May 2017 subject reports

Mathematical Studies SL – Timezone 1

Time zone variants of examination papers

To protect the integrity of the examinations, increasing use is being made of time zone variants of examination papers. By using variants of the same examination paper candidates in one part of the world will not always be taking the same examination paper as candidates in other parts of the world. A rigorous process is applied to ensure that the papers are comparable in terms of difficulty and syllabus coverage, and measures are taken to guarantee that the same grading standards are applied to candidates' scripts for the different versions of the examination papers. For the May 2017 examination session the IB has produced time zone variants of Mathematical Studies SL papers.

Overall grade boundaries

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0–15	16–29	30–39	40–52	53–65	66–77	78–100

Standard level internal assessment

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0–4	5–6	7–8	9–11	12–14	15–16	17–20

The range and suitability of the work submitted

This was the first May examination session where the Mathematical Studies SL projects were uploaded and marked onscreen.

As usual nearly all of the candidates opted for a statistical analysis. There were a few projects that should have been actively discouraged by the teacher as they lacked any originality. There were also some projects that seemed to be more like a homework assignment than a Mathematical Studies SL project. These projects did not show the time requirement and also showed that teachers did not give sufficient guidance to their students. It would be nice for

schools and teachers to steer candidates away from the obvious into more substantial investigation. There was a wide variety in the quality levels across schools. Some schools and teachers seemed to understand the criteria and the expectations for the project quite well, whereas, in other centres, projects were generally weak, data collection was sparse and the teacher did not seem to understand the assessment criteria. Many candidates used surveys or Internet referenced sources to collect their data. It was pleasing to see sources referenced but often the survey to which they referred was not given. Quite a few projects were missing the raw data and it was not always easy or possible to verify results. The vast majority of projects had structure and developed logically. Most had at least some appropriate notation and terminology. Unfortunately, there were still careless errors in calculations, notation and terminology and often variables were not defined.

Teachers are also encouraged to make comments throughout the project in the margins and check the accuracy of the mathematics. There are still a significant number of projects that only develop one process, either simple or further, repeating it a number of times, and considering it as separate processes. Also, some develop only further processes not realizing how this affects the criterion C level awarded for the project.

The conclusions drawn were mostly consistent with the results. Validity was, as always, the criterion that was least well addressed although there are improvements in this area.

Candidate performance against each criterion

A: Some candidates did not include a title and others had no plan or did not mention any mathematical processes and so could not be awarded any more than 1 mark for this criterion. Candidates, generally, were able to achieve level 2 as projects contained an aim, a title and a plan, if at times brief. Candidates usually mentioned some of the mathematical processes they would use. Although, at times, there are processes not mentioned in the plan that are carried out in the analysis. This deprives the candidates of achieving more than level 2. Giving reasons for the mathematical processes appears to be challenging for the candidates but they have to include this in order to be awarded full marks.

B: Some candidates did not show the raw data collected so it was not possible to verify all of the calculations.

In general, candidates understand this objective well. Candidates are able to gather raw data either by personal collection or from the Internet and organize it in a manner appropriate for analysis. Very few candidates seem aware of how to collect a random sample. Most samples are convenience samples or a candidate seems to think that if they stand in a hallway and ask whoever passes by, that this is a random sample. Unfortunately, too many teachers seem to think this as well. Sampling processes could be better described. Most candidates are able to earn a 2 for this criterion but not a 3. Frequently the data is just too sparse for the intended analyses, especially if the χ^2 test is an intended process. It is also, too frequently, very simple in nature. In the Teacher Support Materials (TSM) the guidance on a correlation or χ^2 statistics project is that a project is strengthened if at least three variables are chosen. Then the

candidate can investigate which of two factors is most related to the third. This rigor is present in too few projects.

