# Examiners’ Report
Principal Examiner Feedback

Summer 2017

Pearson Edexcel GCSE (9 – 1)
In Mathematics (1MA1)
Higher (Calculator) Paper 2H

**Edexcel and BTEC Qualifications**

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

**Pearson: helping people progress, everywhere**

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2017
Publications Code 1MA1_2H_1706_ER

**GCSE (9 – 1) Mathematics – 1MA1**
**Principal Examiner Feedback – Higher Paper 2**

## Introduction

It was clear that a significant number of students had been entered at an inappropriate level and found much of the second half of this paper inaccessible. Students seemed to be well prepared for standard questions, eg. Q22 but were not as successful with those requiring problem solving techniques. It was pleasing however to see some very good attempts at the more challenging questions. Very few students showed evidence of not having access to a calculator.

Students do not always appear to know when to show calculations and a conclusion and when to write a statement for their answer.

In a number of questions, the word "estimate" was taken in a different context to that intended and many solutions contained approximated values. This was particularly evident in Q1, Q8, Q13 and Q20b.

Only the most able students made any real attempt to answer Q21 and Q23

Handwriting was poor in many responses, making it difficult to read solutions. Decimal points were not always clearly identifiable. Often rulers were not used accurately, which frequently led to errors, particularly reading the cumulative frequency in Q8. Errors were often not crossed out clearly enough, making it difficult to identify final answers.

## Report on individual questions

### Question 1

The great majority of students were able to correctly find the probability of the dice landing on "1". Many went on to correctly solve the problem but many stopped after just finding the probability of the dice landing on 1 or 3, eg 0.31 + 0.18 = 0.49 was a common answer. Some students made errors when adding probabilities, but would have received the first process mark if they had shown that they were subtracting their sum from 1. Students should be encouraged to show this important line in their working, even though they may think it is trivial. It was not uncommon here for students, misinterpreting the word 'estimate', to round their answer to 0.5 before multiplying by 200. Some did this earlier in their solution. Some students found the expected number of 1s and 3s separately and failed to add them together to find the total number. Having correctly solved the problem, too many students gave their answer as a probability, $\frac{98}{200}$ , or a simplified version of this. Quite a few students multiplied P(1) and P(3) before multiplying by 200 as well.

**Question 2**

Those students that started their solution by realising that the 117 children in the Circle equated to one quarter, giving 468 as the total number of children, usually went on to complete a fully correct solution. Many students, however, started by dividing the 2600 seats available in the ratio 5 : 2 and rarely made any further progress. Some students applied the ratio 5 : 2 to individual areas of the theatre which then led to decimal values which were often incorrectly rounded. Percentage calculations, finding 60% of 2600 were usually correct. A number of students gave a fully correct account and then neglected to actually answer the question posed and were consequently denied full marks. Some students used a two-way table to help them organise their solution which often proved useful. Too many did not read the question carefully enough and assumed the $\frac{3}{4}$ related to the total amount of people and not just children. There was evidence that some students got lost in their own workings through lack of commentary.

**Question 3**

The front elevation of a trapezium was usually correctly drawn even when shown in a 3D configuration. The side elevation however was very poorly done; a 2cm by 1cm rectangle or a 5cm by 2cm rectangle were the most common errors seen. Even when a correct 4cm by 2cm rectangle was drawn the 2 cm line, 1cm above the base, was often omitted. The students who drew the diagrams side by side had a better success rate as they seemed to have a better sense that they should be the same height. Unfortunately, many students still fail to include the horizontal line in the side elevation. Some students drew nets of the prism and rarely gained any credit.

**Question 4**

The most common error made in part (a) of this question was by those students who assumed that average speed was found by finding the mean of two speeds and calculated, unnecessarily, the speed from Manchester to Sheffield. Conversion between hours and minutes was poor; often 0.8 hours was written as 80 minutes and 75 minutes as 1.15 hours and 123 minutes as 2.03 hours. Students who chose to work in minutes (117 ÷ 123) often lost the last mark due to not being able to convert it to km/h.

In part (b), very few students recognised that the time taken for both parts of the journey had to be equal for the given statement to be correct. The most common mistake was to assume that the distances had to be equal. Some students commonly misread the question and tried to justify if she was right or not.

## Question 5

This question was poorly answered even by many of the more able students. In part (a), many incorrectly used a ratio 2 : 1 (5.4 : 2.7) and many assumed the triangles to be right-angled at *A* and *B* and tried to apply Pythagoras's theorem or trigonometric methods.

In part (b), the most common error for those students gaining any credit was simply to divide 6.15 by the correct ratio 1.5 and then leave their answer as 4.1 without ever trying to find the length of *AB*.

