GCE Examiners' Report

Mathematics

AS/A level

Summer 2024

Introduction

Our Principal Examiners' report provides valuable feedback on the recent assessment series. It has been written by our Principal Examiners and Principal Moderators after the completion of marking and moderation, and details how candidates have performed in each unit.

This report opens with a summary of candidates' performance, including the assessment objectives/skills/topics/themes being tested, and highlights the characteristics of successful performance and where performance could be improved. It then looks in detail at each unit, pinpointing aspects that proved challenging to some candidates and suggesting some reasons as to why that might be.[1]

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

Further support

Document	Description	Link
Professional Learning / CPD	WJEC offers an extensive programme of online and face-to-face Professional Learning events. Access interactive feedback, review example candidate responses, gain practical ideas for the classroom and put questions to our dedicated team by registering for one of our events here.	https://www.wjec.co.uk/home/professional-learning/
Past papers	Access the bank of past papers for this qualification, including the most recent assessments. Please note that we do not make past papers available on the public website until 12 months after the examination.	Portal by WJEC or on the WJEC subject page
Grade boundary information	Grade boundaries are the minimum number of marks needed to achieve each grade. For unitised specifications grade boundaries are expressed on a Uniform Mark Scale (UMS). UMS grade boundaries remain the same every year as the range of UMS mark percentages allocated to a particular grade does not change. UMS grade boundaries are published at overall subject and unit level. For linear specifications, a single grade is awarded for the subject, rather than for each unit that contributes towards the overall grade. Grade boundaries are published on results day.	For unitised specifications click here: Results, Grade Boundaries and PRS (wjec.co.uk)

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

Exam Results Analysis	WJEC provides information to examination centres via the WJEC Portal. This is restricted to centre staff only. Access is granted to centre staff by the Examinations Officer at the centre.	Portal by WJEC
Classroom Resources	Access our extensive range of FREE classroom resources, including blended learning materials, exam walk-throughs and knowledge organisers to support teaching and learning.	https://resources.wjec.co.uk/
Bank of Professional Learning materials	Access our bank of Professional Learning materials from previous events from our secure website and additional pre-recorded materials available in the public domain.	Portal by WJEC or on the WJEC subject page.
Become an examiner with WJEC.	We are always looking to recruit new examiners or moderators. These opportunities can provide you with valuable insight into the assessment process, enhance your skill set, increase your understanding of your subject and inform your teaching.	Become an Examiner | WJEC

Contents

Executive Summary

The examination papers in GCE Mathematics were generally of a similar standard to previous examination series. As is always the case, some questions were more demanding in some topics than in previous series, whilst others were less demanding. What was noticeable this year, and to some extent also in the previous two series, was that many candidates embarking on the AS / A2 Mathematics course have gaps in their knowledge and understanding, which consequently impacted on their ability to access more demanding topics and skills.

There are some areas of the subject content that are not well understood each year and this year was no exception. This includes topics such as vectors, logarithms, graphs in kinematics and the continuous uniform distribution. Other topics that are specific to units are listed in the individual unit reports. Similarly, there are certain skills that are lacking each year which can prove costly, e.g. algebraic manipulation and graph sketching.

What was evident this year was that questions that were set in a non-standard format, i.e. in context, both mathematical and non-mathematical, proved challenging for candidates. They struggled to translate the information given in the question into the relevant mathematical processes. These problem-solving styles of questions require a deeper understanding of the underlying mathematics, than simply following routine processes and procedures.

Although there were many candidates who scored low marks on the exam papers this series, there were also some excellent solutions seen to all questions in all four GCE Mathematics units, e.g. circle geometry (Unit 1), hypothesis testing (Units 2 and 4), differential equations (Units 3 and 4) and moments in context (Unit 4).

Areas for improvement	**Classroom resources**	**Brief description of resource**
Sketching graphs	Geogebra	Free software package – for teaching and learning mathematics.
Conditional probability	Knowledge Organisers	Worked examples of information represented in a variety of forms.
Differential equations	Knowledge Organisers	Notes on rates of change, proportionality, and construction of differential equations.