C: There were often times when the simple processes were not correct or not relevant to the task and this limited the award to level 1 or 2. Most candidates and teachers were aware of the need to present some sample calculations by hand, or to present their calculations in the context of the formula. However, many teachers and candidates did not seem to focus on the relevance requirement to earn level 3. In many centres, there was a "more processes the better" attitude which had a negative impact on a candidate's overall score in this criterion. Also there were many cases of invalid χ^2 tests and regression lines which were irrelevant. This last mistake is particularly disturbing because, if you present a scatter plot, you should use it (or a calculation of the correlation coefficient) to determine if it is relevant to find a regression line. Many candidates use Excel and then only add a trend line, a calculation of the regression equation and a calculation of r^2 without demonstrating any understanding. These poor practices preclude higher marks. Too few candidates proceeded with regression in the logical order of scatter plot, calculation of the coefficient, followed by a regression line if appropriate. In addition, if the regression line is not used in any meaningful way, it is hard to understand the purpose of the calculation, whether it is mathematically valid or not. Also, too many candidates failed to label graphs and axes or to represent data in a logical manner

D: Most candidates drew conclusions consistent with their mathematical processes. Candidates commonly earned a 2. Sometimes there were inconsistencies which detracted from the work and led to level 1 being achieved. In the better projects, candidates presented partial conclusions as they went along, and then summarized these at the end. Few candidates earned a level 3 for this criterion because the projects were too simple in conception to allow for a substantive discussion. Overall, the majority of candidates were able to produce thoughtful interpretations. Candidates should be discouraged from making unsubstantiated conjectures about the reasons for their findings.

E: It was usually the stronger candidates who commented meaningfully upon the processes used and the results found. Some went on to discuss the limitations of their results. Many candidates commented on the validity of their data in a manner that went beyond "I needed more data". A number of candidates also successfully commented on the validity of their processes, but most candidates think their processes are valid if they have checked their calculations or they have performed their analysis on Excel. It was common for valid and accurate to be treated as synonyms. Based on candidate understanding of this criterion, it appears that there are many teachers who do not fully grasp the objective of this criterion.

F: All projects had some structure and most developed logically. A few projects lacked explanation at each stage. Others had graphs and mathematical processes out of order. Many candidates did not ensure that their charts and graphs were clearly labelled and sometimes it was difficult to know to which chart or graph they were referring. Many candidates relied on Excel graphs and regression features which were not always appropriate for their data, or they included unexplained trend lines. In addition, computer/calculator notation was used when it should not have been. Bibliographies/referenced sources were often seen in an Appendix. Level 3 was not achieved mainly because, although the project was quite good, it was too simple. Level 3 was also not achieved as there was a lack of explanation on how the categories

for the χ^2 test were subdivided. Teachers and candidates seem unaware of the need to clearly explain how their data was divided up for the χ^2 test.

Surveys were not always submitted with the projects or raw data was organized into a contingency table without presenting the raw data, making it impossible to check the results.

G: Most candidates were able to earn one of the two marks for this criterion but few candidates earned both marks. Terminology was sloppy and vague and notation was varied in its incorrectness. Candidates should be taught how to use a simple equation editor. Also, the variables were often not explicitly described.

Recommendations for the teaching of future candidates

Teachers should:

- make sure that the candidates include ALL raw data collected in the body of the project or the Appendix.
- ensure the simple processes used are meaningful and relevant to the task.
- ensure that the candidates define the variables.
- ensure that candidates show some/all calculations that lead up to the result.
- ensure, when found, that the equation of the regression line is used.
- explain sampling to the candidates.
- encourage candidates to show calculations by hand even if they are making use of technology such as Excel.
- instruct candidates to fully explain any information being conveyed through screenshots. Examiners are not expected to know Excel formulae or the calculator notation of different devices. Where screenshots are used, the image should be clear and the candidates should explain what is being shown, using correct notation in the body of the work.
- help the candidates to understand how to address validity.
- show the candidates how to use an equation editor for correct notation.
- make sure that all candidates read the assessment criteria and are fully aware of what they demand.
- explicitly provide evidence, on the IA projects (preferably by annotating the pages directly) for awarding the different levels of achievement for the criteria.
- give candidates examples that show good work, not so good work and bad work, so they can better understand the differences between them.
- monitor candidate work, and give candidates suggestions about how to increase the sophistication of their analysis.
- preview the electronic version of the work, prior to upload, ensuring all pages are present and correctly oriented, and that any comment boxes are expanded and not covering any part of the work. Examiners will only see a static image of the work and cannot expand or move comment boxes.

Further comments

It would greatly help the moderation process, if schools wrote comments related to each criterion, where the evidence is located on the body of the projects; some schools did and this was extremely helpful for the moderator. Schools should follow the upload instructions (available on IBIS) regarding annotating directly onto word-processed work. Examiners will see a static image of the work and cannot expand comment boxes or move them to read text beneath them. To that end, comments should be fully expanded, but positioned in regions of whitespace (such as the margin) prior to the work being uploaded.