## Question 6

This question was very well answered and most students gained at least two marks for the correct application of compound interest methods to one of the banks, usually the Personal Bank. In working out the value of the investment at the Secure Bank, many used a multiplying factor of 1.09 or 1.9 instead of 1.009, or 1.43 instead of 1.043 for Personal Bank. It is pleasing, however, to note that the majority of students adopted a method using multiplying factors rather than building up the values year by year. A small but significant number of students subtracted the interest rather than adding it on. Using £2500 instead of £25000 was a common error and lost the accuracy marks. Students often struggled to work with changing interest rates for Secure Bank, especially 0.09%, many also started again with £25000 following the calculation for the first year with 4.3%. A small minority made the standard mistake of finding simple interest. Again a few students failed to explicitly identify the bank giving the greater interest. Some circled the box of information for their choice of bank. This gained no credit.

## Question 7

Many students had clearly never covered this topic and did not know the meaning of an error interval. Of those students who knew what they were doing failure in giving the correct inequalities prevented full marks being achieved. One mark was often awarded for sight of either 4.755 or 4.765

It was not uncommon for students to give the difference between the bounds as their final answer, losing the accuracy mark.

Incorrect use of inequality signs (getting them the wrong way around) was also common even when correct endpoints had been identified.

## Question 8

This question was in general answered well. Many students correctly read off a cumulative frequency value of 48 but then failed to subtract from 60 to find those students with a height greater than 160 cm. A number of students thought that "greater than 160 cm" meant they had to take a reading at 161cm. A significant number of students thought that the required number could be found by finding the area under the graph, usually reading off the 48 value correctly and gaining some credit. Having found the answer some rounded it because they were asked to find an estimate.

## Question 9

The majority of students gained at least one mark for a correct reflection of A in the $x$-axis. Disappointingly this was the only mark many achieved through not being able to draw the line $y = x$, some drawing $y = -x$ by mistake. Even where $y = x$ was correctly drawn, a large number of students had difficulty in reflecting in a diagonal line. More able students usually gained full marks.

## Question 10

In part (a), the great majority of students correctly gave an answer of Jupiter. The most common wrong answer was Uranus, with weaker students just looking at the initial digits and ignoring the powers of 10

It was clear in part (b) that those able to use their calculator for standard form calculations had no trouble finding the correct answer. Many place value errors were the cause of incorrect answers where students simply found the difference between 4.869 and 3.302 (1.567). Other errors were due to selecting the wrong data, such as for the wrong planet, or distance from the earth, rather than the mass of the two planets.

In part (c), many students seemed to think that it was sufficient simply to say that $10^9$ has "two more 0s" than $10^7$ or pointing out that $10^2 = 100$, without relating it to the actual numbers. A large number of students found the difference between the two distances showing they didn't understand what 100 times greater meant. Those students whose first step was to divide the distance of Neptune from Earth by that of Venus from Earth usually gained full marks.

## Question 11

Only a few students demonstrated enough convincing algebraic manipulative skills to carry the solution of this equation to its correct conclusion. Many were able to correctly write at least two fractions with a common denominator, usually the LHS, but then failed when trying to remove the fractional elements. One major failing of many students was to multiply **both** numerator and denominator by a common multiple, eg. $\frac{12(1-x)}{12 \times 6}$ instead of simply $2(1 - x)$. Failure to correctly deal with negative signs was very common.

## Question 12

In part (a), the vast majority of students recognised the error in the diagram but many failed to articulate their explanation satisfactorily, often incorrectly stating that they should add up to 30 or 29 instead of 1

In part (b), most students explained that the statement was incorrect because multiplication of the probabilities was required. Some students incorrectly argued that adding the probabilities gave the probability of either boy scoring a goal. Also many noticed that they expected the probability of both to be lower than either of the original probabilities.

## Question 13

Many students had no idea that frequency could be found by multiplying the frequency density by the class interval and so gained no credit. Of those that did, many used incorrect class intervals of 5 and/or 15 instead of 10 and 30. Inaccurate reading of the scale on the frequency density axis was condoned when awarding method marks if it was clear to which height the reading related. It was not uncommon for students to correctly find the number of members over 50 years of age (35) and then fail to even try to find 20%. Some just found 20% of 134. Students must read questions carefully and answer what is being asked. Only a few students tried to count squares; this was not a particularly successful approach.

## Question 14

Only a minority of students gained full marks here. There was no particular pattern to the confusion that surrounded the majority of students. Many clearly simply guessed.