MATHEMATICS

GCE

Summer 2024

AS UNIT 1 PURE MATHEMATICS A

Overview of the Unit

This paper was well received by candidates, with numerous excellent solutions seen to every question. The standard compared favourably with papers from previous series, with plenty of accessible questions available for the weaker candidates. In general, it was felt that the majority of the paper was relatively straightforward, with a few rather more challenging questions.

Questions on the following topics were well answered:
- Proof by exhaustion (Q4)
- Indefinite integration (Q3)
- Finding points of intersection between a line and a curve (Q16)

Some candidates had difficulty with the following content:
- Vectors in a mathematical context (Q13)
- Finding tangents to a circle passing through a given point (Q18)
- Interpreting logarithmic graphs to form an equation to be solved (Q17)

Areas for improvement:
- Algebraic manipulation
- Recall of standard formulae from GCSE, e.g. cosine rule
- Drawing diagrams, where none are given, to help visualise the problem, e.g. Q7, Q18

Comments on individual questions/sections

Q.5 This was a very standard question requiring knowledge of the cosine rule and the formula for the area of a triangle. Candidates who were able to write these down usually gained all 4 marks, with any loss of marks due primarily to algebraic errors. This question should not have proved difficult for all candidates sitting this paper. However, the responses were very disappointing. Many very unusual errors were seen, including one response where a candidate had attempted to use the solution to the quadratic formula. All candidates studying AS Mathematics should be able to readily recall these standard formulae.

Q.6 In part (a), not many candidates gained the final mark for an exact answer. In part (b), most candidates expanded the brackets in the numerator after multiplying both the numerator and the denominator by the conjugate of the denominator. This did not prove useful in gaining the final mark.

Q.7 This question was generally well done, although candidates did not always choose the most efficient methods to answer parts (c) and (d), thus introducing unnecessary errors.

Q.8 There were reasonable responses to this question, but candidates often did not provide a sufficient enough conclusion.

Q.9 Part (a) was generally well done, with the occasional sign error. In part (b), although most candidates had the right approach, they lacked the stamina or the confidence to persevere with the algebra resulting from the expansion.

Q.12 Part (a) was generally well done. In part (b), very few candidates gained the mark for giving their answer in set notation.

Q.13 This was actually not a particularly challenging question on the topic of vectors. However, many candidates did not understand the requirements of the question in part (c).

Q.15 The mathematical context in which this question was set caused some confusion. Had this question been set as a non-contextualised trigonometric equation, it would most likely have been answered extremely well.

Q.17 This question on logarithms was more straightforward to answer than it appeared to be at first glance, and there were many excellent solutions seen. Some candidates got the incorrect sign in their equation, and some were unable to deal with the constant term in a logarithmic equation. However, the subtraction law was well known and usually correctly used.

Q.18 Part (a) was generally well done. In part (b), candidates who had the right approach usually gained full marks. Unfortunately, the majority of candidates did not know how to approach this question.

Q1, Q2, Q3, Q4, Q10, Q11, Q14, Q16 – These questions performed as expected and there were no areas to highlight.

MATHEMATICS

GCE

Summer 2024

AS UNIT 2 APPLIED MATHEMATICS A – SECTION A

Overview of the Unit

The standard of responses on the Statistics section was slightly poorer this year compared to last year. Many candidates found work at this level overly challenging, particularly the question involving the Venn diagram. The question on sampling proved to be a gentle introduction to the paper, but candidates found the remainder of Section A rather challenging. Candidates struggled with the questions that required explanations in context. However, questions involving numerical calculations, particularly for the Poisson distribution, were generally better answered.

Questions on the following topics were well answered:

- Understanding and identifying different sampling techniques (Q1)
- Calculating probabilities using the Poisson distribution (Q2b, Q2c)

Some candidates had difficulty with the following content:

- Using Venn diagrams to calculate probabilities (Q3)
- Hypothesis tests for the proportion in a binomial distribution (Q4a, Q4b)
- Calculating and interpreting Type II errors (Q4d)

Areas for improvement:

- Giving explanations, or interpretations of results, in context
- Recall of subject content from GCSE, e.g. Q4c (expected frequency), Q5bi (calculating the mean from a grouped frequency table)

Comments on individual questions/sections

Q.1 This was, as expected, the most well answered question on the paper. It simply required candidates to recall the definitions of different types of sampling. Many candidates scored well on this question. There were several candidates who thought the population was the 30 members of the sample. It was rare to see an incorrect answer for part (c).

Q.2 The calculations in parts (b) and (c) were generally well done. Candidates should be encouraged to explicitly state the distribution used in any question involving a statistical distribution, rather than relying on examiners inferring the distribution from their numerical answers, e.g. probabilities. Candidates who failed to show their workings in part (b) scored no marks. A common error in part (c) was to misunderstand how to calculate the probability of fewer than 10 birthday cakes, with candidates calculating $1 - \mathrm{P}(X \leq 9)$.

Parts (a) and (e) were linked. Candidates found it very difficult to articulate the assumptions they had made when using a Poisson distribution earlier in the question. Many gave generic assumptions, which were not linked to the context of the question. However, candidates performed better when asked to assess the reasonableness of their assumptions. In part (d), many candidates misunderstood that selling the next cake before 10:00 meant selling at least one cake in the next half an hour, instead calculating $\mathrm{P}(X = 1)$.

Q.3 This was the most poorly answered question on the paper. Candidates, for the most part, were unable to engage with the probability element of the question. Many were aware that, for independent events $\mathrm{P}(A \cap C) = \mathrm{P}(A) \times \mathrm{P}(C)$, but attempted to form an equation with the numerical values given in the Venn diagram, rather than the associated probabilities. This led to $(x + 20) \times (50 + x) = (8 + x)$, which resulted in the right-hand side of the equation being out by a factor of 100 when the brackets were expanded. Using $x = 10$ to show that $x = 10$ was not a sufficient method to earn all the marks for part (a), although candidates were able to score SC2 for this verification.

Part (b) performed better, although many candidates forgot to subtract 1 from the denominator for the second fraction, leading to $\frac{30}{100} \times \frac{15}{100} = 0.045$. This was credited with M1 only.

Q.4 Some parts of this question were well answered, whilst other parts performed less well. Part (a) was generally well answered, as was part (b), where candidates were able to pick up marks.

In part (c), many candidates were unable to find an expected frequency, despite this being a GCSE-level topic. Many candidates found part (d) challenging. Some were able to carry out the calculation, but were unable to explain the concept of a Type II error in context. Whilst others were able to explain the concept, but were unable to carry out the calculation. It was rare to see a candidate that was able to do both.

Q.5 Interpreting data is often well answered by candidates, but, in this question, many candidates were unable to spot the patterns and trends that the data were displaying. Candidates should be able to critique data presentation techniques and be able to deal with missing data and errors.

In part (a), the quote, together with the graph, is clearly misleading because the graph suggests a decreasing trend, which may lead people to be concerned, but, of course, this is the natural shape of this type of graph – as more people receive the second dose of the vaccine, there will be fewer people remaining who require it.

In part (b), candidates continued to find the standard calculations for the mean and standard deviation of a grouped frequency table challenging. Very few candidates engaged with the ‘1000s’ element of the data.

In part (d), E1 was awarded to candidates who were able to support their decision, regardless of whether they thought the data was correct or incorrect. Candidates and teachers should be comfortable with not always having a “right answer”, as long as they are able to support their answers.

MATHEMATICS

GCE

Summer 2024

AS UNIT 2 APPLIED MATHEMATICS A – SECTION B

Overview of the Unit

Section B was well received, and many exemplar solutions were seen for all five questions. The paper appeared to be accessible to most candidates, except for questions 8(c) and 10(c), for which only a minority were able to achieve full credit.

The attempt rates were consistently high, supporting the fact that sufficient time was available to complete Section B of the paper. Overall, comparison of attempt rates and facility factors suggests that candidates generally performed better than during the Summer 2023 series.

