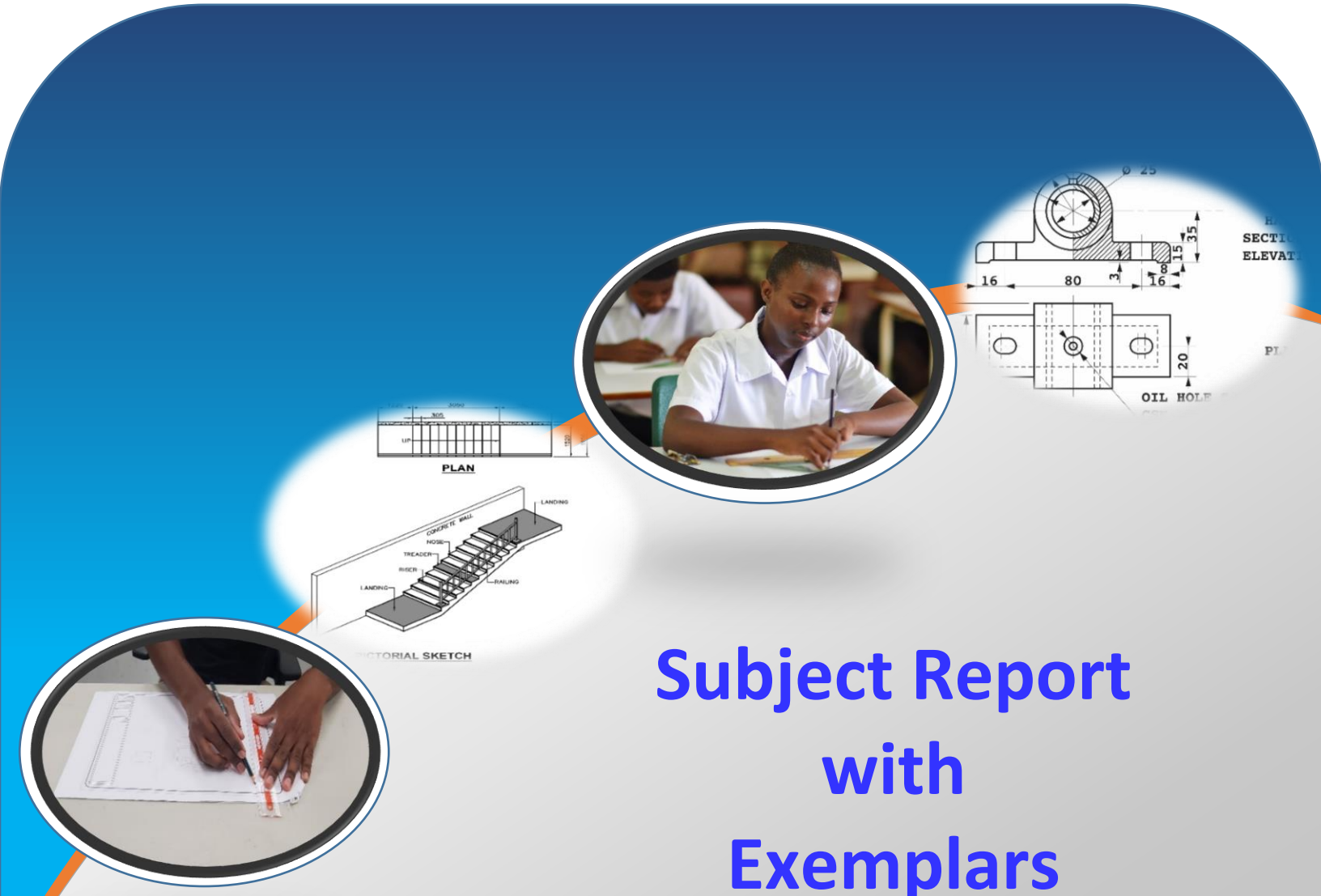
CARIBBEAN EXAMINATIONS COUNCIL

TECHNICAL DRAWING



Subject Report with Exemplars

June/July 2021

CARIBBEAN EXAMINATIONS COUNCIL

REPORT ON CANDIDATES' WORK IN THE
CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

JUNE/JULY 2021

TECHNICAL DRAWING
GENERAL PROFICIENCY

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INTRODUCTION

This guide has been put together using candidate responses to the 2021 June/July examination in CSEC® Technical Drawing. We have kept the answers according to the original design of the examination paper.