## Question 15

Many students tried to prove the two triangles were congruent instead of similar and invented lengths of sides which they argued were equal. Clearly proving two triangles similar was not well known. Angles not in the required triangle were often quoted. *AC* and *BD* were often assumed to be diameters. Many assumed that the lines *AB* and *DC* were parallel and gave "alternate angles" as their reasons for what they saw as equal angles. Angles subtended by an arc being equal in size was a reason that was accepted (but not by a chord as this is ambiguous as a chord subtends in both the major and minor segments) but any reference to a "bow tie theorem" was not. Many references to cyclic quadrilaterals were seen, usually gaining no marks as the wrong angles were identified and wrong reasons stated. Many students gained their only mark for correctly identifying angles *AEB* and *DEC* as being equal because they were vertically opposite angles. Quite a few students thought these opposite angles were right-angles. Students need to learn the accepted version of the circle theorems. The use of three letters to identify angles was used by most students and some labelled their diagrams for additional clarification.

## Question 16

There were a variety of acceptable approaches to the solving of this question but full marks demanded an algebraic approach at some point. Most students were able to at least begin to convert each of the given recurring decimals to a fraction and thus gain credit.

A popular incorrect approach however was to let say $x$ be equal to the given product followed by, for example, $10x = 1.3636\ldots \times 2.222\ldots$ This gained no marks.

## Question 17

It was pleasing to see many students give fully correct solutions to this question. However, many did not and errors included; failure to recognise an angle of 60° in an equilateral triangle, taking 7 cm as the height of the triangle of base 7 cm when finding its area, using an incorrect formula, eg. $\frac{1}{2}$ ($a$ +$b$) sin $C$, using 5.5 cm or 7 cm as the radius of the sector *OQN* and some students found the length of the arc rather than area of the sector.

The cosine rule was sometimes used unnecessarily to find angle *AOB* and the height of the triangle was often found using Pythagoras's Theorem. Some found the area of the triangle as a percentage of the whole sector. Quite a number of students found the area of the whole circle but did not find the area of the sector. In this question, premature rounding prevented the award of full marks on many occasions.

## Question 18

Very few students attempted to convert the three terms to a common base in this question preferring to use their calculators in an attempt to find the value of $2^x$. Of those students that did, many then failed to apply the index laws correctly. Others tried to apply the index laws without converting to a common base. It was not unusual to see $2^x$ = 2.73….. but few were able to complete the solution to find $x$ = 1.45

Some did by a trial and improvement approach and some by applying logarithmic skills (outside this specification but still a valid method). A number of students misinterpreted the values in the question as mixed numbers and converted them into improper fractions.

## Question 19

Only a small minority of students were able to faultlessly follow a solution to a correct conclusion. Many gained 2 marks for satisfactorily dealing with the two algebraic fractions but then failed to recognise that the sum of these two fractions was to be subtracted from 2. In fact, many students failed to recognise that 2 was part of the question.
Poor recognition of the effect of the negative signs was the most common error.

## Question 20

In part (a), very few students were able to derive the equation $y = x + 4$ from the information given.

Students were generally more familiar with drawing tangents and in part (b), many students gained credit for drawing a tangent and attempting to find its gradient, often giving an answer within the accepted range. A number of students drew inaccurate tangents believing that they had to pass through the origin. Some obtained the correct solution by finding the gradient of a chord and not a tangent, this gained no credit.

Some students used calculus to good effect usually resulting in a correct gradient of 2. This is outside this specification but did gain credit.

**Question 21**

This question was the least well answered question on the paper, although a great number of students gained one mark for giving a correct length of 96 mm for the rectangle. The most common error was in thinking that the rectangle was a 96 mm by 96 mm square. Very few students recognised the need to find the height of the equilateral triangle formed from the three centres, preferring instead to find the areas of the three circles and then being unable to find the remaining areas. This question highlighted a lack of experience of enriching tasks where knowledge has to be applied in challenging situations.

**Question 22**

This question was very well answered by a great many students of all levels of ability, gaining at least one mark for realising that the sequence was a quadratic sequence. Having found the second differences of '4', many gave $4n^2$ as the first part of their $n$th term. Having found a correct first term of $2n^2$, many students continued to employ a differencing approach. Others successfully arrived at a correct solution from solving simultaneous equations. Where students were not successful it was common to see $4n$, $2n$ or $n$ instead of $2n^2$; thus many 2 term linear expressions.

**Question 23**

Of those students who understood what this question was asking, the majority gained at least two marks for the gradient of each of the normal and the tangent. Errors were often then seen in applying $y = mx + c$ to find the value of $c$. It is evident many pupils are not confident working with surds. A few students lost marks for forgetting to put "$x$" in their final answer, although credit was given at the first sight of a correct equation.

**Summary**

Based on their performance on this paper, students should:

- set out their solutions in a logical manner, showing all necessary working
- learn to differentiate between simple interest and compound interest
- ensure that the read the question carefully and that their final answer does answer the question as set
- learn the sine rule and cosine rule and how to use these correctly, relabeling the sides and angles of a triangle if necessary
- practise working with histograms

## 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

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom