidates counted the whole 12 by 8 grid and multiplied this by 4 and some candidates tried to engage with the perimeter of the shape rather than the area within the shape.

Question 3

In Question 3(b), those candidates that were able to subtract accurately did not always round their answer to the nearest thousand. Many candidates at foundation tier knew that they needed to subtract but set up their subtraction incorrectly and just subtracted the smallest digit from the largest digit for each of the place values.

In Question 3(d), many candidates gained 1 mark for listing the places, but many missed out the headings for the tallies and/or the frequency. Some stated the heading for the frequency as the most popular destination.

Question 4

Most candidates did not compare one common quantity, such as using 10 ml, and did not make comparisons in pairs, such as small with medium and then medium with large. Most candidates calculated the difference in price between each size or just doubled each value and then compared. For those that did find the cost for 10ml or 1ml, errors were often seen in division. Areas for improvement are accurate division and understanding how to find the best buy.

Question 5

In Question 5(a), a common error was to subtract the given percentages, leading to an incorrect response of 33%.

In Question 5(b), many candidates often gave their answer as 34%, $34/100$ or even $\frac{3}{4}$. This is an area for improvement at foundation tier.

In Question 5(e), most candidates did not know an appropriate non-calculator method to calculate 11% of 743. Many either subtracted 11 or divided by 11. Those candidates that worked with the method of finding 10% + 1% did not always use the full decimal values and rounded their 10% and 1% values. Areas for improvement are non-calculator methods of finding a percentage of a quantity.

Question 6

In Question 6(a)(ii), many candidates worked with $80 \times \text{£}240$ rather than each section of the Venn diagram. Some candidates were able to gain 1 mark, usually for working with 10×180 and 30×60 . Those who did use the correct method sometimes made errors with their multiplication. This is an area that needs improvement.

In Question 6(b)(i), a number of candidates did not engage with the visual situation and did not extend the given diagram, often just drawing the same diagram underneath the original one, which then led to an incorrect answer of 4 couplings. Candidates should be encouraged to continue diagrams so that they can visualise diagrams in a context.

In Question 6(b)(ii), the most common incorrect answer seen was $C = 2P$.

Question 7

Many candidates did not fully understand the given information that the height is twice the width and consequently gave the width as 20cm not 5cm. Most candidates worked with partial perimeter thus showing that they were unable to distinguish between perimeter and area. When working with the costs, many candidates did not work with 50p for 2 cm² and only multiplied 'their area' by 50p or just divided 'their area' by 2.

Question 8

In Question 8(a), some candidates stated that Q1 was not relevant and noticed that there were overlapping boxes or there wasn't a given time, such as days, weeks etc in Q2. Many candidates made statements such as 'children don't know the distance to school' or 'they do not walk to school' or 'there are no option boxes' for Q1. For Q2, many said that children do not like or play board games.

Question 9

In Question 9(a)(iii), many candidates gave the answer as 18km rather than 15km, not realising that the canal boat was not returning to Llangollen.

Bearings continue to be a difficulty for foundation tier candidates and a variety of incorrect answers were given in Question 9(b). One of the most common incorrect answers was 120°, where candidates thought they needed to give the bearing of Chirk Castle from Llangollen.

Question 10

In Question 10(c), most candidates drew their line of best fit not fitting the trend, usually by joining the first and last points or from corner to corner. Many also just joined the points up.

MATHEMATICS – NUMERACY

GCSE

Summer 2023

UNIT 1 INTERMEDIATE TIER

Overview of the Unit

Most candidates attempted all questions. In many aspects, performance was generally as expected. Candidates were more successful with the earlier questions than with the later questions in the paper, as is expected.

Key areas for improvement include the following:

- Expressing a quantity as a fraction or percentage of another quantity.
- Working with units of money without place value errors.
- Understanding the nature of utility bills.
- Non-calculator methods of division and multiplication, including where numbers are multiples of 1000, 10 000 or similar.
- Visualising and interpreting information, annotating or sketching diagrams to aid understanding. This includes splitting composite shapes to find the area and interpretation of 3D solids to find the area of cross-section.

The following topic areas were generally well-understood or well-answered:

- Reading and interpreting scales on graphs, such as on scatter diagrams and travel graphs.
- Finding a share of an amount from a given a ratio.
- Determining a common amount for comparison in a best buy context.
- Understanding that the importance of location, distribution and the target audience when carrying out surveys.

Comments on individual questions/sections

When a question or part-question is not listed, there are no areas to highlight.

Question 1

The majority of candidates compared one common quantity, such as 10 ml, rather than make comparisons in pairs, such as small with medium and then medium with large. Where errors were seen they were usually in division or with place value. Areas for improvement are accurate division and careful consideration of place value.

Question 2

In Question 2(a), a common error was to subtract the given percentages, leading to an incorrect response of 33%.

In Question 2(e), a number of candidates did not show a non-calculator method to calculate 11% of 743 and a number of candidates did not give their response as a whole number. Successful candidates worked with the method of finding 10% + 1%. Areas for improvement are non-calculator methods of finding a percentage of a quantity and considering the accuracy required for an answer in light of the context.

Question 3

In Question 3(a)(ii), although many candidates engaged with some of the information from the Venn diagram, other candidates omitted costs for the intersection. Successful candidates often found the total number of baths and of taps initially, thus having fewer products to calculate. A main error in this part of the question was with place value when calculating products of tens. This is an area that needs improvement.

In Question 3(b)(i), a number of candidates did not engage with the visual situation, consequently doubling, to give an incorrect answer of 6 couplings. Candidates need to be able to visualise the continuation of patterns in order to improve understanding of interpreting diagrams of situations in real-life contexts; successful candidates were able to do this without the need for further sketches.

Question 4

In Question 4, many candidates worked in pounds and understood at least some of the stages, such as finding the sum of the cost of electricity and the standing charge or the need to calculate 5% VAT. However, there were many errors, which are areas for improvement in the future. These include knowledge that VAT is added on and not subtracted from all charges, which is better done once after a total charge is calculated, rather than separately for the electricity cost and the standing charges, as there are fewer opportunities for error.

Also, the standing charge should not be ignored. A common error was to omit the standing charge. Also, when working with sums of money, giving units in each of the different stages of working is often helpful in preventing place value errors, such as working in pence to calculate the electricity cost as 12800 then using this answer as £12800 in later working. Consequently, improvement is needed in understanding how utility bills are calculated, including a standing charge, that may be calculated daily or monthly, and adding VAT.

Question 5

Some candidates demonstrated that they were unable to distinguish between area and perimeter; this knowledge is key to understanding. Some candidates calculated the perimeter or partial perimeter and found the cost of this, disregarding that the units given for the cost were in cm^2 . Some candidates found the cost of the full rectangle and other candidates did not consider the dimensions of their composite shapes. Successful candidates split the 'L' shape into two rectangles and annotated the lengths and widths of each of their two rectangles on the diagram. A number of candidates seemingly resist annotating on diagrams.

Question 7

Many candidates engaged well with the requirement to apply knowledge of ratio and percentages. However, fewer candidates had knowledge of how to express an amount of money as a fraction of another amount of money. A number of candidates did not attempt to find this fraction. Some expressed the amount given to charity as a fraction of the whole £2700 shared initially and a few candidates attempted to make a guess at an approximate fraction. The concept of expressing a quantity as a fraction of another quantity is not well understood and is an area for improvement.

Question 9

In Question 9(c)(i), of the candidates attempting to answer the question, many of them started by dividing by 2. Some candidates did write that they intended to divide 1 500 000 by 120, or by 2 then by 60, but many candidates made errors in calculation, including from not knowing times tables or place value in working with a large number.

