Examiners’ Report
Principal Examiner Feedback

Summer 2017

Pearson Edexcel GCSE (9 – 1)
In Mathematics (1MA1)
Higher (Calculator) Paper 3H

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GCSE (9 – 1) Mathematics – 1MA1
Principal Examiner Feedback – Higher Paper 3

Introduction

The paper was accessible to students who had been prepared for a higher GCSE Mathematics paper. It was evident from the scripts seen that some students were not familiar with all the topics in the new specification. As this is a new qualification, it is important that centres refer back to the specification and check they have full coverage of all topics.

The standard of work seen was good in places but students are reminded to show full working out and to form numbers clearly. At times, some work was very difficult to read and students even found it difficult to read their own writing as evidenced by the transferral of incorrect figures from one part of the question to another.

Students are also reminded that examiners cannot make a decision about which method to mark. Whilst students may try different options it is essential they indicate which method is their final approach. This can be easily achieved by crossing out the incorrect approach. If two methods remain with no choice indicated, both methods will be marks and the LOWER mark will be awarded. It is not in the student's interest to leave more than one method visible.

As this is a new specification some students seemed to think that each question would be a problem and over complicated the questions asked. Centres should remind students that some questions will be a straight forward test of knowledge. Centres are advised to try to balance the teaching of standard procedures with problem solving techniques.

Centres are advised to remind students that they do need to memorise standard formulae for this new specification.

Further practice of 'explain' and 'give reason' type questions would help students, particularly in knowing how much to write as well as what is an appropriate explanation.

Reports on Individual Questions

Question 1

This question was accessible to almost all students with the modal mark being 4 out of 6.
Most students gained at least two marks on part (a). They were able to list the numbers correctly in the various sections of the Venn diagram but the commons errors seen were a failure to use labels or to place the remaining numbers in the universal set correctly.
Students who performed best wrote out all potential values and ticked them off to ensure all were included in the Venn diagram.

Part (b) was generally well answered with most students able to follow through their Venn diagram correctly.

Question 2

Many students answered this question correctly with appropriate methods and obtained three marks. The most successful method was to eliminate one variable, usually x, and obtain a value for y. Those who did this usually went on to successfully substitute their answer into the first equation given. However, arithmetic errors were seen.

Students who lost marks on this question did so through their inability to deal with the subtraction of negative values. Many students realised that the equations had to be subtracted but ended up with incorrect results such as; $5y = 10$, $-5y = -10$ or $5 = -2$. Several students decided to equate the y values by multiplying one equation by 4 but then the basic elimination of the y values let them down.

A few students rounded $-\frac{2}{3}$ to just 0.6 rather than as a negative recurring decimal. This was not acceptable for the final accuracy mark.

Question 3

Part (a) was well answered by the majority of students. Some wrote out all the data and then found the median from their list. Incorrect answers seen were often when the student tried to work out the mean instead of stating the median.

Part (b) was intended to assess one of the new assessment objectives and was not well answered by students. Many felt that any combination of probabilities required either adding or multiplying dependent upon the 'or' or the 'and' in the question. Few looked at the concept being described and considered that the qualities being discussed were not mutually exclusive. This phrase was not essential for the mark but a description of a person being able to have both attributes was required.

Question 4

A very well answered question with the vast majority of students scoring full marks
The most common method used was to calculate using the fraction and then the 35%. These students then correctly subtracted and split the remaining number of cakes in the given ratio of 4 : 5. The most popular alternative approach used was to convert the fraction into a percentage. Accuracy was sometimes lost through premature rounding with this method. Centres are advised to encourage students to calculate with fractions.

Another alternative approach was to add the $\frac{2}{7}$ and the 35% together, either in percentage or fraction form, to then work out the remainder as a percentage/fraction of 420 and then split into the correct ratio. Again some inaccuracies through rounding were seen if the percentage approach was used.

The most common mistake seen was to find $\frac{2}{7}$ of 420 as 120 then to do 420−120 = 300 and then to find 35% of this, rather than the original amount of 420. A student who did this could still score 3 marks, not gaining the process mark for finding the correct percentage or the correct fractional value and then going on to subtract these values from 420

It was pleasing to see the number of students who successfully used ratio at the end of this problem.
This question was accessible to all students.

