GCSE EXAMINERS' REPORTS

GCSE (NEW)
MATHEMATICS

SUMMER 2019

Grade boundary information for this subject is available on the WJEC public website at:
https://www.wjecservices.co.uk/MarkToUMS/default.aspx?l=en

Online 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.

Annual Statistical Report

The annual Statistical Report (issued in the second half of the Autumn Term) gives overall outcomes of all examinations administered by WJEC.

MATHEMATICS

GCSE (NEW)

Summer 2019

UNIT 1 FOUNDATION TIER

General Comments

The number of candidates sitting this paper was similar to those in previous summer series. The questions were a fair test for Foundation Tier candidates.
Candidates were confident with attempting questions at the beginning of the paper, and many maintained this effort even with the more challenging questions towards the end of the paper. These were the questions common to the Intermediate Tier paper and included a number of multi-step questions.
Some topics are more challenging for Foundation Tier candidates. In this paper, these included:

- rounding a number to a given number of decimal places,
- dividing a decimal by 1000,
- calculations involving fractions,
- solving equations of the type x/a = b,
- solving equations where the variable occurs twice,
- using areas to solve a problem.

Comments on individual questions/sections

Q.1 **(a)** Candidates found this standard addition calculation easy to engage with but there were a number of errors in arithmetic.

(b) The sum to do the calculation was usually set out appropriately as

$$\begin{array}{r} 700 \\ -\ \underline{532} \\ \underline{} \end{array}$$

However, this subtraction was found to be challenging for very many candidates. A common wrong answer was 232. Subtracting a number from zero also caused difficulties. Counting on from 532 to 700 might have proved an easier, alternative method.

(c) Not all candidates remembered that 1 is a factor of every number and it was often left out. Frequently, 7 wrongly replaced 9 as a factor.

Q.2 **(a)** Showing evidence of counting the squares, even just by marking some with dots, earned the first mark. However, a number of candidates missed the acceptable range of values by not finding a way of including the partly-covered squares.
To gain the W mark, the candidate had to show a calculation giving 'their number of squares' x 5, and include the units of area, cm^2. Many did not show their calculation clearly which lost them this mark even if they had included the units.

(b) Very many candidates were able to reflect the given shape correctly.

Q.3 Both parts of this question were answered very well.

Q.4 **(a)** Knowledge of the names connected with circles was not secure. Many confused a tangent with a radius or attempted to draw a tangent which did not touch the circumference but cut it such that a chord was drawn.

(b) Candidates were much more confident with drawing a radius though a number of candidates wrongly drew a diameter or extended the radius outside the circle.

Q.5 **(a)** This was a challenging question for very many candidates. Writing 481·627 correct to 2 decimal places meant that the 481 remained the same and only some of the digits after the decimal point would be affected. However, candidates moved the position of the decimal point rather than considering the effect the 7 would have on the 2. There was a large collection of random answers. 481·630 was not accepted as this is written correct to 3 decimal places.

(b) The value of 8^2 is 64. Writing 8 x 8 alone did not earn the mark. A very common wrong answer was 16.

(c) The required answer to $\sqrt{49}$ is 7. So, neither 7 x 7 nor 7 x 7 = 49 was awarded the mark.

(d) Dividing 38·25 by 1000 was problematic for many. The 0 before the 3 in the answer 0·03825 was frequently left out.

Q.6 **(a)** The response to this part of the question was excellent. Almost all candidates realised that the largest sector of the pie chart represented the modal sport and that this was football.

(b) There was some confusion between finding the **probability** that the person chosen at random said that swimming is their favourite sport and the **actual number of people** who chose swimming as their favourite sport. The answer could have been found by either realising that the sector for swimming was a quarter of the circle so giving the probability immediately as 1/4, or by using the angles which gives 90/360, or the number of people which gives 15/60.

(c) Candidates found this part easier to answer and were generally correct in working out the number of people liking tennis to be 15.

(d) The first step necessary before drawing the bar chart was to choose a suitable uniform scale for the vertical axis. This gained the first mark and needed to begin at 0. Both the axes needed to be labelled for the second mark. Candidates mostly named the sports beneath the bars, but very many forgot to label the vertical axis. This label could be ‘frequency’ or ‘number of people’. The third mark was awarded for drawing the correct heights of the bars. A common mistake with drawing the bars was making the height of the football bar 60 which was impossible as this was the total number of people in the survey. The height for football should have been 30, with the heights of both tennis and swimming being 15.

Q.7 This question was challenging for very many candidates.
The most common method used to find how many of the small rectangles fitted into large rectangle, was to work out how many would fit across the large rectangle and how many would fit down it. Five fit across the top and three fit down the side. To find the total number, then 5 x 3 needed to be calculated. Very many candidates, however, wrongly worked out 5 + 3.
To award the organisation and communication mark, it was necessary to see the words ‘across’ and ‘down’ as well as a conclusion to their calculation.
An alternative method was to work out the areas of the rectangles and divide the larger one by the smaller one. Then, the word needed to gain the OC mark was ‘area’.
Several candidates tried to draw the small rectangles on top of the large one but were usually unsuccessful. Others confused area with perimeter.

Q.8 **(a)** There were a lot of random wrong answers to this question, some including p and some not. Candidates would probably have found it easier to work out $8p + 9p$ first and then subtract $12p$ from that answer.

(b) **(i)** Frequent wrong answers for the solution of the equation $6x = 48$ were $x = 7$ (inaccurate knowledge of multiplication tables) and $x = 42$ (subtracting 6 from 48, rather than dividing 48 by 6).

(ii) The most common wrong answer added 32 and 17.

(c) This number puzzle was answered very well.

Q.9 Many candidates found the calculations in the true/false table difficult. Not many worked out the answers in the working space provided but seemed to guess which of true and false to choose. The two questions involving fractions seemed to be particularly difficult.

Q.10 **(a)** Candidates answered this well.

(b) Many candidates found it difficult to write a full explanation. However, it was sufficient to say, ‘add frequencies’ or ‘add numbers in the table’. ‘Count’ was not accepted as it could refer to the original list of numbers.

(c) As the question asked for the probability of an event happening, then the answer should have been given as a number, not as a word, e.g. unlikely. The wrong notation for a probability, e.g. ‘8 in 25’, was rarely seen.

Q.11 **(a)** This was answered well. Very many candidates realised that each term in the sequence was found by adding 4 to the previous term.

(b) Pattern 1 is made from six rods. Every pattern after that is formed from the one before with five extra rods. Very many candidates wrongly assumed that as the first pattern was made up of six rods, then six more rods were added each time. So, for (i), the answer 22 was very frequently seen instead of the correct 21, and in (ii), the answer was given as 192 instead of 191.

(c) The rule shown by the sequence of numbers is ‘divide the previous number by 3’. Very many candidates were unable to recognise this. Some gave the answer as ‘multiply by 3’, forgetting that they must work from left to right. Others realised that the numbers were getting smaller, so they suggested subtracting a number, or several different numbers in turn.

Q.12 The rules given for answering this question were very precise: only the numbers 3 and 7 could be used, and only + and –. In turn, only the numbers 2, 8 and 19 could be made. So there needed to be some experimentation with different combinations of 3 and 7. Some candidates ignored the rules, including other numbers or multiplication sums, in particular. Some slips in arithmetic were also evident.

Q.13 This question was challenging to very many candidates. A large number did not attempt it at all. Of those who did try to answer it, most forgot to draw the rectangle enclosing the two circles of the Venn diagram so immediately lost the first mark. The Universal set was limited to the numbers from 10 to 20 but not everyone restricted themselves to using those numbers only. This caused problems for the numbers in Set B (multiples of 3) which should have been limited to 12, 15 and 18 only but often 3, 6 and 9 were included. There was a tendency to write down a particular number more than one, particularly 18 which should have been written in the intersection and A and B only. It could appear anywhere else as well. This was penalised.

