Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2025

Pearson Edexcel International GCSE
In Mathematics A (4MA1) Paper 2HR

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 2025
Publications Code 4MA1_2HR_2506_ER

International GCSE Mathematics
4MA1/2HR
Principal Examiner's Report

This paper gave candidates of all abilities a good opportunity to demonstrate their knowledge, skills and understanding. Many candidates showed confidence in the first half of the paper and were able to use and apply routine methods to gain marks. The later questions offered sufficient challenge for higher attaining candidates, but it was encouraging to see that most candidates attempted all questions on the paper and were sometimes able to gain method marks on the more challenging questions, even where full solutions were not reached.

Candidates appeared to be well prepared for topics such as prime factorisation, simultaneous equations and reverse percentages. It was pleasing to see many strong responses to the multi-step problem requiring the use of Pythagoras' Theorem and/or Trigonometry to find the area of a triangle, with a good number of candidates gaining full marks. Higher attaining candidates were also successful with more complex algebraic manipulation, including rearranging a formula where factorisation was needed, working with composite functions and using trigonometry in 3D.

Centres are reminded of the importance of encouraging candidates to clearly show all stages of their working. Where candidates do not show how intermediate values within a solution have been obtained, it is then often not possible to award subsequent method marks if we do not have evidence that the values being used have come from a correct method. In addition, candidates should take notice of questions that specifically ask for working to be shown. For example, on question 16 and question 21, several candidates lost marks for relying on their calculators and not showing the required steps, despite being explicitly instructed to do so in the question.

Question 1

Many candidates were able to score full marks in part (a) for factorising the given expression fully. Those who did not score full marks often gained 1 mark for a correct partial factorisation, or for an answer of the form $9c(p + qd)$, or for correctly identifying $(2 - 5d)$ as a factor. The latter was somewhat common with some candidates choosing to divide both terms of the expression by $9c$ to end up with an answer of $2 - 5d$. It was also common for candidates to incorrectly think that 6 was a common factor of both terms and attempt to extract a factor of 6 or $6c$, which did not score any marks.

Part (b) was also very well-answered by candidates. The most common approach was to multiply both sides of the equation by 6 and then rearrange for x. Slips in multiplying both sides by 6 were sometimes seen, with a noticeable number of candidates reaching $5 - 2x = 18x - 4$. Candidates who made this mistake were unable to score the first method mark. Nevertheless, a follow-through method mark was available to any candidate who had a four-term equation and was able to correctly rearrange it so that the x terms were on one side and the number terms on the other. Many candidates were able to score this mark even after an initial mistake. There were a handful of candidates who did not take heed of the instruction in the question to 'show clear algebraic working' and simply wrote down the value of x, most likely from a calculator, or used trial and error to reach the value. These responses scored no marks.

Question 2

This was a well-answered question, with many candidates often reaching the correct prime factorisation and showing their working clearly. Candidates set out their method to find the prime factorisation of 1400 in a number of different ways, with use of a factor tree or a table being the most common. Many candidates who scored the first method mark for finding two prime factors went on to score the second method mark for identifying all the prime factors with no extras. Candidates who included 1 as a prime factor in their final answer were also able to score this second method mark but were unable to score full marks. The question asked for the answer to be written as a product of powers of prime factors and some candidates wrote their answer as $2 \times 2 \times 2 \times 5 \times 5 \times 7$ rather than in the requested form, and so were unable to score the final mark.

As with question 1b, it is not acceptable to use a calculator and simply write down the correct prime factorisation. Candidates needed to show clear working as instructed in the question and they scored no marks for the correct prime factorisation alone.

Question 3

Candidates seemed well prepared for this question on simultaneous equations. The most common approach was to subtract the two given equations to eliminate x and find the value of y. Many candidates then substituted this value into one of the original equations to find x. Other candidates decided to multiply to equate the coefficients of y but sometimes made arithmetic errors in this multiplication. The most common error was when multiplying the equation $3x + 2y = 10$ by 2 and reaching $6x + 4y = 10$. However, one arithmetic error was allowed for candidates who proceeded in this way. Candidates should be encouraged to indicate clearly whether they intend to add or subtract the two equations. Sometimes, lack of such clarity meant a method mark could not be awarded. It was also common to see the use of substitution to solve the simultaneous equations, and this approach was generally successful.

A few candidates used their calculators to work out the value of x and y and did not show a clear algebraic method. A handful of candidates tried to work backwards from the correct values obtained from their calculator, which often led to unconvincing working and zero marks being awarded.

Question 4

This question, asking candidates to find the percentage profit, was generally well-answered. Almost all candidates gained the first mark in this question, commonly for a method to find the cost of the adhesive (5×12) but also for a method to find the number of boxes needed ($45 \div 1.5$) or the cost of the tiles per m^2. Candidates often also went on to gain the second and third method marks for a method to find the total cost or the profit. The most common error was to start by multiplying 45 by 1.5 to find the number of boxes needed.

A number of candidates used an incorrect method when it came to finding the percentage profit, usually dividing the profit by 3000 rather than the total cost (1980). Of those who did correctly divide by the total cost, some did not score the final mark because they gave an answer of 151.5 and did not subtract 100 from this to find the percentage profit. In addition, some candidates did not give their answer correct to one decimal place as instructed in the question and wrote 52% rather than 51.5%.

A special case was available in this question for an answer of 56.3 or 56.25, which comes from not including the cost of the adhesive in the total cost. However, this was not frequently seen.

Question 5

Part (a) of this question asked candidates to reflect a shape in the line $y = x$. Most candidates were able to carry out this reflection correctly. Where candidates did not gain both marks in this part, they sometimes gained one mark for drawing the line $y = x$ or for the correct shape drawn with the correct orientation but in the wrong position. It was clear that some thought the question asked them to reflect the shape in the x-axis or the y-axis, perhaps indicating some confusion with the line $y = x$.

Part (b) of this question asked candidates to enlarge a shape using a scale factor of 2 with a given centre. Again, many candidates were able to carry out the enlargement correctly and draw the correct shape in the correct position for 2 marks. Some candidates gained one mark for a correct enlargement of the shape but in the wrong position relative to the centre.

Question 6

Almost all candidates were able to score 1 mark in part (a) for finding that $5^0 = 1$.

In part (b), candidates were generally able to find the correct value of k. Where the correct answer was not reached, partial credit was available for those who showed one correct application of an index rule, commonly awarded for correct simplification of the numerator to 5^6. A common mistake was to carry out the final step incorrectly and think that $\frac{5^6}{5^{-2}}$ was 5^{-4}. A number of candidates worked only with the indices in this question and did not write intermediate values as powers of 5. If a correct answer was not reached, one mark was only available for those who showed a complete method if choosing to work with the indices alone.

Candidates generally showed confidence in part (c) with many gaining full marks. Common incorrect answers included $2d^{12}e^{15}$ (not cubing the 2) or $6d^{7}e^{5}$ (using incorrect laws of indices).

Question 7

This standard question testing recall and use of the density, mass and volume formula was very well-answered. Where candidates did not score full marks, it was common for them to score 0 marks because they often used an incorrect formula for density. There were a handful of candidates who did quote a correct formula for density, but then rearranged this incorrectly to find the volume before substituting the given values. This scored no marks because the method mark was for substituting the values into a correct formula. It is therefore recommended that candidates substitute numbers into a correct formula first, before rearranging, to help them gain marks.

Question 8

Candidates were usually able to correctly find the mean of the 4 numbers in this question using the information provided. The first mark was awarded for a correct method to find one of the totals, either 60×7 or 46×3. Many candidates were also able to score the second mark for subtracting these totals to find the sum of the 4 numbers. However, a few candidates incorrectly added these totals together and so were unable to score further marks. To score 3 marks, candidates had to then correctly divide the sum of the 4 numbers by 4, although a handful of candidates forgot to do this and offered 282 as their final answer.

Of those who did not know how to tackle the question, they typically subtracted 46 from 60 to get 14 and then multiplied this by 4 to get 56 as their answer.

Question 9

Candidates seemed well prepared for this routine question testing reverse percentages. Candidates generally chose to divide 612 by (1 – 0.15) but other equivalent approaches were also often seen. The most common error was to try to find 15% of 612 and add this on. It is important to emphasise that some candidates wrote 1 – 15% instead of 1 – 0.15 or 100% – 15%. This mixture of decimals and percentages did not score method marks unless it was clear that 15% was processed correctly.

Question 10

This question was generally well-answered, with several candidates able to score at least one mark for writing down the equation of a line that met one of the two conditions: having a gradient of −5 or passing through the point (0, 6). A common mistake in this question was to give an answer of $y = \frac{1}{5}x + 6$, showing a misunderstanding between parallel and perpendicular lines. Occasionally, candidates gave answers such as $-5x + 6$ or $L = -5x + 6$, which were unable to score full marks because we needed to see the correct form of the equation of the straight line and this includes the $y = \ldots$.

Question 11

This multi-step question involving the application of Pythagoras' theorem and/or trigonometry to find the area of a triangle was well-answered. It was common for candidates to score the first two marks in this question, with many finding *AD* by correct use of Pythagoras' theorem. A few candidates chose to find *AD* by first finding angle *EDA* or angle *EAD* and then using trigonometry again. This was a longer method, but was usually done well when attempted. Some candidates were unable to score any marks in this question as they incorrectly thought that *BD* could be found by subtracting 21 from 45 or that the length of *BD* was the same as the length of *CD*.

Candidates who scored the first two marks often went on to score the third for a method to find *BC* or a method to find one of the acute angles in triangle *CDB*. It was more common for an error to occur when trying to find *BC* due to an incorrect application of Pythagoras' theorem, eg $\sqrt{35^2 + 32^2}$. A variety of approaches were possible to find the area of triangle *CDB*, and all methods in the mark scheme were frequently seen. The candidates who chose to use $\frac{1}{2}ab\sin C$ with one of the acute angles sometimes did not use the correct combination of sides for their chosen angle.

Candidates needed to work accurately to 3 significant figures in this question, so some could not gain the accuracy mark here because their final answer did not round to 227 because of premature rounding within their solutions. In addition, some candidates did not score full marks because they found the total area of both triangles rather than the area of triangle *CDB* as asked for in the question.

Question 12

This question required candidates to apply their knowledge of repeated percentage change to a problem, and fully correct solutions were often seen. Almost all candidates approached this question by trying to find the value of the car after two years. A common error at this stage was to evaluate $16000 \times (1 - 0.12 \times 2)$, rather than $16000 \times (1 - 0.12)^2$. For the second method mark, candidates needed to show a complete method to find the decimal equivalent of x% or a complete method for the percentage multiplier for the third year. This was usually done successfully, but a handful of candidates reached the correct percentage multiplier for the third year of 0.925 but then went on to cube root this value. This is likely a result of misinterpreting the question and thinking that 11461.12 represented the value of the car after a total of 5 years. Solutions of this nature were unable to score the second method mark.

Question 13

Part (a) was a routine question asking candidates to factorise $4x^2 - 25y^2$. Many candidates were able to score full marks, but common errors included $(2x - 5y)^2$ or $2x(2x) - 5y(5y)$.

Part (b) asked candidates to show that a product of three linear expressions could be written in the given form. This was usually well-answered, with candidates showing sufficient working to show the result. The most common approach was to multiply a pair of expressions first and then multiply the result by the remaining expression. Even when an error was made in one expansion, 2 out of the 3 marks could be scored as candidates were allowed to make one error in each expansion.

Other candidates expanded the product in one go and reached $8x^3 - 20x^2 + 24x^2 - 60x$ which scored M2. However, since this was a 'show that' question, it was necessary to show this expression and not just proceed to the answer of $8x^3 + 4x^2 - 60x$ with no intermediate working. Some candidates who reached $8x^3 - 20x^2 + 24x^2 - 60x$ simplified this incorrectly to $8x^3 - 4x^2 - 60x$ or gave an answer of $8x^3 + 4x^2 - 60$, for example, which could not score the final accuracy mark. In addition, other candidates who did reach the correct answer of $8x^3 + 4x^2 - 60x$ went on to divide this expression by 4, which made their answer incorrect. Centres may wish to remind candidates of the difference between equations and expressions and when it is appropriate to divide by factors and when it is not.

There were some candidates who showed a misunderstanding of the method needed in part (b) and treated the given expression as if it were $4x(x + 3) + 4x(2x - 5)$ and reached an expression of $4x^2 + 12x + 8x^2 - 20x$. This scored no marks.

Question 14

This question required candidates to complete and use a probability tree diagram in parts (a) and (b) and then work with the probability of three events in part (c).

Many candidates completed the tree diagram successfully in part (a), although a handful treated the tree diagram as a frequency tree and simply wrote the counts instead of probabilities on the branches.

Part (b) was also well-answered, with many candidates multiplying the two required probabilities to reach the answer, sometimes following through from their incorrect tree diagram.

In part (c), candidates could approach the problem by considering the probability of taking more red beads than green beads using the outcomes *RRR*, *RRG*, *RGR* and *GRR* or by thinking about the outcomes *GGG*, *GGR*, *GRG* and *RGG*. Both approaches were seen frequently and were equally successfully in this instance. Many were able to score at least one mark for the calculation of the probability of at least one of these outcomes. Some candidates stopped at this point and thought that *RRR* or *GGG* was the only possible outcome to consider when calculating the probability. Another common error was to only consider *RRG*, *RGR* and *GRR*, and omit *RRR* as a possible outcome, which scored a maximum of two of the three marks available in this part of the question.

It was pleasing to see some strong responses to part (c) that appreciated the answer to part (b) covered the combined probability of outcomes *RRR* and *RRG* and therefore offered very succinct solutions to the problem.

Question 15

This question tested candidates on their ability to use circle theorems.

Several different approaches to this problem were possible and it was also pleasing to see some excellent understanding of circle theorems shown in some responses. The most common approach was to find angle *ABC*, then the obtuse angle at the centre of the circle, and then angle *ACO*. Other more creative approaches were also seen: for example, some candidates drew a tangent at *A* and then proceeded to use the alternate segment theorem, while others constructed a diameter *AD* and then proceeded accordingly. Additionally, some candidates employed a more algebraic approach by setting up a pair of simultaneous equations, often involving angles *ABC* and *ACO*, and these approaches were generally successful.

However, while some candidates were able to provide a complete and correct solution, the question was generally not well-answered overall with many misconceptions and a lot of incorrect working seen. A common incorrect approach involved calculating angle *ABC* as 123 by subtracting 36 and 21 from 180. This error perhaps arose from a misconception that these three angles formed a triangle and must sum to 180. Candidates who followed this method then often doubled 123 and labelled the obtuse angle at the centre as 246. This was subsequently followed by the calculation (246 – 180) ÷ 2, resulting in an erroneous answer of 33. Although 33 was the correct answer, the reasoning behind this method was flawed.

In addition, many candidates simply wrote down calculations in their working and did not clearly link their calculations to the diagram or use angle notation. Candidates who did not show how their calculations related to the diagram could not be awarded the first method mark unless a complete correct method was clearly presented.

Question 16

This question required candidates to rationalise the denominator of a fraction and express the result in a specified form. The question also instructed candidates to 'show each stage of your working'.

Many candidates were able to score one mark here by multiplying the numerator and denominator by a suitable surd. To gain the second method mark, candidates needed to show correct expansion of brackets in an intermediate step. It was common for candidates to score two marks in this question and reach $7-3\sqrt{5}$. The next step of writing the answer in the form $a-\sqrt{b}$ proved to be a challenge for the majority, with only stronger responses able to complete this step successfully. Many candidates simply offered $7-3\sqrt{5}$ as their final answer, perhaps suggesting that they had not carefully noted the specific format requested in the question.

The most frequent cause of lost marks here was when candidates did not show sufficient working, despite explicit instruction in the question to do so. Many candidates used a calculator directly and wrote down $7-3\sqrt{5}$ without showing the required working, resulting in no marks awarded.