Question 5

The modal score for this question was 4, however, some students did not attempt the question, or tried to explain without calculations why polygon P was a hexagon, these approaches should not be encouraged as they rarely score any marks.

Most students began with the dodecagon and were generally successful in determining it’s exterior or interior angle, they then proceeded to find the interior angle of polygon P either by summing the exterior angle of the dodecagon and the interior angle of the square or by using the interior angle of the dodecagon and square and the sum of angles around a point. Students then scored full marks by using appropriate angle facts for the hexagon for comparison. Many students used the formula $(n - 2) \times 180°$ for the sum of interior angles. Students who did not score full marks usually forgot to show calculations for BOTH of the shapes. A number of other strategies were also successful and included the calculation of the exterior angle or the number of sides of polygon P.

Common mistakes made were to confuse interior and exterior angles, or to just state the interior angle of a hexagon as 120° without any justification at all thus not gaining the final communication mark as explanations were either incorrect or incomplete.

Another common mistake was to state that a hexagon has 5 sides. This was disappointing on a higher paper.

Question 6

The question was well answered. Most students successfully worked out the total mass of the drink. This gained two marks. Some students stopped at this point, hence explaining why two marks was a common score on this question. Those students that carried on with the problem usually successfully completed it.

Centres are advised to remind students to check they have answered the question asked fully.

A small number of students calculated the total mass incorrectly by inverting the density formula. This was the main misconception seen.

Question 7

This question was well answered with over 75% of students gaining full marks. Most successful students used the sine ratio for right angle triangles. Some, however, decided to go the 'long' way around the question by use of the cosine ratio thus calculating the wrong side length and then proceeded to use Pythagoras's theorem to find the correct length of *AB*. A significant number of students used the sine rule with an angle of 90°

The most common errors seen were the use of the wrong trigonometric ratio eg cosine or tangent, calculating *BC* instead of *AB* or using the side length, 15 as the angle instead of 23°

Students should try to use the simplest approach possible and not look for 'a problem' in every question.

Question 8

A good proportion of fully correct answers were seen.

Although some students found this question challenging, most managed to score at least one mark for either writing an equation for the radius in terms of x, correctly writing the area of the circle in an equation or calculating r correctly without explicitly writing an equation eg $\pi r^2 = 49$ was often seen or used. Although most drew an appropriate diagram of a square inside a circle, many gave their radius or their diameter as their final answer for x, it was also not unusual to have $\pi r^2 = 49$ incorrectly rearranged to $\pi r = 7$

Of those who realised x was not the same as the radius or diameter generally progressed by choosing to apply Pythagoras's theorem to the problem and a few choosing to use trigonometry. However, those who used Pythagoras's theorem then struggled to rearrange the equation or forgot to square or square root at the appropriate time. The sine rule was seen on a few occasions as was trigonometry using a right-angled triangle.

A general lack of correct algebraic manipulation held back some students.

Question 9

The vast majority of students scored well on this question. The odd silly mistake led to the loss of a mark or an irrelevant explanation was given for part (c).

Generally students found the interquartile range for part (a). Occasionally the scale was misread or the numbers added.

In part (b) many correct diagrams were seen. The most common errors seen were to mis-plot one point or to not use the given grid. Centres are asked to remind students that they should use grids given as this aids them to make comparisons and the use of a different or an inaccurate scale is not appropriate.

For part (c) most comments related to the median or the highest value spent. These were usually appropriate answers with correct interpretation seen. Occasionally the word average or medium were used, these are not acceptable when comparing the medians. Any figures quoted must be correct and some students did not gain the mark because they gave incorrect figures in their explanations. Some explanations were lengthy and over complicated, often resulting in contradiction which meant the mark could not be awarded.

Question 10

Generally this was a well answered question with many students gaining at least two marks for an answer of 1.06 or 1.0599. The failure to subtract 1 and give the correct answer lost them the final mark.

A common error was to subtract £6000 from £8029.35 and then try to deal with this resulting value by either diving by 5 or finding the fifth root of the difference. Some students did try to use a simple interest approach to this question.

The difference between simple and compound interest should be emphasised by centres.

Trial and improvement was often seen but this can only be awarded marks if accurate figures are obtained. An understanding of compound interest and reverse percentage calculations are a better approach.
Some students only wrote down the answer, this is not a good approach as any error immediately means the student scores zero.

Question 11

This question targeted a new area of the specification and it was pleasing to see the majority of students scored at least one mark on this question.

Many students obtained one mark for 215 ÷ 17 = 12.647.. and some went on to correctly indicate that it is not possible to have 0.647.. of a rose tree or that the answer was not an integer when an integer would be required. An alternative method seen was to show 12 × 17 (=204) and 13 × 17 (=221) and an explanation that there could not be a number of trees between 12 and 13

The main errors seen in this question, were to show a correct calculation with no interpretation scoring one mark, or to show 17 × 17=289, which has no meaning in this question or to give a vague reason eg '215 can't be divided by 17' the latter two do not score any marks.

Question 12

A good minority of students scored full marks on this question.

Many were unable to start this question. However, by drawing a diagram some did identify the multiplier of 3 by using 18 parts on their diagram. Students often stopped at this point and showed no more meaningful work.

Of the methods that were seen, the use of fractions and writing all the ratios over 18 was quite successful as was the idea of equivalent ratios written under a diagram. A less often seen method was to introduce an algebraic variable but where this was seen it was often successful.

The most common errors seen were to multiply 1 : 5 by 7 and 7 : 11 by 5 and do nothing else or to find 18 and 6 and then add these to work with 24

Centres are advised that there is a need to practice questions of this nature and that a diagrammatic approach may be the most successful for the majority of students.

Question 13

Most students scored some marks on this question. The award of two marks was relatively frequent and shows that these students could correctly identify two of the lines bordering the region. Too often $x = -2$ was seen instead of $y = -2$

Sometimes $y = x$ and $y = -2$ were given and not $y = 0.5x + 1$. Many students could not give the inequality signs correctly.

For those that failed to score at all, the most common incorrect answer seen was just a list of coordinates with a complete failure to engage with the concept of boundary lines.

Centres are advised to teach students to both plot and state equations of lines.

Question 14

It was pleasing to see a good number of correct answers to part (a) and part (b) almost in the same proportion.

Part (a) was generally well attempted with the vast majority of students gaining at least one mark, normally for the factorisation of the two squares component. The factorisation of the other quadratic caused a problem, with many failing to obtain the correct solution often with incorrect signs seen. Some errors were also seen in the cancellation of the terms in the fraction. Also some further incorrect simplifications were seen. A common misconception still being seen is for students to just cross out part terms Eg x^2 in this fraction. Obviously this issue should continue to be addressed by centres as it is an incorrect step.

In part (b) a larger proportion of students gained the first mark than did in part (a) of this question. This mark was usually for clearing the v or expanding the brackets. The subsequent rearrangement of the equation caused more problems for the students. Several were able to rearrange the equation to the form $vw + 30v = 15t$ only then to state that $31v = 15t/w$, showing a lack of understanding of simplifying expressions.

Some students struggled to read their own writing and often missed off a digit or letter for no apparent reason.

Question 15

The statistics show that students found this question challenging. The main concept required to start the question was the use of $\frac{1}{2}ab\sin C$, no longer given to students.

The question also combined areas of mathematics, a requirement of the assessment objectives and some students struggled with the algebra, surds and the geometric concept.

Some students worked accurately through all stages, showing elegant correct solutions. Whilst others were able to set up the initial algebraic expression or equation, many students were unable to manipulate the algebra into a suitable quadratic equation.

Common errors seen included missing the half from the initial formula, adding the expressions for a and b instead of multiplying or not using an appropriate value for sin 45

Unfortunately arriving at a correct quadratic did not always mean full marks as some students could not go on to solve for x at this stage. The solving of a quadratic equation should be practised by centres as it can form part of many different questions.

Question 16

This question was not attempted by all candidates suggesting possibly that this topic had not been covered by all centres. When answers were seen it was evident for part (a) that most students had a good appreciation of the process of iteration and successfully secured the first mark for putting the starting value of -2.5 into the iteration formula. Sadly, wrong answers appeared to come from the incorrect squaring of negative numbers. Students could avoid this error by placing negative numbers in brackets on their calculator. By showing their substitutions students could gain 2 marks. This question exemplifies the need for students to show their working out especially when the calculator is used heavily to ensure that method marks can be awarded.

Part (b) was not well answered. Some students did state that the equation had been re arranged to give the iterative formula. Others correctly stated that iteration provides convergence towards a root of the cubic equation. A common misconception in part (b) was that the 3 answers from iteration in part (a) provided the 3 solutions to the cubic equation.

Question 17

Most students attempted this question, although in part (a) a small number of students tried to work without finding any bounds failing to identify from the question that they needed to write down upper and lower bounds for both the time and track length. Others successfully gave the correct bounds for the track length but used the same rounding for the time bounds, thus not distinguishing between rounding to the nearest 5 and rounding to the nearest 10.

When showing a division some students did not appreciate that they needed to divide the upper bound for distance by the lower bound for time - upper/upper and lower/lower were commonly seen. Different misconceptions seen were not to work in consistent units of time or to convert incorrectly. Centres need to continue to emphasise that time is not a decimal base.

The use of a number line to work out the bounds was very successful when used.

In part (b) many students indicated that the average speed would drop and this was sufficient for the award of the mark. Whilst others were too vague only referring to ‘it would change’ and not specifying what would change or indeed how it would change.

Question 18

A respectable proportion of students scored at least one mark for recognising the right angle between a radius and the tangent. Many displayed this in their diagram.

Some students began by calculating the unknown side in the right-angled triangle using Pythagoras’s theorem. Whilst on its own this scored no marks, it was sometimes used successfully by students to correctly find a suitable angle. Other students used incorrect trigonometry and so scored no further marks. Some students assumed the angle subtended by the arc as $2 \times 60°$ which again did not merit any marks.

Once a suitable angle was found some students stopped there whilst others went on to find the arc length by using an appropriate method. Unfortunately some students used the area of the circle and found the area of the sector instead of the arc length. Another error seen in the later stages of the question was to give the length of the minor arc.

Students are advised to carefully read the question. Centres are advised to stress the use of standard 3 letter notation for angles and arc lengths.

Question 19

This was the penultimate question on the paper and required solving a quadratic inequality even so almost half the students scored at least one mark on this question. The use of the quadratic formula or factorisation was correctly done by most who attempted either process.

Many who applied either process then accurately identified the two critical values of -2 and 0.5. Only a small number of students were able to correctly state the two distinct regions.

Those who sketched a graph and identified the two regions on the graph were much more successful in gaining the final accuracy mark. The incorrect use of inequalities or giving one continuous inequality was often seen on complete solutions. Of those that found the correct critical values only about one quarter of these students went onto give correct inequalities.

Question 20

Part (a) was correctly answered by a significant proportion of the students. Unfortunately of the incorrect answers seen some gave (1, 0) instead of (0,1).

In part (b) a significant number of students were unable to attempt this question even though they were asked to sketch a **circle** so could have started with that. A disappointing number of students were unable to write the co-ordinates as (x, y) and mixed up the order of the values thus losing the last mark because of poor and incorrect labelling. A common error seen was to translate in the positive y direction, but one mark could still be awarded if the radius was shown to be 4. Another common error was using a radius of 2 or 16

The quality of sketches varied greatly with some being drawn free hand and others with the aid of a pair of compasses, either was acceptable; on sketches clear labelling is helpful.

Centres are advised to check that students use clear and consistent labels on this type of question going forward.

Summary

Based on their performance on this paper, students should:

- show working and not just use a calculator and then write down the answer only
- check their arithmetic carefully, particularly when negative numbers are involved
- learn all formulae appropriate to this tier of entry
- draw a diagram when one is not provided for a geometry question to aid understanding of the situation
- ensure that the conventional three label lettering is used to identify angles in geometry questions.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:
http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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