Q.14 **(a)** **(i)** Equations of this type ($x/7 = 21$) lure candidates into thinking that $x = 21 \div 7 = 3$. This was a very frequent wrong answer.

(ii) Most candidates did not realise that this is an equation to be solved. They ignored the = sign completely. They seem confused by the use of the letter f, which is different from the usual x found in an equation, so the prompt of seeing an x was missing. They collected like terms together, though frequently this was done wrongly: $13f + 2 = 15f$ and $6f + 5 = 11f$ were very commonly seen.

(b) This was another very challenging question and showed gaps in algebraic understanding. The box '5n – 3 is always an even number' was ticked with the explanation: '5n – 3 = 2 which is even'. Or, the box '5n – 3 is always an odd number' was ticked with the explanation: '5 and 3 are odd'. Many candidates did not realise that they could choose different values for n which would then give both even and odd answers, so the third box should have been ticked.

Q.15 Very many candidates were not secure in their knowledge of the difference between area and perimeter. This question dealt with area only but lots of answers wrongly used the perimeter of ABCE. If their answer indicated this was their area, e.g. by writing area = …, or by using cm^2, then the final mark could be awarded for adding 14 (the area of the triangle) correctly to 'their area of the square'.
Other candidates engaged with the angles in the square despite there not being any reference in the question to angles.

Q.16 The apparent complexity of the diagram seemed to confuse candidates and they found this question very difficult to engage with. A number of different facts about angles in triangles and on straight lines needed to be used. Sorting out what was required and where it should be used, proved to be too difficult and so random familiar angles like 90° and 180° were written down as answers despite these being obviously wrong for the size of the shown angle.

Summary of key points

- There is still confusion about the difference between chance and probability. If a question asks for a *probability*, then the answer should be a numerical answer between 0 and 1 inclusive. If a question asks for the *chance* of an event happening, then a word is expected, e.g. likely.

- Candidates are not secure in knowing the difference between perimeter and area (Q7 and Q15).

- In a non-calculator paper, candidates have to use straightforward arithmetic, either in a one-step question or as a calculation to solve a longer problem. Accuracy in addition and dealing with subtraction are essential skills, as is accurate knowledge of multiplication tables.

- It is important for candidates to know the requirements of the OC mark (organising and communication skills, including labelling of steps in working and the inclusion of a conclusion) and the W mark (showing working in a proper mathematical way and including units if necessary).

MATHEMATICS

GCSE (NEW)

Summer 2019

UNIT 1 INTERMEDIATE TIER

General Comments

The number of candidates entered for this paper was higher than that of previous examinations at this level.
Overall the paper was comparable with the previous papers that have been sat and was a suitable and fair test for the candidates at the Intermediate level.
Some questions proved to be challenging.
The general performance of the candidates who sat the paper was very similar to that of candidates who were entered for previous Summer Series examinations.
It is pleasing to note a continued improvement in the responses to questions relating to topics such as probability, sequences, prime factors, quadratic graphs and in recognising bounds of numbers expressed to a given degree of accuracy.
Algebraic skills, however, still prove challenging for many candidates at this level.
Some of those questions which were common with the Higher Tier paper were not well answered.

Comments on individual questions/sections

Question	Comment
1	Only a few candidates gave the correct response to all five calculations. Most of the candidates correctly indicated that 23 – (4 + 2) × 3 = 5 was a 'TRUE' statement. A large number, however, wrongly thought that ½ of ⅛ = ¼ was also a 'TRUE' statement. Those candidates who made use of the, '*Space for working'* had a greater degree of success in identifying if the calculations were 'True' or 'False'.
2	(a) Most of those who completed the table did so correctly. The number of correct answers suggests that most candidates understood that the blue coloured ball numbered 100 (B 100) should be recorded in the 'Number ≥ 100' box. (b) A stricter mark scheme could have demanded that candidates clearly stated that the required check would be that the numbers in the table added up to 25. On this occasion a mark was awarded for simply stating that the numbers were to be added. It had to be clear that it was the table that was being used and not simply crossing out all the information in the given list. (c) Most candidates realised that the answer should be given as a fraction or decimal. 'Unlikely' is not an acceptable answer.

3	Candidates are usually adept at recognising rotational symmetry. However, in this question they were asked to complete diagrams in order to satisfy the required order of rotational symmetry. This proved to be a more challenging task for many of them. Interesting to note the success rate for each of the three parts. For parts (a) and (c) just under a half of the candidates gave a correct response. In part (b) there were fewer correct answers with several candidates opting to shade two squares that resulted in a 'line symmetry' rather than a rotational symmetry.
4	(a) Candidates were able to successfully handle the negative number aspect of this sequence. (b) (i) Most of those who did not gain a mark, either gave an incorrect answer of 22 (using 16 + 6) or an incorrect answer of 24 (using 4 × 6) (ii) The common incorrect answer being 192 (using 186 + 6). (c) One would like candidates to include the words 'the previous number' in their description, but they were not penalised if the simply stated 'Divide by 3'. A surprisingly large number gave the answer of 'Multiply by 3'.
5	The question specified that only addition and subtraction was allowed. So, writing, for example, 4 × 3 instead of 3 + 3 + 3 + 3 was not accepted. (a) The popular correct solutions were 7 + 7 – 3 – 3 – 3 – 3 and 3 + 3 + 3 – 7. (b) The popular correct solutions were 3 + 3 + 3 + 3 + 3 – 7 and 7 + 7 – 3 – 3. (c) The popular correct solutions were 7 + 7 + 7 + 7 – 3 – 3 – 3 and 3 + 3 + 3 + 3 + 7. A surprisingly large number of candidates gave the incorrect answer of 7 + 7 + 7 – 3 = 19. A number of candidates offered correct solutions to each part but with an unnecessary amount of numbers, where some of the +3s and +7s were cancelled out by −3s and −7s.
6	The first mark was for a correct presentation (two intersecting circles AND labelled A and B AND within a rectangle). Many candidates failed to gain this mark as they did not draw a rectangle to represent the universal set. Some candidates failed to gain the second mark as they had included the numbers 3, 6 and 9 in Set B. In some cases, only one of the two final marks were gained as the candidate had not shown the numbers 10, 16, 17 and 19. These numbers being part of the universal set but not belonging to either Set A or Set B.
7	(a) 2(5a − 7·5) is not an acceptable answer. (b) (i) An embedded answer (147/7 = 21) was accepted, but not if followed by a contradictory answer of x ≠ 147. Candidates should be discouraged from presenting an embedded answer. (ii) Many candidates, having accurately noted that 7f = 3, gave an incorrect final answer of f = 7/3. (c) A valid explanation required candidates to exemplify two conditions where 5n – 3 could be either an even number or an odd number depending on the integer value given for n.

8	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. A solution such as ‘ $7 \times 4 = 14$ cm^2 $7 \times 7 = 49$ cm^2 $49 + 14 = 63$ cm^2’, does not explain to the reader what is being calculated at each stage. Explanations should be given at the point in the solution when they are presented (not a series of calculations followed at the bottom of the page with a detailed explanation). Correct mathematical form is required. We do not want to see, for example, ‘CE = 14 ÷ 4 = 3·5 × 2 = 7’. Units, where appropriate, should be shown. Those candidates familiar with the area of triangles and rectangles found the actual question accessible.
9	Many candidates failed to realise that angle ‘a’ was in an isosceles triangle. As a consequence, they did not use the appropriate method to find a base angle when given the apex angle (110°). The mark scheme allowed for correct ‘follow through’ answers for angles ‘b’ and ‘c’.
10	(a) Most candidates were able to find the correct prime factors. Common reasons for not gaining the final mark were (i) inclusion of ‘1’ as a prime factor, (ii) not expressed as a product but simply listed (or worse given as $3^2 + 5 + 7$). (b) Candidates who displayed the prime factors of both 315 and 42 as intersecting sets in a Venn diagram were very successful in identifying 21 as the Highest Common Factor (HCF). Many candidates seemed unaware of what was required.
11	Calculating the correct value for y when substituting into the quadratic proved difficult for some of the candidates. Nearly all of the candidates chose to use the suitable scale of ‘2 cm square ≡ 10 units’ for their y-axis. A suitable scale was deemed to be one that both made use of most of the graph pare available (so ‘2 cm square ≡ 20 units’ was not awarded a mark) and one which allowed accurate plotting of the points (so ‘2 cm square ≡ 8 units’ was not awarded a mark). In most cases the coordinates were accurately plotted on the graph paper. Candidates should take care to draw a smooth curve passing through (not just in the vicinity of) all of their plotted points. Marks were lost if the plotted points were joined by straight lines.
12	The hint, given in the question, to draw additional lines on the diagram was not always acted upon. Some of those who correctly calculated angle AOB to be 45° failed to realise (as in Q9) that this angle was in an isosceles triangle. As a consequence, they did not use the appropriate method to find a base angle when the apex angle was known. Only a minority of the candidates considered the method of initially finding the sum of all the interior angles of an octagon.

13	This is a topic that many find difficult. Very few candidates constructed accurate drawings using only a ruler and a pair of compasses. There was little evidence of 'fake arcs' but more a case of random arcs drawn from random centres. The construction of the perpendicular bisector of line AB requires <u>two pairs</u> of intersecting arcs in order for a correct line to be drawn. There was a better success rate with the construction of a 60° angle than with the perpendicular bisector. Only a few candidates constructed the angle bisector in order to draw BÂP = 30°. There was evidence of protractors being used to draw BÂP = 30°. The alternative method of constructing angles of 30° at both point A and point B was not seen.
14	It was essential to show that they were working with 30 (or 30·2), 2 and 0·5. Poor arithmetic led to many candidates failing to gain the final mark, with 2^3 often equated as 6, and even incorrect multiplication of 30 by 8. A disappointingly large number of candidates evaluated 240 / ½ as 120.
15	This question was not well answered at the Intermediate level. (a) The initial step of showing the relative frequency as a fraction was rarely seen. Those who did show 640/2000 often failed to accurately convert it into the required decimal 0·32. (b) A few candidates were able to show that the number of people, in the second day sample, who were from Anglesey was 1260. Very few were able to complete the question. (c) The explanation that the answer found in part (b) was most likely to give the best estimate of the relative frequency had to refer to the sample being larger.
16	(a) Interesting to note the success rate for each of the three parts. (i) Just under a half of the candidates circled the correct answer when asked to identify the lower bound of a value given correctly to the nearest 10 when considering a continuous value. (ii) More than half of the candidates circled the correct answer when asked to identify the lower bound of a value given correctly to the nearest 1 when considering a continuous value. (iii) Only about a quarter of the candidates circled the correct answer when asked to identify the lower bound of a value given correctly to the nearest 5 when considering a discrete value. (b) Disappointing that again poor arithmetic (evaluating 3·4 × 7) was as much of a cause of not giving the correct answer as a failure to use standard form.
17	(a) There was a requirement in the question for an inequality to be written down. Candidates who failed to do so would not gain any marks. (b) If logically possible, candidates could follow through on their incorrect inequality given in part (a). A correct answer of £3 would also gain full marks in part (b) even if no inequality was shown. <u>Note:</u> Had the question stated, '**Use** your inequality to …. ', then full marks would not be awarded for an answer only.
18	(a) A similar type of question was included in the Specimen Assessment Materials and also on a previous examination paper. It was disappointing therefore that so few correct answers were given. Most candidates assumed that the branches regarding 'the show at the Millennium Centre' were to be labelled 0·24, 0·76, 0·24 and 0·76. (b) A follow through answer using their values for P(Not going on a tour bus) × P(Not going to a show) was allowed. Unfortunately, not many candidates seemed to be familiar with the required rule.

Summary of key points

1. The calculations required on the non-calculator paper are relatively simple.
   Marks were lost due to some poor arithmetic e.g.

   (i) Q5c. 7 + 7 + 7 – 3 = 19.
   (ii) Q11. $3 \times -2^2 - 25$ incorrectly evaluated.
   (iii) Q14. $2^3 = 6$ and 240 ÷ 0·5 = 120.
   (iv) Q15a. 640/2000 incorrectly evaluated.
   (v) Q18b. 0·7 × 0·2 = 1·4.

2. Candidates should identify common shapes when they are not specifically named.
   e.g. the isosceles triangle in Q9 and also in Q12.

3. The understanding of the hierarchy of number operations proved challenging (Q1).

4. Showing the method used, allows an opportunity for candidates to gain some marks even if the final answer is incorrect.
   e.g. Q14. An unsupported answer of 120 would gain zero marks.
   However, sight of $\frac{30 \times 8}{0{\cdot}5} = \frac{240}{0{\cdot}5}$ = 120 would gain 2 of the 3 marks available.

5. Construction using only a ruler and a pair of compasses is still a challenge to many candidates.

6. See the comment (Q8) regarding the requirement for gaining the mathematical *'Organisation and Communication'* mark, and the mathematical '*Accuracy in Writing'* mark.

MATHEMATICS

GCSE (NEW)

Summer 2019

UNIT 1 HIGHER TIER

General Comments

Once again, candidates' performances reflected the increased demand of later questions in the paper. Very few questions were not attempted, demonstrating that candidates had been appropriately entered for this tier. Whilst there were plenty of excellent performances across all topics, questions requiring algebraic skills caused significant difficulty for many, particularly in the second half of the paper.

Comments on individual questions/sections

Comments on individual questions

Question	Comment
1	(a) Most knew how to repeatedly divide 315 by prime numbers in order to obtain the product of prime factors, though there were occasional lapses in accuracy. Some missed out on the final mark by failing to use the required index or by writing a summation or list rather than a product. (b) The majority expressed 42 as a product of prime factors, though did not necessarily know how to then use 2×3×7 in order to find the HCF of 315 and 42. An incorrect final answer of '7' was common, as this is the highest single prime factor of both 315 and 42. Weaker candidates simply listed (prime and non-prime) factors or listed factor pairs, then could not proceed any further. A surprising number answered part *(b)* correctly having not succeeded in part *(a).*
2	This was done well. Calculating the missing value in the table was almost always done correctly, which helped candidates in plotting points and sketching the quadratic graph. However, if the missing coordinate was incorrectly calculated, candidates did not seem to appreciate the need to revisit their calculation in order to produce a smooth parabola. In choosing a suitable scale, some failed to label the axes adequately, sometimes omitting minus signs for the negative portion of the vertical axis. In drawing a 'curve', marks were lost for joining all of the points with straight lines.
3	This question on angles in an octagon was generally accessible, particularly in terms of the first 2 marks. There were three common routes: calculating $A\hat{O}B$ then working with isosceles triangle *OAB*; using an exterior angle to find an interior angle, then halving; dividing the sum of the interior angles by 8, then halving. Occasionally, there were other interesting solutions e.g. drawing vertical and horizontal lines then working with a right-angled isosceles triangle. It was a concern, however, that a significant number thought that the sum of the interior angles of an octagon was 360°.

	For the OCW requirement of the question, again plenty performed well, earning the OC mark by giving clear structure to the two stages of the solution (calculating an angle or angle sum, then using it appropriately). However, as before, some lost the mark for 'accuracy in writing' due to multiple errors such as mis-using the 'equals' sign (e.g. 180–45 = 135÷2 = 67·5), mis-spelling words (particularly 'isosceles') or failing to use correct notation to denote angles. There was also widespread confusion in terminology between 'exterior' and 'interior' angles. Some were penalised for not showing sufficient calculations to explain how they arrived at their final answer (despite the usual instruction in the question to 'show all your working'). Some candidates continue to write extensive - and unnecessary - worded descriptions of each calculation and should aim to be more concise.
4	There was a mixed response to this question on constructions. Plenty of candidates did achieve all four marks, but others were penalised for not clearly showing construction methods (which should be indicated by relevant arcs) as this suggested the use of a ruler and/or protractor. Whilst it was essential to draw relevant straight lines for the perpendicular bisector and for the angle of 30°, there were many valid solutions which showed arcs alone for the construction of 60°, subsequently using additional arcs to correctly bisect 60° and produce 30°. Almost all candidates chose to locate point *P* above line *AB*, but it is worth noting that they could just as legitimately have found it below the line.
5	The majority replaced the three numbers in the fraction with appropriate estimates, though some offered unacceptable denominators of 0 or 1. There was occasional failure to evaluate 2^3 correctly, sometimes stating it to be 6. (6 was also sometimes obtained from stating $1{\cdot}98^3$ to be 5·94 then approximating.) Of major concern in this question was that a large number of candidates stated 240/0·5 to be 120 – this was very disappointing at this tier. Since the purpose of the question was about estimation, those few who attempted to calculate the exact answer unfortunately lost a lot of time and gained no marks.
6	(a) Most gave the correct answer of 0·32, though there were some surprising numerical errors, and it was frustrating that some gave a simplified fraction of 8/25 as their final answer (indicating a lack of care in reading the question). (b) Common errors here included either multiplying or adding the relative frequencies for the two separate days, possibly thinking in terms of probabilities of compound events. Furthermore, some candidates found the mean relative frequency (a method which would only be valid if the same number of visitors had attended the show on each day). There were many fully correct solutions, though again the final answer was sometimes left as a fraction (rather than the specified decimal). (c) Good explanations were given for the correct choice, demonstrating secure understanding that relative frequency stabilises as sample size increases. Some, however, thought that the correct value was simply the relative frequency taken from the second day, as that involved the most people surveyed out of the two days (rather than realising the need to use all of the available data).
7	(a) This multiple-choice question on accuracy of measurement was generally well done, with part (iii) causing the most difficulty. (Candidates should give some thought to the difference between continuous and discrete data in terms of rounding.) (b) Most candidates were able to multiply 34 by 7 correctly, but very often made place value errors in obtaining their final answer. Some were unable to correctly express their answer in standard form (sometimes simply 'counting zeros' rather than considering changes in place value).

8	(a) Almost all subtracted 0·3 from 1 to obtain the probability of 0·7. Fewer, however, knew that they needed to divide 0·24 by 0·3 in order to obtain the next missing probability value, and not all who did were able to do so correctly. Many lost marks for placing the incorrect values of 0·24 and 0·76 on the tree diagram. (b) Most knew to multiply the values from the two lower branches of the tree diagram (and incorrect values were followed through). Some however thought they should add these probabilities.
9	(a) This was usually well-answered, though there were some errors in the inequality symbol, sometimes reversed or including equality. It was a pity that some candidates, whilst able to write down the relevant algebraic expressions, gained no marks as they did not present an inequality. (b) Many excellent solutions were given to the inequalities produced in part (a), though some failed to realise that n needed to be an integer. Part (b) was often attempted using trial and improvement or by solving an equation, and both marks were then available for a correct answer. However, it is worth pointing out that an unsuccessful attempt using these methods gained no marks, as the purpose of the question was to engage with inequalities. It was common to gain both marks in part (b) having failed to answer part (a).
10	Plenty of candidates gained full marks here, although drawing the line $2y = x$ did cause difficulty, often becoming $y = 2x$ or even $y = 2$. Some drew a line representing $y = -2$ rather than the required $x = -2$. Candidates should be encouraged to think again if their 'region' is not closed (within the available space).
11	Re-arranging the formula was often done successfully. However, having collected terms in x on one side, candidates were sometimes unable to go any further (by factorising). Weaker candidates struggled with the appropriate order of operations throughout or made multiple sign errors.
12	The majority of candidates recognised the need to calculate missing angles in the triangles, earning them the first mark if they found at least two. It was a pity that some simply stated that the angles were equal due to 'symmetry'. For the second mark, there was a need to specify that two (or three) angles matched, and also to identify the matching side lengths; simply quoting 'ASA' was adequate. It was a concern that a substantial number stated 'three angles' or 'AAA' as if it were a formal (and sufficient) condition for triangles to be congruent.
13	(a) This was usually well done, though there were some place value errors in multiplying the recurring decimal by a power of 10. Another error sometimes seen was to treat the given decimal as if it were entirely recurring, namely 0·248248248…. Although it was a legitimate method in this instance, some candidates made things more difficult for themselves by multiplying the decimal by 100 (or even 1000) then subtracting the original decimal, giving a final (correct) answer of e.g. 2464/9900. (b) The majority struggled here with the need to find the reciprocal of a fraction. The (remaining) power of 2/3 also caused difficulty, and it was notable that the cube root of 27 was frequently given to be 9. Fully correct answers were seen, though 1/9 was an extremely common incorrect final answer.
14	The majority worked appropriately with isosceles triangle *BCE* to find the missing angle(s) of 61°, gaining the first 2 marks, but far fewer were able to correctly apply the alternate segment theorem in order to proceed further.

	There was a wide range of mis-applications of circle theorems e.g. stating *ABEC* to be a cyclic quadrilateral or stating angles *ACE* or *BAC* to be 90°. Even though written reasons (quoting circle theorems) were not explicitly required on this occasion, they were sometimes seen, and candidates should be encouraged to express them.
15	(a) A good proportion identified the correct answer, though the other options (with the exception of 22·5) were also common choices. As has previously been the case with multiple-choice questions, those candidates who made good use of the working lines (for written calculations) tended to be the most successful. (b) Only a small minority of candidates were awarded both marks here. There were many sign errors in expanding the brackets, with the final term sometimes given as -3 rather than (+)3. Failing to square the '2' was a common error in handling the first term. The term from multiplying $\sqrt{7}$ and $\sqrt{3}$ often became 21 or $\sqrt{10}$. Doubling the term containing $\sqrt{21}$ often produced $\sqrt{42}$.
16	The volume of the cylinder was usually correctly calculated in terms of *r*. It was frustrating that some candidates then mis-quoted the formula for the volume of a sphere, given that it was printed inside the cover of the examination paper. It was common to see the same variable *'r'* for both volumes, resulting in an 'impossible' equation. No credit was given for working with a specific value for *r*, e.g. 12 cm. Only a few were able to proceed beyond setting up the initial equation (for 2 marks), with those who attempted to do so usually making basic algebraic errors. Some created extra difficulty by using 3·14 for π, often undertaking lengthy (unnecessary) multiplication. (Those who left their volumes in terms of π were able to proceed more simply by cancelling.) Full marks were only rarely awarded.
17	Part *(a)* was more successfully answered than part *(b)*, where many candidates typically gave an incorrect answer of $y = -f(x)$. In both parts, some candidates needed to take more care with strict use of functions notation, sometimes being penalised for lack of brackets (which made an answer ambiguous).
18	(a) This part was often done well. Candidates only rarely failed to account for the non-replacement of the selected cards, and most knew to multiply (rather than add) the relevant fractions. Only a very few candidates 'cancelled' fractions within the product before multiplying – it is worth pointing out that this is a useful approach as it reduces the size of the numbers being multiplied. Some tried to multiply decimals rather than fractions, but this rarely resulted in a correct answer because it needed to involve a recurring decimal, which was difficult to multiply. (b) This part of the question was less successfully answered, with only a small proportion opting for the most efficient method (subtracting the probability of 'no yellow' from 1). Some did correctly find the sum of seven different probabilities, though this method was laborious and hence susceptible to numerical error. Failure to account for different possible orderings (e.g. YRR, RYR, RRY) was widespread. Finding the probability of choosing exactly one yellow card was another common mis-interpretation. Even though a tree diagram was not essential in this question, it could help to prompt the candidate to include all the necessary possibilities.
19	(a) Awarding both marks was rare here. A numerator of '-a' was extremely common, usually due to lack of consideration for the need for brackets around the numerator of the second fraction. Having combined fractions, incorrect 'cancelling' of terms was often an issue. (b) The response to this part of the question was very disappointing. A significant number of candidates were unable to start correctly, usually failing to clear the fraction.

	If attempted, re-arranging to form a quadratic equation was often done inaccurately. Even having obtained the required quadratic equation (or one of equivalent difficulty), many were then unable to handle it successfully. Of the minority who attempted to solve a quadratic equation, most opted to factorise, usually successfully. Some, however, showed a fundamental lack of understanding of the process by factorising a quadratic expression which was not equated to zero. Others chose to use the quadratic formula (sometimes having to do so as their version of the quadratic equation could not be factorised).

Summary of key points

Candidates appeared increasingly aware of what is required for the OCW requirement (question 3 on this paper) but would nevertheless benefit from looking at examples of good practice. Some still wrote too much, sometimes even stating their calculations in words; it should not be necessary to use more space than is provided on the page of the question.

Numerical skills were generally sound, but there were some areas needing attention, notably:

- knowing that ÷0·5 is equivalent to ×2 (Q5);
- handling more complex indices, particularly when applied to a fraction (Q13*(b)*);
- manipulating surds (Q15*(b)*);
- knowing to ‘cancel’ fractions before multiplying in order to deal with smaller numbers (Q18).

Fluent algebra skills were too often lacking e.g. in questions 11, 16 and 19. Some candidates demonstrated a need to practise standard processes (such as changing the subject of a formula, handling algebraic fractions, solving quadratic equations).

Recognising geometrical situations and using associated terminology were common problems e.g. question 3 (exterior or interior angles of a polygon), 14 (applying the alternate segment theorem).

MATHEMATICS

GCSE (NEW)

Summer 2019

UNIT 2 FOUNDATION TIER

General Comments

The number of candidates entered for this paper was higher than that of previous examinations at this level.
Overall the paper was comparable with the previous papers that have been sat and was a suitable and fair test for the candidates at the Foundation level.
Candidates found most of the questions on the earlier questions accessible, though as expected they found the questions which are common with the Intermediate tier more challenging.
As in previous series, there was evidence that some candidates were not familiar with the whole of the Foundation specification content. There was also evidence of candidates not using their calculators to carry out calculations despite this being a calculator-allowed paper.

Comments on individual questions/sections

Question	Comment
1	Most candidates handled the conversions between pence and pounds well in this question. Some candidates wrote £708 in the missing box for the third calculation instead of £7.08. It was less common for candidates to write their answers with both pounds and pence symbols than it has been in similar questions in previous series. Some candidates clearly used non-calculator methods to answer this question, often getting incorrect answers because of this.
2	(a) Just under half of candidates recognised this shape as a pentagon. Some candidates went one step further, identifying it as an irregular pentagon. (b) This was answered correctly by less than 10% of candidates. The most common incorrect answer was a diamond, though kite was also seen quite often. (c) This was answered correctly by over 80% of candidates. Incorrect answers were varied, with 10% of candidates not attempting the question.
3	(a) Just under half of candidates were able to write out the first three multiples of 47. Most candidates who answered this incorrectly confused multiples with factors. (b) Just under half of candidates were able to identify a factor of 676 in this multiple-choice question. There was no obvious pattern in incorrect answers. (c) This part was answered correctly by 20% of candidates. 211 was by far the most common incorrect answer.
4	(a) Nearly three-quarters of candidates were able to identify the midpoint of the line AB. (b) Candidates found this part more challenging, with just over a third answering it correctly. It was common for candidates to confuse parallel with perpendicular, though some candidates just drew a triangle linking points A, B and C.
5	(a) Over a quarter of candidates did not attempt this question. Some candidates clearly confused square numbers with even/odd/prime numbers. (b) Candidates found this part quite challenging, though over 60% answered it correctly. As in part (a), some candidates clearly confused even numbers with square and prime numbers.
6	Candidates found this True or False question challenging, in particular the final statement which required knowledge of congruency.

7	(a) This part was well attempted. Many candidates wrote 12/20 but were unable to correctly write this a percentage. Some candidates gave an answer 12/8, showing little understanding of fractions. (b) This part was answered correctly by under 20% of candidates. Many candidates provided instructions on how to find a quarter of a number, instead of how to find the number when told what a quarter of it is, as the question asked. (c) This part was answered slightly better, with over 25% of candidates obtaining the correct answer. It was common for candidates to simply write vague statements such as 'because 10 is bigger than 8' – these candidates weren't awarded any marks.
8	(a) Just over a third of candidates were able to accurately measure this angle of 65 degrees. As in most angle measuring questions, there was a tolerance of +/- 2º. It was very unusual for candidates to lose the mark because they were slightly out of tolerance – typically they considerably out, with some candidates clearly using the wrong side of their protractor. (b) Less than 20% of candidates were able to identify which angle was reflex in this multiple-choice question. Some candidates clearly confused reflex angles with obtuse angles, with 145º by far the most common incorrect answer. (c) Candidates found this question challenging. Most candidates who were awarded marks in this question were awarded one mark, with very few being awarded both marks. The most common incorrect answers were 36 degrees for the smaller angle and 180 degrees for the larger angle.
9	This was the OCW question. Many candidates were awarded just 1 mark in this question – typically for calculating the Height of Cuboid B or the volume of Cuboid A. There were few fully correct answers of 90 cm^3. For the OC mark, candidates were expected to clearly lay out their responses. For the W mark, candidates were expected to use correct mathematical form and use correct units, especially for the answer. Some candidates lost the W mark for using cm^2 as the unit for volume.
10	(a) Neary 80% of candidates gave the correct answer in part (i). They found part (ii) a lot more challenging, with under 25% giving the correct answer. (b) Part (i) was poorly answered, with just over 10% of candidates writing an answer of x + 3 or 3 + x. Part (ii) was answered better, with just under 50% of candidates giving the correct answer of 15g or an unsimplified version of it.
11	(a) This part was generally well answered by candidates. Most candidates made efficient use of their calculators to obtain their answers, however some used non-calculator methods (such as partitioning) - these candidates often made numerical errors. (b) This part was answered less well than part (a), suggesting that candidates are more competent at calculating the percentage of an amount than the fraction of an amount. Incorrect answers were often obtained by candidates who divided by the numerator and multiplied by the denominator.
12	(a) A mark was awarded for showing either 19 or −18·2. No marks, however, were awarded if the answer was given as 19f−18·2g. (b) Candidates who completed the first step correctly and reached 7x = 16, were often unable to go any further, with some candidates subtracting 7 from 16. Those candidates who divided 16 by 7, often struggled to write their final answer in the required form – to 1 decimal place.

13	(a) Just over half of candidates were able to accurately compare the times shown in the list. (b) A much lower success rate than part (a), with under a third of candidates answering this part correctly, suggesting that candidates are not so secure in their knowledge of the relationship between metric units of length. (c) This part was poorly answered, with very few candidates able to indicate the correct response for all four statements. Pupils found it very challenging to convert between metric and imperial units, with most candidates awarded zero marks. The third statement was the most successfully answered, with many pupils knowing that a litre is more than a pint.
14	An initial strategy has to be the comparison of two relevant rectangles (drawn or described). This in itself would gain 1 mark. Many candidates did this but didn't get any further. Further marks were awarded for correctly evaluating the perimeter and the area of these rectangles. It was common for candidates to correctly calculate the perimeter of their rectangles but not the area, with some candidates multiplying length by width by length by width, instead of just length by width. As the question is asking for a conclusion, '*Is Catrin correct?*', then candidates were expected to draw together their results and explain what their answers mean. Candidates who calculated the area and perimeter of their rectangles correctly typically went on to write a suitable conclusion
15	It was uncommon to see a fully correct answer to this question. Candidates who gained marks in this question typically calculated the percentage of an amount and stopped. It was evident that candidates at this tier struggle to engage with ratio.
16	(a) It was extremely rare to see a correct answer to this part. Candidates were typically awarded zero marks or two marks, with very few finding one value and not the other. (b) Many candidates gained the two marks available for a correct enlargement but failed to gain the final mark as their enlargement was not in the correct position.
17	The question did not specify that the candidates were required to display the probabilities of choosing the letter R in a formal manner. So, in this case stating, 'two chances out of ten' would be just as acceptable as '2/10'. Candidates who engaged with this question typically found these probabilities and did nothing else. Very few fully correct answers were seen.

Summary of key points

- Make use of the calculator at all times. After all, this is the 'calculator-allowed' paper. Marks were lost due to some poor non-calculator arithmetic e.g.
  (i) Q1. Many candidates used the working lines for their calculations, often making numerical errors.
  (ii) Q15. Trying to find 18% of £256 by using the partitioning method i.e. finding 10%, 5% and 3×1%.

- Candidates are expected to know the conversions between metric units of length, weight and capacity. It was clear in 13(b) that few candidates were able to do this.

- Candidates are expected to know the approximate conversions between metric and imperial units. Knowledge of these approximations is needed for both GCSE Mathematics and GCSE Mathematics-Numeracy. It was evident in Q13(c) that candidates haven't learnt these conversions as required.

- See the comment (Q9) regarding the requirement for gaining the mathematical *'Organisation and Communication'* mark, and the mathematical '*Accuracy in Writing'* mark. Too many candidates are still just writing their final answers, showing no workings whatsoever.

- There are still some topics in the Foundation tier in which candidates demonstrate little knowledge or understanding, especially those in common with the Intermediate tier. In this paper, the Ratio aspect of Q15 was typically ignored or answered poorly.

MATHEMATICS

GCSE (NEW)

Summer 2019

UNIT 2 INTERMEDIATE TIER

General Comments

The number of candidates entered for this paper was higher than that of previous examinations at this level.
Overall the paper was comparable with the previous papers that have been sat and was a suitable and fair test for the candidates at the Intermediate level.
The general performance of the candidates who sat the paper was very similar to that of candidates who were entered for previous Summer Series examinations.
It is pleasing to note a continued improvement in the responses to questions relating to topics such as percentages and ratio, probability and trial and improvement.
Algebraic skills, however, still prove challenging for many candidates at this level.
Questions that required candidates to interpret and analyse the problem before generating strategies to solve them were not as well answered.

Comments on individual questions/sections

Question	Comment
1	(a) (i) A very high success rate showing that candidates are competent at using the basic facilities of a calculator. (ii) For some reason, a few candidates decided not to make use of their calculator and fully showed the calculation of 4 × 78·3 = 313·2 followed by 313·2 ÷ 9 = 34·8. Sadly, there were sometimes numerical errors when the calculator was not used. (iii) Understanding of what is meant by the reciprocal of a number is part of the Intermediate specification. Many candidates fail to show this understanding, even on a question at this basic level. (b) Rounding a number to a given number of significant figures is always more problematic for candidates, than when rounding to so many decimal places. 440·0 is not an acceptable answer to 2 significant figures.
2	(a) A mark was awarded for showing either 19 or −18·2. No marks, however, were awarded if the answer was given as 19f −18·2g. (b) Having successfully reached 7x = 16 a few candidates lost the final mark by writing x = 16/7 = 2·2. Those candidates who insist on giving embedded answers to this type of question were unable to accurately do so on this occasion. Let us hope the practice will be discouraged in future.
3	(a) A very high success rate shows that most were able to accurately compare the times shown in the list. (b) A much lower success rate indicates that candidates are not so secure in their knowledge of the relationship between metric units of length. (c) Few candidates were able to indicate the correct response for all four statements. There is uncertainty about the conversion between metric and imperial units.

4	An initial strategy has to be the comparison of two relevant rectangles (drawn or described). This in itself would gain 1 mark. Further marks were awarded for correctly evaluating the perimeter and the area of these rectangles. As the question is asking for a conclusion, '*Is Catrin correct?*', then candidates were expected to draw together their results and explain what their answers mean. This would have been a better question if one person made a statement about the perimeter being doubled, and a second person made a statement about the area being doubled. As it stands showing that the area is not doubled is sufficient to prove that Catrin's statement is incorrect. The mark scheme was adjusted to accommodate this situation.
5	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. AND Correct mathematical form is required. A solution such as ' 10% = 25.6 5% = 12.8 1% = 2·56 So 46·08 ÷ 3 = 15·36 × 2 = 30.72.' does not explain to the reader what is being calculated at each stage and the final set of calculations does not display correct mathematical form Explanations should be given at the point in the solution when they are presented (not a series of calculations followed at the bottom of the page with a detailed explanation). Units, where appropriate, should be shown. Most candidates used the first method shown in the mark scheme and dealt with the percentage first before using the ratio.
6	(a)/(b) Some candidates were unable to engage with these two parts. More correct answers were given for part (b) than for part (a). This suggests that candidates are more comfortable when dealing with an expression that contains only one variable. (c) A surprising number of candidates gave $4y^2$ as an incorrect first term. Could it be that the 2 inside the bracket led them to squaring the *'y'*?
7	(a) Not well answered. The fact that both the missing values were negative probably increased the challenge posed by the question. (b) Many candidates gained the two marks available for a correct enlargement but failed to gain the final mark as their enlargement was not in the correct position.
8	The question did not specify that the candidates were required to display the probabilities of choosing the letter R in a formal manner. So, in this case stating 'two chances out of ten' would be just as acceptable as '2/10'. The majority of candidates, however, wisely presented their solution as one would expect. Again, wisely, the candidates made use of the information that both, Alison and Sarfraz, carried out the process 100 times. The alternative method shown in the mark scheme demonstrates that the use of the 100 is not a necessity.
9	(a) Disappointing that less than half the candidates were able to gain full marks on a standard linear sequence type of question that has been asked on several previous occasions. (b) A simple marking scheme gave credit for the two steps required to answer the question. First mark for correctly isolating the 3t (or −3t) term. Second mark for correctly dealing with the 3 (or −3). This could be a follow through from their 3t =±r ± 8.

	Candidates who gave –t rather than (+)t as their subject did not gain the final mark. Candidates who gave a final answer of (r + 8)/3 without showing 't =' did not gain the final mark as in this case there is no formula. Many candidates displayed poor algebra work. (c) A common error was to have an initial equation of x + 5 + 2x – 3 = 46. Those candidates who drew a sketch of the rectangle had greater success in forming a correct initial equation.
10	A question where candidates were required to interpret and analyse the problem before generating a strategy to solve it. As there was no mention in the question itself of Pythagoras or using trigonometry to find an angle, many candidates failed to meaningfully engage with the question. Some of those who used Pythagoras failed to make a statement, based on their answer, that the triangle could not be a right-angled triangle. Many used a single right-angled trig ratio to find an angle. As the angle was correctly found to be around 30° or around 60°, they declared it was not a right-angle, thinking that this was sufficient. When using trigonometric relationships, it is important to use two **different** pairs of given sides. As expected, (it's not in the Intermediate specification) no use was made of the second alternative method which made use of the cosine rule.
11	(a) Approximately half of the candidates correctly identified that the set $A \cap B$ represented the shaded area in the Venn Diagram. (b) Extremely few of the candidates correctly identified that the set B' represented the shaded area in this Venn Diagram.
12	Considering the three conditions to be met by their set of numbers: • Most had a set with a range of 10 (8 + 2). • Some had a set with a mean of 9 (sum of their numbers = 36). • Few had a set with a median of 8 (9 – 1).
13	Far more candidates (perhaps by visualising ¼ of 128) stated that there were 32 female staff in Porth than the fact there were 24 male staff based in Porth. Those who had a correct final answer were given a generous '*benefit of the doubt'* that, if they had written 32/128 + 24/72 =(!) 56/200, it was down to poor mathematical writing rather than dubious fraction work.
14	Previous examinations have had a better response to this type of question. Many candidates seemed unsure of the angle notation $Q\hat{P}R$, not realising exactly which angle was to be found
15	The question asked candidates to form the two equations in terms of x and y from the information provided. A mark was awarded for showing the correct equations. Unfortunately, some candidates did not write any equations as part of their solution, and so there was no opportunity to gain any follow through marks for solving their pair of simultaneous equations correctly.
16	Those candidates familiar with this type of question usually gain all four marks. The 'Trial and Improvement' question is one where **all** the necessary working must be seen. In this case, a correct answer with no supporting work will not gain marks. The work must include a calculation to prove that the answer to the required degree of accuracy is correct. Some did not carry out the necessary check required (e.g. looking at 1·65) to establish that the answer was 1·6 and not 1·7, and therefore only gained two marks. Many lost the final mark as they did not give their answer correct to 1 decimal place. Having gained the crucial third mark for carrying out the check at x = 1·65 they continued to test at x = 1·64, x = 1·63 and x = 1·62 and gave their final answer to a greater degree of accuracy than was required.