The Covid–19 challenges experienced by territories writing the Caribbean Examinations Council's (CXC) examinations were varying depending on their respective economic situations and their readiness for virtual classes. Thus, no doubt, the aforementioned would have impacted some candidates' preparedness for the 2021 examinations.

To mitigate the pressures experienced by all as a result of the foregoing, the CXC provided guidelines on the objectives of the greater part of the examination to territories, through the local registrars. Additionally, whether they were using the traditional or the CAD option, candidates were provided with pointed guidelines on the format or the presentation of solutions. It is the observation of the CSEC Technical Drawing examination team that over the last four years evidenced by the solutions (scripts) submitted whether by the traditional or CAD method, candidates have not demonstrated that these guidelines have served the purposes intended. Thus, there is the fervent wish that stakeholders' territory-wide would pay greater attention to the instructions given in an effort to best prepare candidates to optimally perform in the examinations.

Candidate entry for the 2021 examination reflected a decrease; from 9462 entries in 2019 to 8012 in 2021. An analysis of the performance on the 2021 examination showed that the number of candidates achieving Grade I was below that of 2019 and 2020 but higher than 2018. There was a decrease in the number of candidates achieving Grade II when compared to 2018, 2019 and 2020. Overall, the percentage of candidates achieving acceptable Grades I–III declined to 79.70 when compared to 84.41 in 2020, 87.47 in 2019 and 84.50 in 2018.

The distribution of grades on Paper 01 was satisfactory. Approximately 68 per cent of candidates achieved Grades I–III.

The distribution of grades on Paper 021 and Paper 022 was below average. Approximately 40 per cent of candidates achieved Grades I–III on Paper 021 and 26 per cent achieved Grades I–III on Paper 022.

Performance on Paper 03 remains good with approximately 90 per cent of candidates achieving Grades I–III.

PAPER 01 – MULTIPLE CHOICE

This paper consisted of 60 multiple-choice questions, testing the profile dimensions of Knowledge (Profile 1), Application (Profile 2), and Practical Ability (Profile 3). The mean score of 33.84 was consistent with candidates' performance on the paper over the previous three years.

PAPER 02 OPTION A – BUILDING DRAWING

Section I — Working Drawing

Question 1

Candidates were presented with the outline of a building and a proposed site for a single-storey residence. They were required to produce a site plan to include the building given specific requirements. The required site plan consisted of appropriate conventions in accordance with the syllabus.

Candidates were required to draw the site plan at a scale of 1:100 showing the location of the building using specific setbacks. The following labels were to be identified:

- Boundary lines
- Proposed building in accordance with specified setbacks
- Sewer pipes in relation to the proposed building
- Septic tank and soakaway
- Direction of flow for drainage of surface water
- Eave line
- North symbol
- Identified streets
- Driveway

In addition, specific dimensions for the setbacks were given to guide candidates on the placement of the building on the site. Candidates were also required to print a suitable title and scale. Candidates using CAD were given instructions to print.

This question was mandatory and was attempted by approximately eighty per cent of candidates who registered for the Building option.

From the responses, candidates appeared to be comfortable generating a drawing of a site plan from the information given, whether using the traditional or the CAD medium. This suggests that candidates had a good knowledge of site plans and were able to apply that knowledge to the question. As such, candidates were generally able to represent the following as requested:

- Draw the outline of the land/lot.
- Identify and label streets.
- Insert the building using setbacks.
- Apply line conventions.
- Apply the given dimensions.

Candidates were also able to insert and label the following:

- North symbol
- Eave lines
- Sewer lines; septic tank and soakaway
- Boundary line
- Direction and flow of drainage
- Setbacks

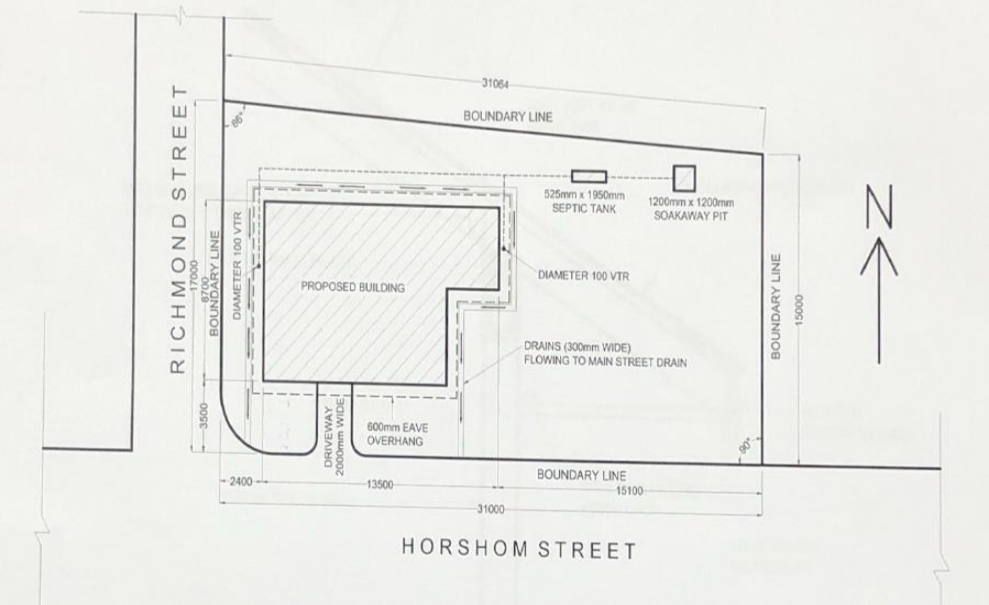
Difficulties observed in candidate responses included the following:

- Knowledge of dimensioning conventions using CAD
- Applying and drawing the sewer system and drainage
- Applying and indicating the hatching for a proposed building
- Labelling setbacks
- Indicating correct line representation for eave line
- Printing

A significant percentage of candidates who provided a response were able to interpret the question and display knowledge of site plans with placement of labels as given. Candidates' knowledge and application of the site plan was acceptable. However, their practical ability and neatness needs to be improved. While many candidates appeared to have difficulty scaling the drawing, especially when using the CAD option, some were successfully able to replace the scale with a smaller scale and achieve accurate measurements when faced with a difficult situation. These candidates were rewarded for the ability to utilize scales successfully.

A large proportion of candidates using CAD had difficulty printing their responses. This was noted by drawings which were printed too small to be assessed precisely.

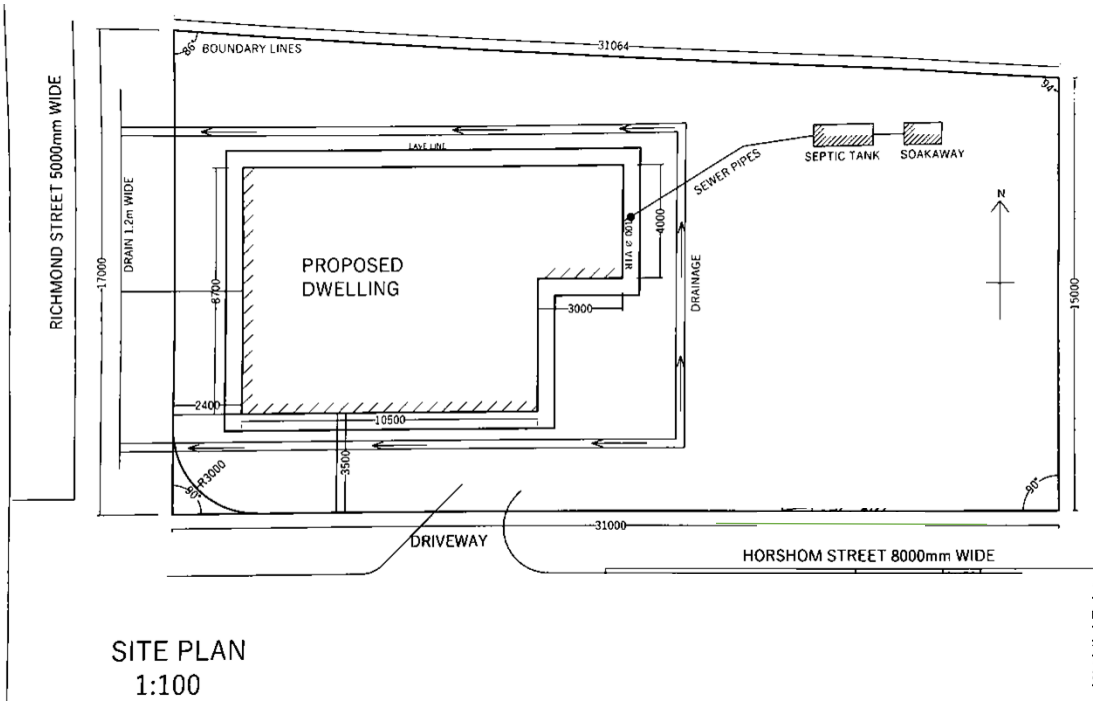
A Candidate's Answer to Question 1



Examiner's Comments

This candidate was able to correctly place the building on the site plan using the dimensions specified for the setbacks. An excellent understanding of the sewer system and surface water drainage was evident from the drawing submitted. The standard procedure for the hatching of the building was indicated. All other site plan items were inserted and clearly labelled. However, the candidate took the initiative to draw and print the drawing at a smaller scale to fit the 11 x 17 sheet as the given scale appeared large. Correct line types, line weights and line scales were correctly applied.

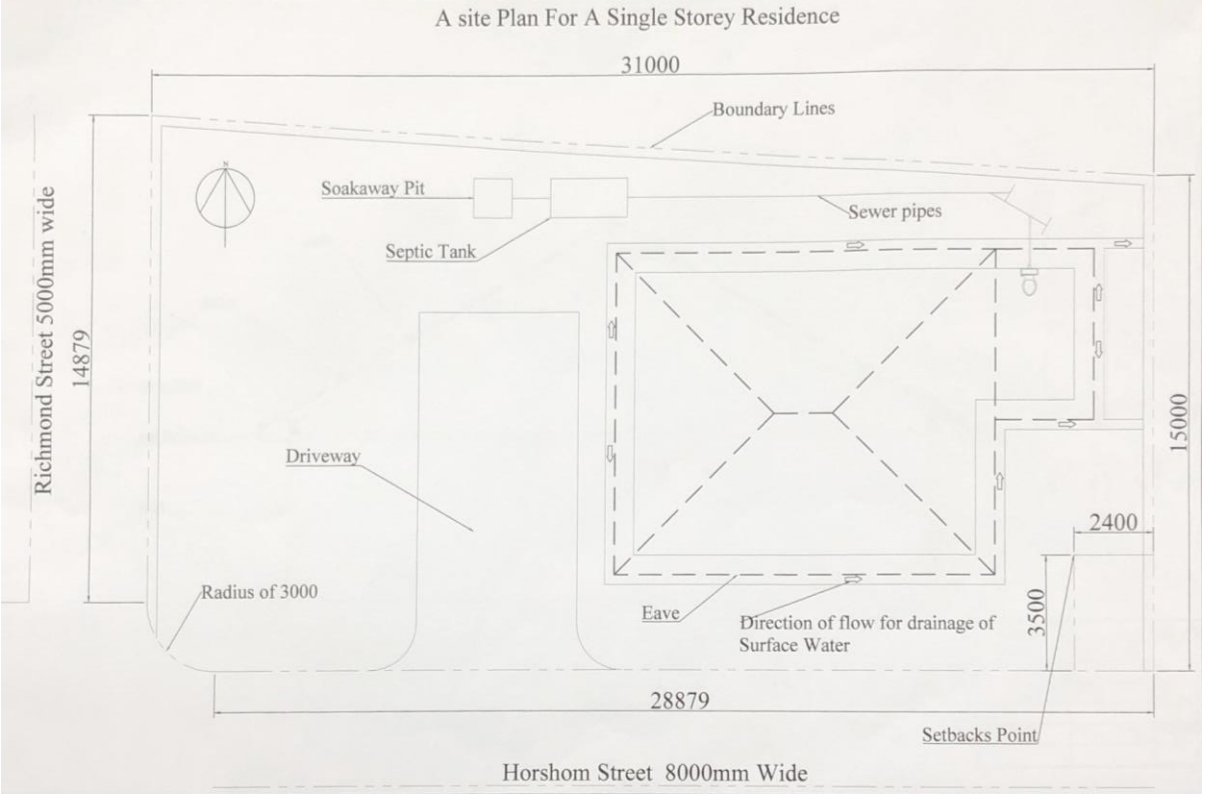
A Candidate's Answer to Question 1



Examiner's Comments

This candidate's response reflects an excellent understanding of the site plan required and was drawn to scale. The building was placed on the site according to given setbacks. A clear understanding of the sewer system and surface water drainage was evident from the drawing submitted. All other items were inserted, labelled and identified. The candidate was able to apply line types, line weights and line scales correctly. The drawing was printed clearly using the correct scale. However, dimensions were not placed using the correct convention.