Teachers could, as an alternative, write their comments in the text box at the point of upload, stating the page where the evidence for awarding each level of achievement for the different criteria is located.

Standard level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0–14	15–28	29–37	38–49	50–61	62–73	74–90

The areas of the programme and examination which appeared difficult for the candidates

Many candidates were unable to recognize that the length (of a trout) is a continuous variable. Only the very best candidates wrote down a detailed and unambiguous explanation when required to provide a reason to support their answer. Although many could find the equation of a straight line, only a small proportion rearranged this into the required format of $ax + by + d = 0$.

Few were able to identify and use correct notation of the domain and range of a function given its graph. Most candidates were unable to find the coefficients a and b in the quadratic equation. The geometric sequence had $r < 1$ so frequently the reciprocal of the correct answer was seen. A surprising number were not able to correctly substitute into given formulae e.g. compound interest or the nth term of an arithmetic sequence.

The areas of the programme and examination in which candidates appeared well prepared

It was pleasing to see candidates able to answer questions completely correctly and that candidates generally attempted all questions. There was evidence that the syllabus had been covered in its entirety. In particular candidates were able to convert from logic notation to words and vice versa without error. Almost all candidates were able to find the frequency from a histogram and many could identify the modal interval from the given histogram. Generally χ^2

calculations were performed accurately using a calculator. Almost all candidates were able to fill in some of the missing probabilities on a tree diagram accurately. In this examination session trigonometry and geometry were observed to be a strength with many recognizing to select the law of sines to find the missing length in a non-right triangle and attempting to use the correct formula for the area of a triangle. Venn diagrams were well understood.

The strengths and weaknesses of the candidates in the treatment of individual questions

Question 1: Descriptive Statistics

Candidates were able to find the values to fill in the frequency table from a graph, write down the modal class and calculate a percentage. It was surprising to see so many candidates not identify the length of trout as a continuous variable.

Question 2: Percentages and scientific notation

Most candidates were able to correctly identify the percentage in part (a) which would have been easier if a Venn diagram had been drawn. However, many candidates lost marks in part (c) due to giving an exact answer in part (b) and then rounding before converting to scientific notation.

Question 3: Logic

Parts (a) (writing in words from symbolic form) and (b) (writing in symbolic form from words) were generally done well. Many candidates struggled to correctly complete the truth table. While it could be seen that candidates generally understood what logical equivalency was, very few candidates were awarded marks in part (c)(ii). Unfortunately, most candidates did not give a reason that were sufficiently explicit.

Question 4: Venn Diagram

Although it was evident most candidates understood the concepts many did not score full marks because of poor notation or listing elements rather than giving the number of elements in a specified region.

Question 5: Arithmetic sequences

Few candidates successfully interpreted that this question was testing their understanding of arithmetic sequences. Many candidates were successful with part (a) through writing a list of

values. There were few candidates who explicitly used the formula for arithmetic sequences in the working box. This led to many candidates not receiving any marks for part (b).

Question 6: χ^2 test

Parts (a) (find a missing value from the observed value table), (b) (write down the degrees of freedom), and (c) (find the χ^2 calculated value with a GDC) were generally well done. Most candidates knew that they needed to compare the χ^2 calculated value with the critical value. However, a surprising number of candidates stated an incorrect conclusion even when correctly comparing the two values. There were several candidates that attempted to use the p-value but only gave a 1 significant value of 0.004 and therefore the answer could not be considered correct. It was evident that some candidates had not been taught this topic.

Question 7: Tree diagram

Most candidates were able to fill in the missing values of the tree diagram but not so many could find the combined probability. The weakest candidates did not recognize that it is impossible to get a probability greater than 1.

Question 8: Currency exchange

Candidates struggled with knowing when to calculate the commission in part (a). Many candidates first converted to the new currency and then tried to deduct the commission rather than deducting the commissions first.

Question 9: Geometry (3D cone)

This question was generally well done, many candidates used the correct substitution into the volume of a cone formula, but had difficulty solving for the cone's radius. Many candidates forgot the units for the curved surface area of the cone or had an exponent of 3 rather than 2. There were also some issues with premature rounding on this question.

Question 10: Geometric sequence and series

Many candidates recognized that recursively the sequence could have been defined as divide the previous term by three but did not see this meant the common ratio was a third.

Question 11: Linear function

Candidates generally did well in writing down the gradient and finding the y-coordinate. Most candidates were also able to find the perpendicular slope. Few candidates were able to get full marks as they neglected to give integer coefficients in their answer to part (c).

Question 12: Graphs of rational functions

This was one of the most difficult questions for candidates. Many candidates tried to use the graph to determine the domain of the function rather than the equation. Of those who attempted to write down a domain, few of the answers were in correct mathematical notation. Few candidates used a ruler for the line $y = -6$ and the weaker candidates drew a vertical line. Only the strongest candidates understood what was required to find the range of a rational function given the graph and the general equation. Very few candidates received full marks for this question.

Question 13: Sine rule and area of a triangle

Quite a few candidates automatically assume all triangles are right-angled; those that did not, recognized that they needed to use the sine rule. Many used the wrong angle for the area formula in part (b).

Question 14: Compound interest

Many candidates do not read the instructions regarding level of accuracy. Others did not take into account how frequently the investments would be compounded even though this was in bold. The best candidates wrote down correct working to support their answer.

Question 15: Quadratic equation

Overall, most candidates struggled with this question. Many were able to write down given the y-intercept was 10 that the constant was therefore 10; however there were many that did not attempt to find the other coefficients of the quadratic equation and likewise writing down the x-intercept.

Recommendations and guidance for the teaching of future candidates

- As a wrong answer with no working is awarded zero marks it is important that relevant working is always written down. Candidates should firstly record the formula chosen (if any) and then show the values substituted in.
- Clearly label the parts of the question ((a), (b) etc.) in the working.
- The unrounded answer from the calculator should be written down; often answers were truncated rather than rounded.
- Candidates should always check if the final answer is unreasonable, such as a probability greater than 1.
- Read the question and take note of the key information, which is often is written in bold.
- Make sure candidates are aware of each command term. For example, “Draw” means a ruler (straight edge) should be used for straight lines.
- Teach the whole syllabus including use of GDC to avoid premature rounding. Make sure candidates know how to use their GDC including checking it is in degree mode.
- Ensure candidates use the formula booklet throughout the teaching of the course and are not only exposed to it on the day of the examination.
- Practise past papers to gain familiarity with mathematical notation, question styles and pacing.
- Some candidates are writing outside the working box, either by the question itself or below the bottom margin. This risks the examiner not seeing their work; if responses need to continue outside of the give box, candidates should use the additional answer booklets (available in all IB DP examinations) and label the work accordingly.
- Teachers should continue to urge their candidates not to cross out work unless they plan to write something else. Once working has been crossed out, no marks may be awarded even if the working is correct.
- Answers should be written in pen, with pencil reserved for diagrams. Candidates should not write all of their working/answers in pencil as the responses are scanned and information may be lost if the pencil lines are too light.

Standard level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0–11	12–23	24–33	34–44	45–54	55–65	66–90

General comments

It is noted that there were some discriminating components in the exam, but the stronger candidates were able to find some success in these parts. It was pleasing to see that

candidates were conscious of showing their working. Relative to recent examination sessions, candidates seemed to be aware that "follow through" marks can only be awarded if working is shown in subsequent parts. It was pleasing to see many candidates were adept in the use of the GDC. Few accidentally used their calculator in radian mode and most were able to find the correlation coefficient and regression equation.

The areas of the programme and examination which appeared difficult for the candidates

- Reliability of using a regression equation to estimate a value.
- Understanding what is meant by the command term 'Show that'.
- Using the given information in a question.
- Labelling axes of graphs and sketching smooth curves with asymptotic properties.
- Identifying the intervals of a curve which satisfy specified information.
- Solving an exponential function with a negative exponent.
- Using and interpreting a mathematical model in a contextualized situation.
- Calculating conditional probability.
- Understanding the relationship between a derivative and the equation of a tangent.
- Decreasing functions.

The areas of the programme and examination in which candidates appeared well prepared

- Finding and using the equation of the regression line.
- Calculating percentage error.
- Algebraic manipulation.
- Application of Pythagorean Theorem.
- Evaluating a function for a positive value of x.
- Use of GDC to find the coordinates of key features of a function.
- Calculating the volume of a cylinder.
- Evaluating an exponential function.
- Calculating simple probability.
- Normal distribution.
- Finding the derivative of a function.