Question 17

This question required candidates to rearrange a formula for k. Candidates who were successful approached this by multiplying the equation through by $7 - 3k^2$ to eliminate the fraction, isolating the terms in k^2 on one side of the equation, factorising for k^2 and then rearranging for k. Many candidates were well prepared for this question and were able to complete these steps correctly to reach an acceptable answer.

Candidates who did not gain full marks generally still earned the first method mark for eliminating the fraction and expanding the brackets correctly. There were occasional errors when it came to expanding the bracket $p(7 - 3k^2)$, with some candidates incorrectly expanding this to $7p - 3k^2$ instead of $7p - 3k^2p$. Nonetheless, the next method mark for isolating the terms in k^2 was a follow-through mark, so many were still able to score this mark. However, in many instances, sign errors during isolation of the k^2 terms prevented further credit.

After isolating the terms in k^2, many stronger responses attempted to factorise k^2 and often did this correctly. Other responses often reached $8k^2 + 3k^2p = 7p - 5$ but then did not attempt to factorise and instead tried to divide the equation by p, usually unsuccessfully. Of those who correctly factorised k^2, most went on to score full marks; however, some omitted the subject '$k =$' with their final answer, losing the accuracy mark. In addition, there were instances where the square root symbol did not clearly extend over the entire fraction, resulting in loss of the accuracy mark.

Question 18

This was an accessible question on vectors that was well-attempted.

In part (a), many candidates were able to correctly interpret the diagram and write down $\overrightarrow{AB}$ in terms of **a** and **b**. As expected, the most common incorrect answer was 4**a** + 4**b**.

In part (b), stronger responses were usually able to use the ratio correctly and find $\overrightarrow{OP}$. Common errors included misunderstanding the ratio and thinking that $\overrightarrow{AP} = \frac{1}{3}\overrightarrow{AB}$ or making errors with signs. It was more common for candidates to make a sign error when using the path $\overrightarrow{OP} = \overrightarrow{OB} + \overrightarrow{BP}$ because this required them to use the negative of their answer to part (a), which was not always done.

Question 19

Part (a) of this question asked candidates to identify the value that could not be included in the domain of a function. Candidates who were successful clearly identified the value of $-\frac{1}{2}$. This was sometimes done by writing $x = -\frac{1}{2}$ or $x \neq -\frac{1}{2}$, both of which were accepted. However, many candidates used inequalities to express their answer such as $x > -\frac{1}{2}$ or $x \leq -\frac{1}{2}$ which were not accepted. Other common incorrect answers were 0 and $\frac{1}{2}$.

Candidates seemed well-prepared for part (b) of this question when finding a composite function. Where the correct answer was not reached, a common error was to find $\mathrm{fg}(x)$ instead of $\mathrm{gf}(x)$. It was more common to see a correct expression for the composite function reached, but then spoilt by further incorrect working. For example, examiners often noted incorrect simplifications such as $\frac{3x-4}{6x-7}$ simplified incorrectly to $\frac{x-4}{2x-7}$ or candidates setting $\frac{3x-4}{6x-7}$ equal to 0 and solving. In weaker responses, candidates seemed to think gf(x) meant they needed to multiply the functions together and tried to simplify $\left(\frac{x}{2x+1}\right)(3x-4)$.

Question 20

This was a challenging question on histograms, but many candidates were able to find the required probability and score full marks.

Several approaches were possible here. The most common approach involved dividing 75 by 100 to calculate the frequency density of the first bar. After doing this, candidates found the frequencies of the other intervals by calculating the areas of the respective bars. A frequent error was to calculate the number of books weighing between 400 grams and 600 grams and provide 200 as the final answer, without dividing this by the total number of books to find the probability. This resulted in 2 marks being awarded. Other candidates correctly found 200 as the number of books between 400 grams and 600 grams but offered an answer of $\frac{200}{700}$, incorrectly using the last value on the horizontal scale as the total number of books.

An alternative approach involved candidates attempting to establish a measure of scale. For example, some candidates divided 75 by 6 to conclude that each large box represented 12.5 books. Successful candidates then calculated the total number of large boxes as well as the number of large boxes corresponding to the interval between 400 grams and 600 grams, and then used the measure of scale to determine the frequencies. However, some candidates who appeared to adopt this approach did not clarify the meaning of their measure of scale. For instance, some divided 75 by 15 without explicitly stating what this represented (eg a row of squares). In cases where the measure of scale was not clearly defined or remained ambiguous, marks could not be awarded.

Given that the solution to this question was independent of the specific information provided, candidates could also apply their own linear scale to the frequency density axis to compute the areas of the bars and then determine the required probability. This method was generally well executed where seen, although some candidates made errors with their scale on the frequency density axis and where the scale became non-linear, this precluded the awarding of marks. Other candidates presented a simplified approach based on the ratio of the number of squares representing weights between 400 and 600 grams to the total number of squares.

Weaker responses showed misunderstanding of histograms, treating bar heights directly as frequencies rather than their areas. Attempts relying on bar heights scored no marks.

Question 21

This was a standard question that asked candidates to solve a quadratic inequality and show clear algebraic working.

Candidates could use factorisation, the quadratic formula or completing the square to find the critical values and earn the method mark. These steps were usually well-executed, but examiners noted that there was sometimes poor substitution into the quadratic formula, with –7 seen as the first term in the numerator, instead of −(−7), and writing -7^2 instead of $(-7)^2$ as part of the discriminant.

Among those who obtained the method mark, many found the correct critical values. However, several candidates struggled to identify the correct solution region, often giving $-\frac{3}{2} < x < 5$ as an answer. Additionally, some candidates offered $-\frac{3}{2} > x > 5$ as an answer, but a single inequality is not acceptable here.

As noted in some of the previous questions, the omission of key working was often detrimental to candidates' success here. Since the question explicitly required clear algebraic working to be shown, it was not permissible for candidates to rely solely on their calculators to find the critical values. Some candidates evidently obtained the correct critical values from their calculators and then attempted to produce a factorised expression such as $\left(x+\frac{3}{2}\right)(x-5)$ which is an incorrect factorisation of the given quadratic and not acceptable. Without showing the required algebraic working, candidates often scored zero marks for this question even if the correct inequalities had been reached.

Question 22

This was a challenging question requiring candidates to find the maximum volume of a cuboid with given dimensions.

It was pleasing to see many candidates score the first mark for correctly writing down an expression for the volume of the cuboid. To earn the second method mark, candidates needed to correctly differentiate their volume expression, which most who attempted differentiation did. The subsequent step involved setting the first derivative equal to zero and solving for x. However, errors occurred when candidates found the second derivative and mistakenly set that equal to zero rather than working with the first derivative.

Among candidates who set the first derivative to zero, many then correctly substituted the resulting value of x back into the volume expression to calculate the maximum volume. Nevertheless, some candidates scored 3 marks because they gave the value of x that maximised the volume (often 2.5) as their final answer, instead of substituting this value in to find the maximum value.

A minority of candidates did not employ differentiation in their approach to this problem. Instead, after finding the volume expression, they used trial and improvement to estimate the value of x that maximised the volume. Solutions relying on trial and improvement were only credited if it resulted in the correct exact maximum volume; approximations such as 31 or 32 were not accepted.

Question 23

This question on 3D trigonometry was well-answered by the stronger candidates on this paper.

The first step was to find length *CE*, which was accomplished using a variety of methods. To earn the first method mark, candidates needed to find *CE* but some incorrectly calculated *CE* as 40 ÷ tan 35 instead of 40 × tan 35. Other candidates attempted to use the sine rule, but some could not score the first method mark for their attempt since they neither reached the correct *CE* value nor showed the algebraic steps to rearrange their equation involving *CE*. For example, although the equation $\frac{CE}{\sin 35} = \frac{40}{\sin(90-35)}$ was correct, some candidates gave an incorrect *CE* value without showing intermediate steps, so could not gain the mark.

Many candidates who scored the first mark went on to score the second mark by presenting a complete method. Most correctly evaluated $\tan^{-1}\left(\frac{\text{"28"}}{40 \div 2}\right)$, but some mistakenly evaluated $\tan^{-1}\left(\frac{40 \div 2}{\text{"28"}}\right)$ instead, often leading to an incorrect final answer. Some candidates chose to use Pythagoras' theorem first to find *ME* before using trigonometry, which was usually successful.

Question 24

This multi-step problem required candidates to work with the length of a line segment and perpendicular bisectors.

The most successful responses began by using the fact that the length of *PQ* was $4\sqrt{10}$ to form an equation in *a*. A common error was omitting brackets around the 2*a* in the expression, eg $2a^2 + 12^2 = (4\sqrt{10})^2$. If this was not recovered, the first two method marks could not be awarded. In addition, sign errors were common when expressing the length of *PQ*, with $\sqrt{(3a+a)^2 + (7-5)^2}$ being quite common. It was also clear that some candidates mistakenly thought that $4\sqrt{10}$ was the gradient of *PQ* rather than the length. A few candidates sidestepped the algebra by constructing a right-angled triangle with hypotenuse $4\sqrt{10}$ and base 12, and then used Pythagoras to find the height as 4. Then it was simply a matter of solving 3*a* − *a* = 4.

More candidates were able to score marks by demonstrating their knowledge of perpendicular gradients. There were many correct expressions for the gradient of *PQ*, either in terms of *a* or using what the candidate believed the value of *a* to be. These earned the third method mark. As expected, some candidates did not gain this mark because their method to find the gradient involved dividing the change in *x* by the change in *y*, eg $\frac{7--5}{a-3a}$ (or equivalent). Nonetheless, the fourth method mark was commonly awarded for finding the gradient of the perpendicular bisector, following through their gradient of *PQ*.

Many candidates who had a correct value for *a* and then a correct gradient for the perpendicular bisector went on to score full marks in this question. However, some candidates did not realise the perpendicular bisector must pass through the midpoint of *P* and *Q* and instead found the equation of a perpendicular line through *P* or *Q*.

It was pleasing that there were not many blank responses on this question as many candidates were able to gain partial credit on this question for demonstrating their ability to do key skills, such as finding the gradient of a line segment, finding the coordinates of a midpoint or working with the length of a line segment.

Question 25

This question required candidates to find suitable values for the equation of a trigonometric curve given the graph.

Of those who scored the marks for finding the values of *a* and *c*, a common effective approach was to form simultaneous equations, for example $a + c = 4$ and $a - c = -2$. The most frequent correct value of *b* was 45, while other acceptable angles such as 315 and 405 were rarely seen. It was most common for the value of *a* to be taken as positive, but a few candidates consistently used a negative value of *a* and still scored all marks.

Question 26

The final question on the paper required candidates to work out the surface area of a bowl formed by removing a smaller hemisphere from a larger hemisphere.

Successful candidates started by forming an equation in terms of the radius of the larger hemisphere. While many candidates were able to identify from the formula sheet that $\frac{4}{3}\pi r^3$ was the formula for the volume of a sphere, only the strongest responses formed the correct equation of $\frac{1}{2}\times\frac{4}{3}\pi x^3 = 6174\pi$. Many candidates who formed the correct equation went on to solve this correctly for the radius of hemisphere, but a frequent error was taking the square root instead of the cube root when solving for the radius. In addition, examiners noted that some candidates misread the volume of the hemisphere as 6174 instead of 6174π.

The mark scheme allowed for candidates to score marks for a correct method to find the total surface area of the bowl using their value for the radius, even if this did not come from a correct method. Most commonly, candidates often calculated the surface area of the top of the bowl, earning the third method mark. However, candidates generally found it challenging to come up with a complete method for the total surface area and often subtracted the curved surface areas of the two hemispheres instead of adding them. Another common error was to calculate surface areas of whole spheres as opposed to hemispheres, using $4\pi r^2$ instead of $2\pi r^2$.

A small number of candidates misinterpreted the question by taking x to represent the radius of the removed hemisphere rather than the radius of the bowl. A special case was available for candidates making this error, from which several candidates benefited.

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