In Question 9(c)(ii), successful candidates were able to convert litres to cm^3 , visualise a cuboid with a rectangular cross-section and hence use the information given for the length and capacity to find the area of the cross-section. However, there were few candidates who engaged with all of these stages. A common error was to find the product of the length and the capacity, rather than divide, often combined with incorrect conversion of litres to cm^3 . Many candidates thought 1 500 000 litres required division by 1000 or 10000 to convert to cm^3 , rather than multiplication by 1000. Clearly an area for improvement is knowledge that 1 litre is 1000 cm^3 and to be able to apply this knowledge in conversions. Visualising a reverse problem, thinking about the information given, is also an area for improvement, with guidance that annotating diagrams can aid understanding.

Question 10

In Question 10(a), although some candidates did not have a strategy to express a quantity as a percentage of another quantity, an issue came earlier on in engaging with the stages and context of the problem. A number of candidates did successfully calculate the quantity of sugar, but then decided incorrectly to subtract this from the 300g of chocolate spread thinking that the cocoa was $\frac{1}{8}$ of this remaining amount; not reading and interpreting the information given carefully. Reading and interpreting each element of information is a skill that needs improvement.

In Question 10(b), the vast majority of candidates who attempted this question reduced 840 g by 20%, rather than thinking of 840 g as 120%. This concept is not well understood and is an area for improvement.

Question 11

In Question 11(a), a number of candidates ignored the cumulative frequency graph. Instead they halved the height of the graph paper to give an incorrect response for the median.

In Question 11(b), there was evidence of engagement with the question and an improvement in performance compared with similar questions in the past. However, a number of candidates either calculated that 90% of 60 was 54 employees or they stated that 57 employees had logged on by 9:01a.m. but did not interpret their statement to show that the policy was met.

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UNIT 1 HIGHER TIER

Overview of the Unit

As expected, candidates performed better in the first half of the paper compared with the second half. Candidates' performance on some questions assessing the same skills as in previous series was a little lower. This was possibly in part due to the questions themselves being slightly more challenging. However, marks were lost by many candidates in nearly all questions throughout the paper due to arithmetical errors in performing basic calculations with decimal numbers and large numbers.

Key areas for improvement include the following:

- Performing multiplications and divisions with large numbers and decimal numbers.
- Performing calculations with numbers in standard form.
- Working with the volumes and areas of similar shapes.
- Calculating the area of a complex shape by splitting it into basic shapes.

The following topic areas were generally well-understood or well-answered:

- Working with box-and-whisker plots.
- Sharing in a ratio.
- Calculating percentages of amounts.
- The upper and lower bounds of measurements.

Comments on individual questions/sections

When a question or part-question is not listed, there are no areas to highlight.

Question 1

The vast majority of the candidates showed a good understanding of working with a ratio, and most showed they could calculate 24% of 1200 successfully. Nearly all knew a correct method for this calculation, but some made careless slips. A mark was lost by many in cancelling the fraction $\frac{288}{1500}$ down to its simplest form, with many giving their final answer as $\frac{72}{375}$.

Question 2

Part (a) was not answered that well. The question partly assessed metric conversions, and this topic was a source of error for many later in part (b)(ii). The main common error was choosing 1:1000 but all other incorrect options were also chosen.

In part (b)(i), many realised they needed to divide 1 500 000 by 120. Some did it in stages, dividing by 2 and by 60, and more success was seen by those that chose this method. Many made mistakes with their divisions, however. Some did not cancel zeros to ease the arithmetic, and of course this resulted in larger remainders working through the division. Others disappointingly showed divisions but did not know how to perform them.

Part (b)(ii) was answered poorly, with very few fully correct answers. Some correctly converted the number of litres into cm^3 , but then didn't convert the 300 m into cm so that the area in cm^2 could be calculated. Many knew they had to divide the capacity by the length, but few used correctly converted measurements. Quite a number of candidates used an incorrect method or didn't attempt the question.

Question 3

In part (a), most candidates calculated the masses of each ingredient using the information in the question, but a significant number chose to convert the fractions given in the question into percentages, which was a more efficient method to arrive at the percentage of palm oil. Some made errors in calculating $\frac{4}{5}$ of 37.5 g (or $\frac{4}{5}$ of 12.5%), and others did not know how to generate the percentage required if they worked with masses rather than percentages. Most candidates gained marks here by showing they knew how to work out 58% and $\frac{1}{8}$ of an amount accurately. Some misunderstanding of the question was seen, with some calculating $\frac{4}{5}$ of 300 rather than $\frac{4}{5}$ of 37.5.

In part (b), those who knew the correct method generally went on to gain full marks, although as usual with reverse percentage questions, some incorrectly thought that subtracting 20% of 840 was the method required. It was answered reasonably well on the whole, which was pleasing. Some gave us the initial correct statement that $840 = 120\%$ but then did not know a correct method to arrive at 100%.

Question 4

In part (a), many incorrectly took a reading from 35 on the cumulative frequency axis rather than 30. This was due to the numbering on this axis going up to 70.

Part (b) was generally well answered, with most gaining the majority of marks.

Question 5

Not much success was seen in part (a) of the question, as candidates are generally not aware of how the first 'person' should be chosen using systematic sampling.

Part (b) was answered quite well, although it was clear that many candidates were not aware of the method of systematic sampling.

Question 7

In part (a)(i), the majority of candidates knew the correct method to arrive at the least possible volume of a carton, but it was disappointing to see the number who could not correctly calculate 40×12.5 .

In part (a)(ii), the majority used the correct upper bound for the flow rate of soft drink into the cartons in their calculations. Some however did not realise the need to divide by the least possible volume of a carton. Again, a number of candidates made arithmetical errors in their calculations.

In part (b), most candidates knew they needed to start by dividing 960 by 20. Some incorrectly thought that $2 \times$ the side length squared was equal to 48. A number of fully correct simplifications of the square root were seen, but it was evident that many did not know the correct method required to do this step.

Question 8

Part (a) was very poorly answered, and not many correct approaches were seen. Many did not approximate the 1.7×10^{-24} , and a considerable number thought they needed to multiply rather than divide.

More success was seen in part (b), but many were unable to successfully manipulate the standard form numbers to a form where all numbers had the same power of 10, thus enabling easy addition.

Question 9

Both parts of this question proved difficult for most candidates. In part (a), many did not form an equation, or they used the volume of a full sphere rather than a hemisphere. Working correctly with the fractions on either side of the equation also caused problems, and some used r^2 in their equation, with no credit given to these candidates as the formula is given to them on the formula sheet at the front of the paper.

In part (b), the volumes of the similar shapes were given as a ratio, and this proved difficult to work with for many candidates. The two ratio numbers were cube numbers, and therefore cube rooting them gave the ratio of the lengths in the two shapes, but few candidates knew that this was the initial step required.

Question 10

In Question 10(a), many candidates just used distance = speed \times time, i.e. distance = 20×40 , in part (a)(i) and then used similar incorrect work in part (a)(ii). Quite a few candidates who showed correct work in part (i) did not attempt part (ii), showing they had not worked out a correct strategy that would get them to the total journey time. A number of candidates correctly calculated the time the train was at 20m/s but then forgot to add 120 seconds to find the total time for the journey.

A number of candidates did not attempt Question 10(b), while some showed some understanding of having to multiply by 10 or 100 or 1000, but nothing more. The fact that the recurring decimal was greater than 1 caused difficulty possibly, as some did not give a mixed number as their final answer.

Question 11

A number of candidates used an incorrect formula for the area of their triangles if they chose to involve them in their area calculations. Few chose to efficiently split the octagon into a rectangle and two congruent trapeziums. Some also incorrectly had pi in their calculation for the volume of a cone, not realising that 800 was the value of $\pi \times \text{radius}^2$. It was clear though that a number of candidates had no idea of how to tackle this problem.

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Summer 2023

UNIT 2 FOUNDATION TIER

Overview of the Unit

Many candidates attempted most questions. In many aspects, performance was generally as expected; although candidates were not always more successful with the earlier questions than with the later questions in the paper, as is usually expected.

Key areas for improvement include the following:

- Calculator methods of working with time, including fractions of hours.
- Understanding and using distance charts.
- Knowing the difference between perimeter and area of rectangles.
- Taking note of units given in the question, considering the need to convert units.
- Finding a percentage of a quantity with a calculator.
- Expressing a quantity as a fraction or percentage of another quantity.
- Reading and interpreting conversion graphs that do not start at (0,0)

The following topic areas were generally well-understood or well-answered:

- Substitution into a word formula.
- Working with money problems where all costs are in pounds.
- Finding the mean of a set of numbers.

Comments on individual questions/sections

When a question or part-question is not listed, there are no areas to highlight.

Question 1

It was disappointing to see that many candidates could not interpret a distance chart correctly in Questions 1(a) and 1(b). Because of this, many candidates did not find the correct 4 distances to add together in part (b). Follow through marks and special case marks were available to allow for some credit of the work that candidates had shown. A common incorrect answer was for a total of 615 miles from adding all 6 distances.

Question 1(c) was well-attempted, but errors were often made with finding the time taken to climb Pen y Fan. This time was often given as 2 hours 55 minutes and when adding it to the other correct times, candidates often gave the answer of 12 hours 5 minutes (the correct answer for the question) but from incorrect working. Adding times, especially when going past 1 hour is an area for improvement. Candidates often used a traditional adding method for time and hence came to the wrong final answer.

In Question 1(d), changing of units from metres to km (or vice versa) hindered candidates. The most common error was that some candidates changed 10050m into 10.5km rather than 10.05km.

For those candidates that knew how to calculate the 'mean' in Question 1(e), most gained all 3 marks. Some candidates found the median value and some just added the 9 values and did not divide by 9.

Question 2

In Question 2(a), many candidates confused perimeter and area with most finding the area of the base of the large kennel. Some candidates only worked with partial perimeter and a common incorrect answer was 7.8cm.

Candidates appeared to like Question 2(b). Errors occurred with Finbar or Sirius being placed in Kennel 1 which meant that candidates confused factors with multiples and confused even and odd square numbers. When Sirius was placed in Kennel 1, Howard and Eric were often placed in Kennel 7.

Question 3

Candidates who could calculate a percentage of a quantity correctly with a calculator usually gained at least 2 marks in Question 3. Many candidates did not know a correct calculator method for finding a percentage of a quantity and this is an area that needs improvement. It was good to see that some candidates correctly found 5% of 27000 instead of dividing by 20 to find the pension scheme contribution. Even though the question clearly stated 4% of his salary and $\frac{1}{20}$ of his salary, several candidates subtracted 5105 from 27000 and then attempted to find 4% and $\frac{1}{20}$ of this difference. Other errors included using their student loan repayment and dividing by 20 to find the pension scheme contribution. The marking scheme included several special case marks to award those candidates who knew how to find 4% and $\frac{1}{20}$ but not of 27000.

Question 4

In this question, the most common error was to work with 4 tables and 12 chairs which was double one of the given diagrams. Other errors were working with 16 or 24 chairs. Some candidates only found the cost for the 4 tables and 'their number of chairs' but did not add the 2 costs together. Those that drew the correct diagram usually gained all 5 marks.

Question 5

In Question 5(b), nearly all candidates did not consider that the straight line did not pass through the origin. Most candidates thought that the given statement was actually correct.

Question 6

In Question 6(a)(i), most candidates did not work with $2\frac{1}{4}$ hours correctly. Many candidates were able to gain 1 mark for multiplying 'their time' by 90.