Questions on the following topics were well answered:
- Finding the magnitude and direction of a vector (Q6)
- Forces and application of Newton's laws (Q7, Q9)
- Selecting and using the formulae for constant acceleration for motion in a straight line (Q9(a),Q10(a),(b))

Some candidates had difficulty with the following topics:
- Understanding and using the language of kinematics (Q8(c))
- Using calculus in kinematics for motion in a straight line (Q8(b))
- Sketching a displacement-time graph (Q10(c))

Areas for improvement include:
- The use of exact values from calculators, to avoid loss of accuracy due to premature approximation. Also, candidates should be prepared to work in terms of g.
- Graph sketching and the use of diagrams. With the introduction of question-and-answer booklets this series, candidates could simply annotate the diagrams that are provided in the question (Q7, Q9)
- Using the full functionality of calculators, e.g. for checking solutions of equations (Q10(b))

Comments on individual questions/sections

Q.6 This question on vectors was the most successful question in Section B. However, many candidates did not secure the final mark since they did not give their answer as a three-figure bearing, as requested in the question.

Q.7 The vast majority of candidates were successful at answering this question on using Newton's laws. The context did not cause any major issues. A common misconception was to apply Newton's second law to box Q alone, instead of boxes P and Q combined. This may be due to the fact that only box Q was in contact with the horizontal forks. It was encouraging to see candidates taking full advantage of the diagram provided in the question, by annotating it using directional arrows and numerical values.

Q.8 This was the least accessible of the mechanics questions on the paper. Nevertheless, part (a) was very successful with almost all candidates recognising that it as a simple application of Newton's second law.

Responses to part (b) were mixed. Most candidates correctly established that integration was required to obtain an expression for the velocity. However, despite successes in finding the acceleration in part (a), many integrated the expression for F in an attempt to find the velocity.

Part (c) was designed to assess the understanding and use of the language of kinematics (AO2), specifically the fact that speed and velocity will only differ when the velocity is negative. Most candidates determined a value of v at $t = 9$ to attain one mark, but did not link this to the acceleration in part (a) and so did not earn the final mark.

Q.9 Part (a) required the use of a constant acceleration formula to find the acceleration of a pulley system. Despite this being an unfamiliar scenario, this was very well received.

Responses to part (c) were disappointing. Many candidates incorrectly stated that 'tension is constant throughout the string'.

Q.10 Part (a) was answered successfully, but not always in the most efficient way. A small number of candidates used two applications of the 'suvat' equations: initially using $v = u + at$ to find a, followed by $s = ut + \frac{1}{2}at^2$ to find the required distance. Whilst this is a legitimate approach, some opted to use a prematurely rounded value instead of $a = \frac{13}{6}$. As expected, this led to a small error in the required distance.

The most frequent error in part (b) was to incorrectly use $t = \frac{184}{3}$ as the length of time for which the car is accelerating. Some of the most able candidates provided further justification as to why $t = \frac{184}{3}$ should be discounted. Whilst this was not required, it was very encouraging to see.

Candidates generally struggled with the concept of a displacement-time graph in part (c). Many sketched the familiar 'trapezium' shaped graph, suggesting confusion with a velocity-time graph. Numerous solutions featured three straight lines and hence did not highlight the necessary concavity for the parts of the sketch where the car is accelerating and decelerating.

MATHEMATICS

GCE

Summer 2024

A2 UNIT 3 PURE MATHEMATICS B

Overview of the Unit

This paper was well received by most candidates. Excellent solutions were seen to all parts of every question. The standard of this paper compares favourably with those in previous series, and there was no evidence that the paper was too long. Generally speaking, candidates found questions that involved explanations (Q1(c), Q8(c), Q13) and which required a deeper understanding of the underlying mathematics, the most challenging. The questions that assessed standard processes and procedures usually performed better. Question 15, which required translation of the question in context into mathematics, was often misunderstood and consequently was very poorly answered.

Questions on the following topics were well answered:
- Solving trigonometric equations (Q2)
- Decomposition into partial fractions (Q1)
- Sketching a modulus graph / transformations of graphs (Q4)

Some candidates had difficulty with the following content:
- Interpreting the graph of $f'(x)$ (Q13)
- Understanding and using sigma notation for sums of series (Q7)
- Separation of variables in order to solve a first order differential equation (Q14)

Areas for improvement:
- Algebraic manipulation
- Correct recall of standard techniques from GCSE, e.g. cancelling algebraic / numerical terms in a fraction

Comments on individual questions/sections

Q.1 Part (a) was generally well done. In part (b), the integration was generally well done, but many candidates failed to use logarithmic laws to simplify the final answer to the required form.

Q.6 Parts (a) and (b) were generally well done. In part (c), the first instance of integration by parts was generally well done, but strangely, many candidates failed to complete the second integration by parts correctly.

Q.7 This was a standard question on arithmetic and geometric progressions, expressed in sigma notation. However, candidates did not seem to be familiar with the sigma notation, or know how to interpret it, which was disappointing, as Section 2.3.4 in the Unit 3 subject content states, “Understand and use sigma notation for sums of series”.

Q.8 In part (a), candidates seemed to think, incorrectly, that a change of sign was sufficient for the presence of a root in a given interval. Continuity is also a required condition. Unfortunately, it was rare for a candidate to mention continuity.

Part (b) was generally well done. In part (c), many candidates realised that $f'\left(\frac{1}{3}\right) = 0$, but failed to give an explanation as to why that meant the Newton-Raphson method failed. Generally, candidates are not particularly articulate when asked to provide an explanation, although, often, it is possible to make an educated guess at what they are saying.

Q.9 This question was generally well done, except many candidates did not give their final answer in terms of π, but, instead, gave their answer as a decimal.

Q.10 The responses to this question were much better than expected.

Q.11 Many candidates failed to use the double angle formulae required in order to simplify the expression for $\frac{\mathrm{d}y}{\mathrm{d}x}$ to $-\tan\theta$. A variety of strange cancelling was seen in candidates' solutions.

Q.12 Part (a) was well done. In part (b), owing to the presence of a third term, very few candidates realised that the binomial expansion could be used.

Q.13 In part (a), many candidates were able to write down the conditions for $f(x)$ to be decreasing and convex, in terms of $f'(x)$. However, they did not seem to be able to interpret the $f'(x)$ graph, to determine the correct interval. Candidates were a little more successful in part (b), as no explanation was required.

Q.14 Part (a) was surprisingly well done. However, in part (b), candidates did not seem to be able to separate the variables in order to proceed with the required integration, so this part proved difficult for many candidates.

Q.15 Candidates who interpreted the context of the question correctly did well, as this was a standard compound interest question. Unfortunately, many candidates were not able to translate the context of the question into mathematics.

Q2, Q3, Q4, Q5 – These questions performed as expected and there were no areas to highlight.

MATHEMATICS

GCE

Summer 2024

A2 UNIT 4 APPLIED MATHEMATICS B – SECTION A

Overview of the Unit

Candidates performed more consistently this year than in previous years, although many candidates found work at this level fairly challenging. The slightly more formulaic elements of the paper, such as the hypothesis testing on the product moment correlation coefficient (PMCC) and on the sample mean of a normal distribution, offered plenty of opportunity for candidates to showcase their knowledge. There were other elements, particularly the questions requiring explanations and the latter parts of question 4, where candidates could again demonstrate their understanding of the subject content in Unit 4 Section A. Questions 3 and 4 were considerably better answered than questions 1 and 2.

Questions on the following topics were well answered:

- Hypothesis test for a correlation coefficient (Q3b)
- Hypothesis test for the mean of a normal distribution (Q4d)

Some candidates had difficulty with the following content:

- Understanding and using conditional probability with a two-way table (Q1)
- Understanding and using the continuous uniform distribution (Q2)

Areas for improvement:

- Candidates should be encouraged to develop a deeper understanding of the topics in this unit, rather than simply following standard processes and procedures. This will allow them to offer more insightful explanations.
- Candidates should also be reminded that, when answering questions that require explanations, to take note of the number of marks allocated. A clear, succinct answer for a one-mark question will often suffice.

Comments on individual questions/sections

Q.1 This question was intended to be a gentle start to the paper with a familiar feel, but, unfortunately, many candidates found this question challenging and it was, in fact, the least well answered question on the paper. Most candidates were able to pick up one mark out of three, either for using $\frac{80}{162}$ in a product of fractions, or using $\frac{162}{180}$ as the denominator of a fraction.

In the first method, many candidates did not take into account the fact that there was both one student and one girl fewer in the second fraction, leading to calculations such as $\frac{80}{162} \times \frac{88}{180}$. In the second method, they forgot to consider the girls who were in 'employment or other' and used $\frac{79}{179}$ as the second fraction in the numerator.

Q.2 Candidates did not perform particularly well on this question either, with 7% of candidates not attempting the question, and many others scoring very low marks. Many candidates thought that the smallest angle had the distribution $\mathrm{U}(0,90)$, whereas others thought that the distribution was $\mathrm{U}(1,89)$ or $\mathrm{U}(1,44)$. The majority of candidates attempted to calculate the mean and standard deviation with reasonable success. As a general point, candidates are encouraged to state the distribution they are using in a question. Relatively few candidates were able to successfully start part (b), with many struggling with the trigonometric element of the question.

Q.3 Candidates performed relatively well on this question. It allowed them to use their reasoning skills and their knowledge of hypothesis testing to good effect. Many candidates realised that testing for negative correlation in part (a) was unreasonable and so Awena should use a one-tailed test to test for positive correlation. Some candidates simply stated the definition of a one-tailed test, without considering the context of the question. Answers such as "Awena is looking to see if there is only positive or only negative correlation, not both" were more common than expected.

Part (b) was similarly well answered compared to previous years. Some candidates demonstrated a good understanding of the topic and were able to earn all the marks available. Some made errors in the hypotheses, some failed to square root the value of R^2 given in the question, and some chose the critical value from the Spearman's Rank table, rather than the PMCC table. Candidates should be encouraged to state their hypotheses clearly at the beginning of any hypothesis test.

In part (c)(i), the majority of candidates were able to give a reasonable comment about n being too large to be able to use the statistical tables. However, only a small minority of candidates realised what was required in part (ii). Candidates seemed unfamiliar with the use of a large data set and did not seem to appreciate that, when given the choice to use all the data, this is preferable to using a sample. Examples of all the various options given in the mark scheme were seen. The most common answer given was "Take a smaller sample," which was not credited with any marks.

Q.4 Some parts of this question were well answered, whilst other parts were less well answered. Parts (a) and (b) generally performed well. Only a minority of candidates recognised the conditional probability element in part (c). Candidates should be encouraged to consider when it may be appropriate to use conditional probability, even if the word 'given' is not explicitly stated in the question. The majority of candidates simply calculated $\mathrm{P}(2.4524 < X < 3)$ and went no further.

Similarly to question 3, the hypothesis testing part of the question produced responses of varying quality. Some responses were well structured and correct. Others lacked cohesion and accuracy. Once again, candidates should be encouraged to write their hypotheses clearly at the beginning of their hypothesis test.

In part (e), many candidates realised that multiplying $\frac{1}{2} \times \frac{1}{6} \times \frac{1}{3}$ was the correct thing to do, although fewer candidates recognised that ABC was different to BAC. Some candidates multiplied by 3 instead of 6, so clearly had some understanding.

Many good responses were seen for part (f), with candidates successfully using all three methods detailed in the mark scheme. The first alternative method was the least common and the second alternative method led to the most errors. Similarly to part (e), candidates did not appreciate that AB was different to BA. This led to the very popular, but incorrect, answer of $\frac{11}{36}$. Candidates had most success when using the first method in the mark scheme.

MATHEMATICS

GCE

Summer 2024

A2 UNIT 4 APPLIED MATHEMATICS B – SECTION B

Overview of the Unit

Section B was well received, and many exemplar solutions were seen for all five questions. The paper appeared to be accessible to most candidates, except for questions 6(b) and 9(c), for which only a minority were able to achieve full credit.