The strengths and weaknesses of the candidates in the treatment of individual questions

Question 1

Candidates were not always able to identify the range in the context of the question. Some found an interval stating extreme values. A few candidates misinterpreted 'average body weights', and so calculated the mean value of the data. The correlation coefficient was calculated correctly, though some made an error rounding their final answer. Surprisingly many candidates were not able to describe the correlation in terms of strength and direction. The coefficients of the equation of the regression line were usually correct but not always given to 3 significant figure accuracy. Most candidates were able to use their regression equation to estimate a value. It was pleasing to see candidates show their working in this question.

Candidates should be reminded that unless subsequent working is seen, follow-through marks are not possible for incorrect answers. Candidates were able to correctly calculate the percentage error, with only a few using an incorrect denominator. The validity of a regression equation continues to be a poorly understood area of the curriculum. Common errors included citing the magnitude of the percentage error. It is insufficient to state that a data item is small or large. Teachers should advise their candidates that validity is contingent upon both the strength of the correlation and the value of the independent variable being in the given data range.

Question 2

Most candidates were able to find correct expressions for the composite areas in ABCDE, but surprisingly few equated this to 222. This was despite the emboldening of 'equation' in the question. Future candidates should be guided in the difference between an "expression" and an "equation", and to read questions carefully, taking special note of words in bold. Those who found the composite areas in part (a) displayed good algebraic skills to expand and group their expression for the area. Manual attempts to find x proved quite problematic with few arriving at a correct solution. Those who found a decimal value for length CD, often left the latter parts unanswered, which in turn compounded earlier errors in this question. It is important that candidates are aware of the tools available in their GDC. Use of the powerful solver function in the GDC should be encouraged, especially when solving a quadratic equation with high coefficients. A variety of methods were used to show angle $\mathrm{B\hat{A}E} = 67.4^\circ$. These included using Pythagorean Theorem, cosine rule and area formula. Some substituted in the known angle, thus invalidating the process. Teachers should remind candidates that substituting the known value negates the process in a "Show that" question. Candidates who wrote down the correct steps in the calculation of angle $\mathrm{B\hat{A}E}$, did not always receive the final mark. In a "Show that" question, both the consistent unrounded and rounded answers must be seen to ensure the final line has in fact been arrived at and not simply quoted from the exam paper. This a point which require constant reiteration. Calculation of the length CF was a discriminating component with this question, with few attaining full marks.

Question 3

Candidates were able to successfully evaluate the function $f(x)$. Sketching of the unknown function was not always well done. Greater care should be taken to draw a smooth curve to reflect its key features. Curves veering away from the y-axis do not reflect the asymptotic behaviour of the function. Candidates should be encouraged to constrain their sketch to the given window and to use their GDC to assist in finding the approximate location of stationary points and intercepts. Unfortunately many candidates did not label their axes. There was difficulty finding the equation of the vertical asymptote, with many failing to submit a response to this part (c). Candidates were reasonably accomplished in their use of the GDC to find the coordinates of the x-intercept. Part (e) proved to be a difficult task for all candidates. It was not uncommon to see candidates attempt to find the derivative of function $f(x)$. It was pleasing to see candidates equate their expressions for f and g. The final mark was often lost for stating the answer as a coordinate pair. Candidates should be conversant with appropriate

terminology, knowing the difference between coordinate, coordinates, intercept, and the solution of an equation.

Question 4

Candidates were able to substitute the correct radius into the volume of the cylinder formula. In most cases units were also included. Since there was only one diagram shown in this question, some candidates may have concluded there was only one shape. This perhaps led to some confusion in part (b), where the radius of the pan was interpreted as the radius of the sphere. Even if not prompted, it is good practice for a candidate to illustrate/sketch the given information. This can help to bring clarity to questions involving geometric shapes. Overall parts (c) and (d) were well answered. That said, some weaker candidates had a poor understanding of function notation, incorrectly identifying $P(t)$ as $P \times (t)$. It was pleasing to see candidates show their working throughout this paper. This made it possible for follow through marks to be awarded. While many wrote down the correct equation in part (d), few were able to use their GDC to solve for the variable t. It was disappointing that few candidates were able to convert their time to the nearest second. A wide variety of answers were seen in part (f). This revealed that while candidates can perform a series of calculations, they are not always able to understand its relevance in the context of the question.

Question 5

Many candidates had difficulty using one variable statistics with a frequency list. This could be misinterpretation of the given information or a failure to assign the frequency list in the GDC. In preparation for the IB examinations, it is recommended teachers lead their candidates through the process of a calculator reset. This will enable a candidate to become familiar with the default settings in their calculator. Unfortunately this error led to a sequence of incorrect answers in parts (a), (b) and (c). Most were able to answer the simple probability question in part (d), but the conditional probability question was poorly understood. Finding the probability from a normal distribution was carried out successfully. Relative to previous sessions it was pleasing to see more candidates support their working with a probability statement or a normal distribution curve. The “expected value” is a numerical estimate and by definition should be treated in a manner similar to the statistical mean; teachers should advise candidates, that unless directed otherwise, their expected value should be expressed exactly or correct to three significant figures.

Question 6

Most candidates were able to find the correct terms for the derivative, but appeared to have limited understanding of the significance of this result. Though many substituted $x = 2$ into their derivative, few equated their derivative to the gradient of the tangent line at this point. Candidates were slightly more successful in finding the equation of the tangent line. Those who were successful in this part usually showed full working, with few attaining this result directly from the GDC. Most candidates missed the demand in part (c) and did not use their derivative to find the x-coordinates of the stationary points. Candidates should read the questions carefully, identifying the command term and taking note of any specific instructions to answer the question. Most were able to evaluate their derivative at $x = -1$ but some made

algebraic errors in their calculation. Many candidates had difficulty justifying why the function was decreasing at $x = -1$. This provided further evidence that candidates were able find and use a derivative function, but had difficulty assigning meaning to the algorithm. Candidates were more successful in finding the *y*-coordinate of the local minimum.

Recommendations and guidance for the teaching of future candidates

- Though the candidates appeared to take care in the accuracy of their calculations and answers, this is a point that requires constant reminder. Premature rounding can be an issue for multi part questions. Candidates should show and use unrounded answers in their working as much as possible.
- Answers should, where relevant, include the correct unit.
- Read each question carefully. Take note of the information to be used, the specified method, accuracy required for the final answer.
- Understand the expectations for command terms such as Find, Show that, Sketch, Draw, Calculate etc.
- Encourage candidates to show all calculations and display the steps they make, laid out in a logical and coherent manner. As instructed, each question should be started on a new page in the answer booklet to help with the readability of responses.
- The 'Show that' command requires candidates to state both the unrounded and final answers. Substituting in the known value is 'reverse engineering' and invalidates the process.
- Candidates need to be competent in using mathematical techniques as per the course guidelines. It is possible to be overly dependent on the graphing calculator. By the same token they need to be aware of how to utilize the advanced features of the GDC. Care must be taken choosing an appropriate graphing window. Failure to do so may result in the candidate not identifying important features of the function.
- Teachers should help candidates understand the default settings in their calculator, especially if key settings are reset when the device is readied for the examinations.
- Candidates should be conversant with appropriate terminology for each area of the course. For example, the 'range' of a function has a different meaning to the 'range' of a statistical data set.
- Candidates are to be encouraged to understand the concepts behind the algorithms that they are taught. This is particularly important in differential calculus.
- Contextualized questions often present a challenge for candidates. During the course, candidates should be exposed to questions which require interpreting written information and transforming this into a mathematical problem.
- Where possible use diagrams and sketches to illustrate the information given in a question.
- Give consideration to the weight of a question. Lengthy explanations are not necessary when the question is worth only one or two marks.
- A graph should be sketched accurately and axes labeled and scaled. Important features in a sketch should reflect their approximately correct location.
- Be careful to note the information that is given in the question. Full follow through

marks may not be awarded for failing to use this information.

- Develop a solid understanding of the properties of geometric shapes.
- Answers should be written in pen, with pencil reserved for diagrams. Candidates should not write all their working/answers in pencil as the responses are scanned and information may be lost if the pencil lines are too light.
- In Paper 2, candidates should follow the rubric and not write any responses in the question booklet, as these will not be marked; all responses must be written in the answer booklets provided.