In Question 6(a)(ii), many candidates who ticked the correct boxes did not show evidence for their answer.

In Question 6(b), some candidates were able to calculate the cost of the phone call by dividing by the correct exchange rate or giving an embedded answer of £15. However, some multiplied by the exchange rate. Very few candidates had a strategy to find the length of time for the call with some calculating $30 \div 15$.

Question 7

In Question 7(a), common errors included: not considering that a twin room was for two people in Gwesty Arwel; not considering the number of nights, especially for Gwesty Arwel or even trying to find the cost of 8 nights for both hotels; ignoring the discount available or not being able to calculate 14% correctly at Gwesty Arwel; and considering only 18 people for twin rooms in Hotel Glan y Môr. Some candidates found the individual costs for 1 night at Hotel Glan y Môr but did not add them, meaning that they lost marks.

In Question 7(b), a common error was to use 32474 km, 33860 km or even $32474 + 33860$ as the distance travelled. Some candidates multiplied by 4 rather than divided by 4. However, several candidates did gain either 2 marks for finding the cost of 'their kms' or gained all 5 marks.

Question 8

In Question 8(a), several candidates were able to gain 1 mark for adding the correct girls' or boys' values. Errors did occur with reading some of the frequencies. Some candidates only stated that there was one more boy compared to the number of girls or that the bars looked higher in the boys' frequency diagram.

In question 8(b), nearly all candidates did not have the knowledge of how to express one quantity as a percentage of another. Most did not even write the values as fractions. Several candidates stated that there were 4 girls and 3 boys and stated the difference was 1%.

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UNIT 2 INTERMEDIATE TIER

Overview of the Unit

Most candidates attempted all questions. In many aspects, performance was generally as expected. Candidates were more successful with the earlier questions than with the later questions in the paper, as is expected.

Key areas for improvement include the following:

- Calculator methods of working with time, including fractions of hours.
- Taking note of units given in the question, considering the need to convert units, including lengths and areas and giving units in answers.
- Expressing a quantity as a fraction or percentage of another quantity.
- Understanding the nature of grouped data and that extracting exact raw data is not possible from grouped data.
- Using multipliers with indices when working with compound increase (or decrease) problems.
- Using and applying knowledge of right-angle triangle trigonometry.
- Visualising and interpreting information, annotating or sketching diagrams to aid understanding. This includes visualising nets of 3D shapes.

The following topic areas were generally well-understood or well-answered:

- Applying knowledge and skills to solve a right-angle triangle problem, in particular with the application of Pythagoras' Theorem.
- Reading and interpreting scales on graphs, such as on conversion graphs and frequency diagrams.
- Using exchange rate information, converting currency.
- Working with money problems where all costs are in pounds.
- Finding the cost of fuel, given the cost per litre, for a number of litres.

Comments on individual questions/sections

When a question or part-question is not listed, there are no areas to highlight.

Question 1

In Question 1(b), many candidates did not consider that the straight line did not pass through the origin, a common incorrect answer was 200°F.

Question 2

In Question 2(a)(i), a number of candidates did not know how to calculate the cost of a phone call for the quarter hour after working correctly with finding the cost for 2 hours. This is an area for improvement. A number of candidates incorrectly used the cost of 90p as per hour rather than per minute.

In question 2(b)(ii), many candidates were able to calculate the cost of the phone call but demonstrated no strategy to find the length of time this call lasted by referring back to the initial table.

Question 3

In Question 3(a), common errors included not considering the number of nights, not considering that a twin room was for two people in Gwesty Arwel, considering only 18 people for twin rooms in Hotel Glan y Môr and ignoring the discount available at Gwesty Arwel.

In Question 3(b), a common error was to use 32474 km or 33860 km as the distance travelled. However, many candidates approached the stages of solving this problem correctly and were successful in calculating the cost of the fuel.