The attempt rates were consistently high, supporting the fact that sufficient time was available to complete Section B of the paper. Overall, comparison of attempt rates and facility factors suggests that candidates generally performed better than during the Summer 2023 series.

Questions on the following topics were well answered:
- Resolving forces in two directions and eliminating variables (Q5)
- Taking moments and resolving forces vertically (Q7)
- Constructing and solving a differential equation (Q9)

Some candidates had difficulty with the following topics:
- Using kinematics formulae for constant acceleration for 2D vectors (Q8)
- Interpretation of the solution of a differential equation in context (Q9(c))

Areas for improvement include:
- The use of exact values from calculators, to avoid loss of accuracy due to premature approximation. Also, candidates should be prepared to work in terms of g.
- The use of diagrams (Q6). With the introduction of question-and answer booklets this series, candidates could simply annotate the diagrams that are provided in the question (Q5, Q7, Q9)

Comments on individual questions/sections

Q.5 This was the most successful question on the entire paper, and it was reassuring to see some candidates annotating the diagram provided in the question. The main issue that arose was from candidates using the obtuse angle of $100°$ with an incorrect trigonometric ratio. The most successfully candidates used the angle of $10°$, above the horizontal.

Q.6 Efforts in this question were disappointing. The attempt rate, of 98 %, was strong, but the facility factor was low at 37%. This supports the fact that some candidates are still not comfortable with projectiles in a vector setting. The algebraic element may have made the question slightly less accessible. The best solutions included a basic sketch that reinforced the information given in the main body of the question.

Many vector solutions were attempted in which some of the components were omitted. This led to meaningless expressions such as

$$\mathbf{s} = (12\mathbf{i} + 21\mathbf{j})(5) + \tfrac{1}{2}(-g)(5)^2.$$

The use of the word ‘proportion’ caused confusion in part (b). Many merely stated the time for the ball to reach its highest point.

Q.7 This question was well done by most candidates, particularly those who annotated the diagram provided in the question. It was reassuring to see that candidates were not overly troubled by the context of the question. One of the most frequent mistakes was to incorrectly determine one of the distances. Remarkably, a significant number of candidates are still opting for two applications of moments, which relies on correctly determining distances. Invariably, this approach was much less successful than resolving forces vertically, along with a single application of moments. Some struggled to articulate the mathematical reasons to support their answers for the safety requirements.

Almost all candidates secured the final mark for the modelling assumption used in part (b).

Q.8 Part (a) was generally well answered, with almost all candidates attempting the resultant of the three forces before using Newton’s second law. Part (b) was less successful with many candidates making careless errors when attempting to simplify their expression in vector form.

Q.9 Most candidates were able to derive the differential equation given in part (a). For part (b), some struggled to legitimately separate the variables. Furthermore, for those whose were successful in separating the variables, many made sign errors or simply omitted the ‘5’, following integration of $\frac{1}{g-5v}$.

Many candidates did not achieve the mark for part (c), mainly because they failed to get a sensible result in (b). The most able candidates were able to determine the limiting speed using the underlying differential equation.

Supporting you

Useful contacts and links

Our friendly subject team is on hand to support you between 8.30am and 5.00pm, Monday to Friday.
Tel: 029 2240 4251
Email: mathematics@wjec.co.uk
Qualification webpage: https://www.wjec.co.uk/qualifications/mathematics-a-as-level/

See other useful contacts here: Useful Contacts | WJEC

CPD Training / Professional Learning

Access our popular, free online CPD/PL courses to receive exam feedback and put questions to our subject team, and attend one of our face-to-face events, focused on enhancing teaching and learning, providing practical classroom ideas and developing understanding of marking and assessment.

Please find details for all our courses here: https://www.wjec.co.uk/home/professional-learning/

WJEC Qualifications

As Wales' largest awarding body, WJEC supports its education community by providing trusted bilingual qualifications, specialist support, and reliable assessment to schools and colleges across the country. This allows our learners to reach their full potential.

With more than 70 years' experience, we are also amongst the leading providers in both England and Northern Ireland.

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