17	Hardly any part marks were awarded in this question. It was either the full 3 marks or no marks at all. Candidates, on the whole, find it difficult to comprehend the concept of 'reverse percentage'. Instead of equating 6154 to 85% of the original number, most candidates found 15% of 6154 and then added this onto 6154. The incorrect answer of 7077·1 was seen far more often than the correct answer of 7240.
18	Knowing some of the angle properties of circles is part of the Intermediate Tier specification. It appears that many candidates at this level are unfamiliar with these properties. Those who did gain marks, fared better with the fact that '*y'* = 2 × 'x' than they did with '*x*' = 180 – 126. In order to gain the marks for giving the reason for each of their answers, '<u>opposite angles</u>' AND '<u>cyclic quad</u>' had to be stated for angle '*x*'. For angle 'y', the minimum requirement was to mention the '<u>angle at the centre</u>'.

Summary of key points

1. Make use of the calculator at all times. After all, this is the 'calculator-allowed paper. Marks were lost due to some poor non calculator arithmetic e.g.
   (i) Q1(a)(ii). Incorrect division of 78·3 by 9.
   (ii) Q5. Trying to find 18% of £256 by finding 10%, 5% and 3×1%.

2. Make use of equations to solve problems where appropriate.
   e.g. (i) Q2(b). Solve the equation using algebra. Don't try to show an embedded answer.
   (ii) Q9(c). Forming an equation (as opposed to 'trial and improvement') allows for part marks to be allocated.
   (iii) Q15. 'Formation and solution of two simultaneous equations by and algebraic method' is part of the Intermediate Tier specification.

3. Candidates are expected to know the approximate conversions between metric and imperial units. (Q3c). Frequent class testing might help them to remember the crucial approximations.
4. Many candidates seem unsure of the angle notation QPR, not realising exactly which angle is being referred. (Q14)

5. Using congruency as well as just simply identifying congruent shapes may be tested. (Q7a.)

6. See the comment (Q5) regarding the requirement for gaining the mathematical *'Organisation and Communication'* mark, and the mathematical '*Accuracy in Writing'* mark.

MATHEMATICS

GCSE (NEW)

Summer 2019

UNIT 2 HIGHER TIER

General Comments

The number of candidates entered for this paper was higher than that of previous examinations at this level.
Overall the paper was comparable with the previous papers that have been sat and was a suitable and fair test for the candidates at the higher tier level.
Although there were testing questions on the paper, it is pleasing to note that the majority of candidates attempted all the questions. A candidate with a good understanding of the Mathematics syllabus had the opportunity to access the majority of the paper and gain credit for appropriate levels of understanding within topics and questions.
There is a notable improvement in higher tier candidates' algebraic skills at the intermediate level (the simultaneous equation was done very well, for example), but more work must be done to address algebraic skills at the higher tier (rearrangement of more complex formula, solving quadratic equations, graphical interpretation of equations in different forms).
There is still a sense that some candidates had possibly been entered at the higher tier without having completed all of the higher tier syllabus, but it certainly felt less so than in previous series.

Comments on individual questions/sections

Question	Comment
1a	A significant number of candidates did get 1 mark for $3n$, but it was surprising how many did not write the correct $3n + 5$. Errors seen were $n + 3$, $5n + 3$ or no algebraic expression at all. These observations are supported by the lower than expected facility factor for the first question on the paper.
1b	Answered well by most candidates, but too many were making basic errors with their signs when adding or subtracting. They were fortunate in this paper to gain a B1 for dividing by 3 from a follow through, i.e. for t = (±r ± 8)/3.
1c	The most common error seen was incorrectly setting up the initial equation, e.g. candidates would often set the sum of the two given sides (not all 4 sides) equal to 46. If an incorrect equation was set up initially, the first two marks were lost, but the final B1B1 was still available, as long as the equation derived was linear. Candidates that multiplied the two expressions, i.e. mistaking the perimeter for the area, gained no marks. Very few candidates employed a trial and improvement method, and if so, they often only exemplified that the perimeter was 46, when the value of *x* was 7.

2	This was the OCW question. Although the question was designed to test if the triangle was right-angled using Pythagoras' Theorem, many candidates used trigonometry instead. The use of *sin*, *cos* and *tan* was frequently seen, but also sometimes the successful use of the cosine rule to prove the assumed 90° angle was not. Errors most often appeared when candidates used *sin*, *cos* and *tan.* Numerous candidates used the same two sides within two calculations, which then gave two angles with a sum of 90°, meaning that they believed the triangle was right-angled. They failed to gain any marks for the mathematics, but still were able to gain one or two OCW marks. The OC mark was lost when there was lack of a brief explanation as to which strategy was employed, be it Pythagoras or trigonometry, or if there was no form of labelling of the triangle if, for example, the candidate stated Pythagoras in the solution as $a^2 + b^2 = c^2$. Candidates are still making errors within their mathematical form to lose the W mark. Furthermore, in this series, the candidate usually lost the W mark for writing, for example, $\sqrt{ANS}$ = 26.06, where *ANS* implied the use of the *ANS* button on the calculator.
3a	Most candidates chose either *A* ∩ *B* or *A* ∪ *B* as their correct answer.
3b	Poorly answered. There appeared to be no consistent incorrect answer either, so candidates either did not know the complement notation or could not interpret the diagram.
4	The candidates showed a good understanding of what was required in this question. If the full three marks were not awarded, generally candidates offered answers worthy of two marks. The two marks awarded were usually for four numbers with a range of 10 and the total adding up to 36 giving a mean of 9. It seemed that the candidates not achieving full marks usually failed on the median, either by not realising the new median needed to be 8, or for including one 8 within their list of 4 numbers, meaning that the median was some other number.
5	Answered well by the majority of candidates. Most were able to calculate the number of female workers (32) at Porth, and the majority of these candidates could correctly calculate the number of male workers (24). However, some candidates who did calculate the final answer correctly did so using incorrect notation, i.e.: $\frac{32}{128} + \frac{24}{72} = \frac{56}{200}$. This was condoned because the answer was correct. However, if the candidate used a calculator and obtained an answer of $\frac{7}{12}$, no further marks were given. Of the candidates who calculated the number of female and male workers at each location, almost all were able to find, or indicate on the diagram, that there were 32 female workers at Porth. The majority of these candidates were also able to calculate that there were 24 male workers at Porth. Having found these results, some candidates used an incorrect notation in finding the probability of choosing a company worker from Porth – they wrote $\frac{32}{128} + \frac{24}{72} = \frac{56}{200}$. This was condoned, as the answer was correct. However, if they calculated $\frac{32}{128} + \frac{24}{72}$ on their calculators and got an answer of $\frac{7}{12}$, they did not gain any further marks. Also, some candidates simply added the probabilities (written as fractions), $\frac{1}{4} + \frac{1}{3} = \frac{7}{12}$, which gained no marks.

6	Answered well by the majority of candidates. A few candidates, as in previous series, took the circuitous route of finding the third side using Pythagoras and then used either *cos* or *tan* to work out the correct angle. Also, a small minority were misled (or misread the question) by seeing two sides and therefore used Pythagoras to find the third side but went no further.
7	This question was answered well by the cohort. Many candidates gained full marks, but this could only be done by solving the equations algebraically. A few candidates used trial and improvement correctly but lost two marks using this method. It was quite common for candidates to offer other letters apart from x and y, often a and c. This was condoned and not penalised.
8	Well answered. It is pleasing to note that more candidates now understand the need to do the extra check (e.g. looking at 1·65) to justify, in this case, whether the root is 1·6 or 1·7 to 2 decimal places.
9	This question was answered fairly well, with the majority of the candidates that did gain full marks showing the calculation as one step, 6154 ÷ 0·85. Others showed their working in steps, e.g. knowing 85% of the original number being 6154, some calculated 1% to be 6154 ÷ 85 before multiplying by 100 to find the required answer. However, the common misconceptions of reverse percentages were still present. A significant number of candidates still incorrectly found 15% of 6154 and then added it on, either in steps, or by multiplying by 1·15.
10	(a) Many candidates were unable to recognise *ABCD* as a cyclic quadrilateral, and hence did not know to calculate x as 180° – 126° = 54°. Of those who did find x to be 54°, the majority did realise it was the cyclic quadrilateral, but many omitted the fact that it was due to the opposite angles adding up to 180° which was required to gain the mark. (b) Of the 4 marks available, it was finding y to be double 'their x' which was the only mark that many candidates gained in this question. Even if they gained the mark for the angle, few candidates were able to quote 'the angle at the centre to be double the angle at the circumference'.
11	This was poorly answered. This question divided candidates into two camps: they either gained full marks or did not understand negative scale factor at all. Very occasionally, candidates gained one mark for correctly locating two vertices out of the three required in their resulting triangle. It was uncommon for candidates to use an incorrect but negative scale factor.
12a	The difference of two squares method of factorisation has appeared a number of times on previous series. However, the quality of response was disappointing. Again, candidates either gained full marks or no marks. The reason may be that candidates failed to realise that 1 is a square number and $81p^2$ was insufficient to help them notice this type of algebraic expression.
12b	Disappointing response as in question 12a. Factorising quadratic expressions is an important algebraic skill for higher tier candidates. However, many failed to appreciate that this expression should factorise to two brackets. Although many candidates attempted the partitioning of $19t$ they then failed with their arithmetic to continue to $21t - 2t$ which would have then helped them to proceed to the correct answer contained in two brackets. It was uncommon to award 1 mark for $(7t \dots 2)(t \dots 3)$.
13	The common error in this question was candidates failing to understand the range of values when it is to the nearest 5(km), i.e. adding and subtracting 2·5(km). A common response was 295÷6·5 which could only gain 1 mark. Furthermore, a notable number of candidates divided by 5·5 which would give lower value for the answer.

14	A considerable number of candidates knew that $A = ½ ab\sin C$ should be used in this question and of these candidates many gained the first mark by correctly substituting in the values. However, many failed to rearrange the equation and get the correct value for the angle *BAD*. The second stage of the question was done more successfully. Using a stated or derived angle, many candidates did use correctly the method to calculate the area of a sector.
15	This question was poorly answered. Candidates clearly did not understand the connection between a factorised quadratic expression and the intersection with the x-axis. Of the few candidates who gained any marks for this question, it was usually one mark for matching one rather than two graphs with the correct equations. It was extremely rare for anyone to gain both marks. Occasionally, one correct strategy seen was to 'solve' each equation by replacing y with 0 ($y = 0$ being the x-axis). This possibly did help candidates to answer the first two questions, but further understanding was then required to know that a negative x^2 coefficient produces a quadratic curve with a maximum turning point.
16a	This question was not answered as well as expected. Candidates could have used their calculator to work out the key points on the curve, but it was clear that many did not. They appeared to be unaware of the general shape of $y = \sin x$. All manner of incorrect curves was seen, notably waves with higher frequencies, for example, $y = \sin 2x$.
16b	The majority of candidates who did gain any marks was for finding $x = -30°$, but they failed to use the graph, probably because it was incorrect, so $x = -150°$ was seldom seen.
17	Although this question on dependent events seemed quite straightforward and involved a context that should have been familiar to most higher tier candidates, this question was not as well answered as expected. (a) A fair percentage of the candidates did get part (a) correct, but there were many who calculated the probability of Angharad and Meirion winning the 1st and 2nd prize with replacement. Another common incorrect method was to multiply 3/100 with 1/97, rather than 1/99. Had the question asked for the probability of Meirion winning the 1st prize and Angharad the 2nd prize, we probably wouldn't have known about this misconception. (b) The first comment about part (b) is that it was evident that a significant number of candidates had difficulty in understanding what the question was asking – it was probably the double negative using 'no-one' and 'other than' that was the cause of it. However, many candidates were aware of what was asked for, but failed to list all three possibilities. It was common to see P(A,M) + P(M,A) or P(A,M) + P(A,A), which gained 1 mark. The candidates who drew a tree diagram were able to identify the 3 possible outcomes and were more successful. However, the most successful were the candidates who realised they could have placed Angharad and Meirion's tickets together and simply calculated the product 4/100 × 3/99. It would have been preferable if candidates had left their answers as fractions but, if supported by workings out, we accepted rounded answers. The same mistake of calculating with replacement was also seen in part (b).

18	Although the majority of candidates recognised this question as using the cosine rule, many failed to rearrange it correctly, so 1 mark was commonly given. Mistakes from previous series were evident, usually when a candidate substitutes the values into the formula first as stated on the formulae page and then calculates as many of the values first before rearranging. Incorrectly using the order of operations was seen. Another notable mistake was when the candidate collected the evaluated $b^2 + c^2$ with the a^2 and then failed to retain the negative sign with the $2bc \cos A$ term. This means the candidate simply divided by the positive evaluated $2bc$ term. Seldom did candidates calculate an incorrect angle, but if done correctly they gained SC1.
19	Although most candidates made attempts at expanding the brackets on both sides of the equation, it was common to see errors made in their expansions. If making one error, it was usually on the left-hand side whilst attempting to expand $(3x-2)^2$. The errors included seeing $6x^2$, rather than $9x^2$, or $-6x+6x$, which cancelled leaving $9x^2+4$ or $9x^2+4$. There were fewer errors in expanding the RHS. Some candidates failed to realise that they then had to rearrange their quadratic equation so that it was equated to zero before the quadratic formula could be employed. There are still a number of candidates who are failing to use the quadratic formula correctly, especially when evaluating the b^2 term in the discriminant if b is negative. However, from the scripts seen, there is a sense that the response to this type of question is improving.
20	It was pleasing to see that most of the candidates attempted the question. The vast majority of candidates did consider the ratio or multiplier for the base areas, 199/47, but then incorrectly believed this to be the linear scale factor. If they simply multiplied this value with the volume of the smaller solid, 350 cm^3, they gained no marks. However, if they cubed the value they thought to be the linear scale factor and irrespective if they multiplied by 350 cm^3, or not, they gained B1, but no further marks. Fortunately, a significant minority of candidates did recognise the need to take the square root of the area multiplier in order to find the linear scale factor, from which they could then cube to find the multiplier required to find the larger volume. These candidates invariable gained the M1 along with the B2. The final A1 was for a correct answer found without any premature approximation – they were likely to do this if giving their answers as decimals and, because of this, many candidates who had gained both B2 and M1 did not get the final A1.

Summary of key points

Areas of the specification that require attention include:

- Being able to recall and correctly use the circle theorems,
- Enlargements using negative scale factors,
- Interpreting factorised quadratic equations graphically,
- Sketching and interpreting trigonometric graphs
- Changing the subject in order to find the angle when using the Cosine rule,
- Setting up and solving quadratic equations using the formula,
- The relationship between the linear, area and volume scale factors.

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