Question 4

In Question 4(b), a number of candidates used 1.34 miles as 1340 metres, considering 1.34 miles to be kilometres rather than miles as stated. Taking due care with units given in a question is an area for improvement.

Question 5

In Question 5(b), a number of candidates did not have knowledge or skills to express one quantity as a percentage of another. Expressing one quantity as a fraction or percentage of another quantity is an area for improvement.

Question 6

In Question 6(a)(ii), a number of candidates did not demonstrate understanding that exact raw data could not be extracted from grouped data. The understanding of the nature of grouped data could be improved.

Question 7

In Question 7, many candidates did not compound the increase, they calculated the initial 36 extra steps and considered this as the increase for each of the 28 days. The use of a multiplier was rarely seen. This is an area that needs improvement. A number of candidates attempted to work day by day.

Question 8

In Question 8(b), a number of candidates realised they needed to calculate the area of an A2 sheet of paper but did not consider the units of their answer. Some candidates correctly attempted to multiply by 120, but did not consider the units, g/m^2 . Often there was no attempt to convert either the length and width into metres or the area into m^2 . Many other candidates incorrectly decided to divide by 120, whilst other candidates tried trial and improvement methods instead of multiplication. Working with units given in the question and giving units for a stage of working calculation are areas for improvement.

In Question 8(c), candidates used different methods and there were some good examples of using a variety of skills in solving a problem. Candidates had good knowledge and understanding of the application of Pythagoras' Theorem.

In Question 8(d), many candidates did not consider bounds.

Question 9

In Question 9, a number of candidates demonstrated little secure knowledge of trigonometry. A number of candidates incorrectly decided the missing length of the cuboid was the diagonal of the label, 17.5 cm or 19 cm. Of the candidates with some knowledge of trigonometry, often notation was poor, or knowledge was insecure. Right-angled triangle trigonometry is an area for improvement.

Question 10

In Question 10, a common incorrect response was $2.5 \times 0.18 = 0.45$, as many candidates had no idea of the concept of the curved surface area of a cylinder. A few candidates attempted a 3D sketch the chimney and annotated their sketch with information given in the question but made no progress. Visualising the net of a cylinder would aid understanding. Visualising 2D and 3D situations are areas for improvement

MATHEMATICS – NUMERACY

GCSE

Summer 2023

UNIT 2 HIGHER TIER

Overview of the Unit

As expected, candidates performed better over the first half of the paper compared to the second. Candidates performed well on some of the standard Unit 2 topics throughout the paper but could have performed better on others. Also, there were some quite challenging questions towards the end of the paper that candidates found difficult.

Key areas for improvement include the following:

- Knowing the conversion 1 mile = 1.6 km.
- Rearranging the formula for arc length to calculate an angle.
- Knowing the link between nominal annual rate and actual monthly rate that would be applied for savings accounts.
- The method of random sampling using a list of random numbers.

The following topic areas were generally well-understood or well-answered:

- Repeated percentage increase.
- Length of similar shapes.
- Pythagoras' theorem.
- Right-angled triangle trigonometry.

Comments on individual questions/sections

When a question or part-question is not listed, there are no areas to highlight.

Question 1

Candidates who knew the conversion 1 mile = 1.6 km generally went on to gain nearly all the marks in this question. The vast majority of candidates knew that they needed to convert the length of Southend Pier from miles into metres, but many didn't know the correct conversion, and therefore marks were lost. It was disappointing that candidates did not perform so well in the Organisation and Communication strand here compared to Unit 1. Most gave a conclusion as to what time Gareth reached the end of the pier, but few labelled the length of the pier in km or m, or the time taken by Gareth to walk it.

Question 2

In part (a)(i), most gave the correct group that contained the median but less success was seen for a correct reason why the median was in this group. Reasons either usually said this group contained the 14th or the 13.5th musician, with the latter being allowed.

Part (b) of this question assessing the estimate of the mean was quite well answered, but this should have been a straightforward 4 marks for higher tier candidates, and therefore it was disappointing to note that quite a number of candidates did not know the method required here.

Question 3

This question was answered well on the whole. Some candidates lost a mark by not rounding their answer, but some did not recognise this as being a repeated percentage increase and just multiplied 2% of 1800 by 28 and added it on to 1800.

Question 4

In part (b), nearly all candidates knew they needed to calculate the area of an A2 sheet, and many knew it needed to be converted into m^2 . However, as witnessed on Unit 1, a large number of these candidates failed to correctly convert units. Credit was given to those that multiplied their area by the paper quality, but some candidates thought division was needed in this final step.

In part (d), many fully correct answers were seen, but a considerable number of candidates misread the question in that they attempted to calculate the greatest possible perimeter of a different-sized sheet of paper, other than A1.

Question 5

It was pleasing to see many fully correct answers here, showing candidates had a good understanding of right-angled triangle trigonometry and knew what was required to enable them to calculate the volume of the cuboid. Some made errors with one triangle, others arrived at the length by first finding the heights of the triangles, and some incorrectly thought that using Pythagoras' theorem to find the diagonal of the label would give them the length of the cuboid.

Question 6

Few fully correct answers were seen for the curved surface area of the cylinder. Many did not give a correct calculation, with a number thinking that the area required was rectangular with dimensions 2.5 m by 0.18 m. Some who did give a correct calculation incorrectly went on to add one or two circular ends. A final source of error was seen with many rounding their answer to 3 decimal places rather than significant figures.

Question 7

In part (b), a number of candidates knew how to calculate the percentage required, but errors were seen in the calculation of how many months of rainfall there were above 60 mm in the group $50 \leq r < 75$ mm. Relatively few fully correct answers were seen.

Question 8

Part (a) was answered quite well, with candidates showing a good understanding of how to calculate a sector area.

Part (b) required rearrangement of the arc length formula, and far less success was seen here. More incorrect formulas were seen, with some thinking that the sector area formula was needed again. Some who performed their calculation in stages rounded prematurely meaning their final answer was outside the acceptable range.

Part (c) required candidates to visualise an unfamiliar scenario and give a reason for why the sprinkler arm delivers water at a faster rate the further out you go along the sprinkler. It was pleasing to see that many candidates correctly gave reasons that implied the outer part of the arm covered a greater area compared to the inner part of the arm, and therefore the increased rate was required to produce an even watering of the circular area.

Question 9

Very few fully correct answers were seen in part (a), with many thinking that compounding the nominal annual rate was required.

Slightly more success was seen in part (b), where candidates needed to substitute values into the AER formula given on the formula sheet. It was evident however that a number of candidates were unaware of what was required here.

Question 10

In Question 10(a), it was good to see many correct solutions to this question involving the sine rule and the area of a triangle = $\frac{1}{2}ab\sin C$. Some decided to calculate both missing sides of the triangle and use these in their area calculation. Those that rounded their values prematurely, and by too much, ended up with a volume outside the acceptable range and lost a mark.

Question 10(b) was a challenging 3D Pythagoras' theorem question. The front view clearly showed a right-angled triangle and the majority of candidates worked with this successfully. Many though either did not realise the need to work in a second plane or used an incorrect length in this second plane, either using the 3 m or the 2 m.

Question 10(b)(ii) proved to be another challenging question possibly due to the shape being an unfamiliar one. Many candidates gave correct expressions for one or both of the curved surfaces, but less success was seen with the calculations for the semicircular arcs. A number subtracted the area of circles in their calculations but forgot to divide by 2.

Question 10(c) was poorly answered, and it was clear that many candidates were unaware of the method of random sampling using a list of random numbers. For those that did know the method, most did not tell us how they were going to number the tiles and they also failed to state that 0000 would be ignored.

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ⁱ *Please note that where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.*