A Candidate's Answer to Question 1



Examiner's Comments

This candidate was able to correctly place the building on the site plan using the using the dimensions specified for the setbacks. A clear understanding of the sewer system and surface water drainage was evident from the drawing submitted. The standard procedure for the hatching of the building was not drawn, however, the roof shape was used by the candidate as a guide for the building's outline. All other items for the site plan were inserted and clearly labelled. The drawing was printed clearly using the correct scale.

A Candidate's Answer to Question 1

Examiner's Comments

This candidate was able to correctly place the building on the site plan using the using the dimensions specified for the setbacks. A clear understanding of the sewer system and surface water drainage was evident from the drawing submitted. The standard procedure for the hatching of the building was indicated. All other requirements of a site plan were inserted and clearly labelled. However, the scale given in the question made the response a bit large for the 11 x 17 paper so the candidate took the initiative to print the drawing to a smaller scale to fit the 11 x 17 sheet. In spite of this, the scale used and the scale in the title did not correspond so marks would not have been awarded for the title.

Recommendations

- Teachers are reminded that this is the working drawing section of the examination. As such, standard practices and conventions for completing working drawings are to be rigorously followed.
- Emphasis should be placed on dimensioning, labelling and correct line conventions using CAD.
- Teachers are also reminded to
  - encourage students to read questions carefully and to draw to the given specifications
  - guide students in understanding the sewer systems identified in the syllabus
  - instruct students who are using the CAD option to
    - print to the correct scale, paying attention to line weights, font sizes and hatching where applicable
    - draw their solutions and not use blocks or templates from the software when answering questions.
- Instructions and practice for page layout and printing to PDF must be carried out in the classroom.

Section II – Sketch and Design

Question 2

Candidates were presented with instructions to sketch an orthographic sectional detail of a closed eave. They were also required to label specific components of the eave detail correctly. The detail components included the following:

- Wall
- Rafters
- Laths
- Fascia board
- Hurricane strap

Marks were also awarded for the following:

- Orthographic sectional detail
- Proportionate sketch
- Line work/line type/line weight

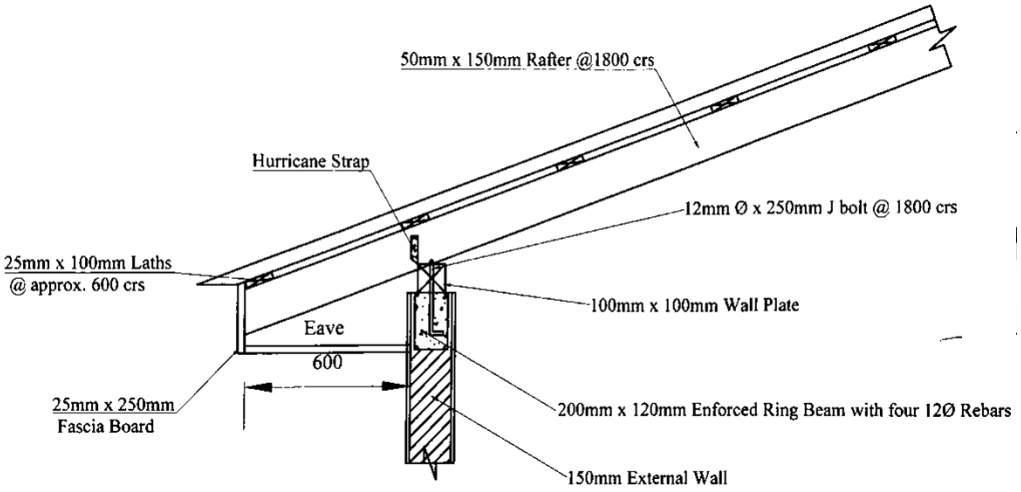
For this compulsory question, approximately 60 per cent of registered candidates responded. Approximately 50 per cent of candidates who attempted the question demonstrated

- an understanding of an eave detail
- general knowledge of labelling and drawing components.

The following are general aspects of weaknesses observed.

- An understanding of the term *orthographic sectional detail* (Candidates attempted to produce drawings showing front, plan and end elevations.)
- Knowledge of a *closed eave*
- Knowledge of orthographic sectional details (Roof plans, cross-sectionals of buildings and 3D drawings were produced instead.)
- Limited knowledge of hurricane strap and placement
- Drawing proportionally
- Printing of CAD drawings to scale
- Proper labelling techniques, especially text and leader lines with arrows

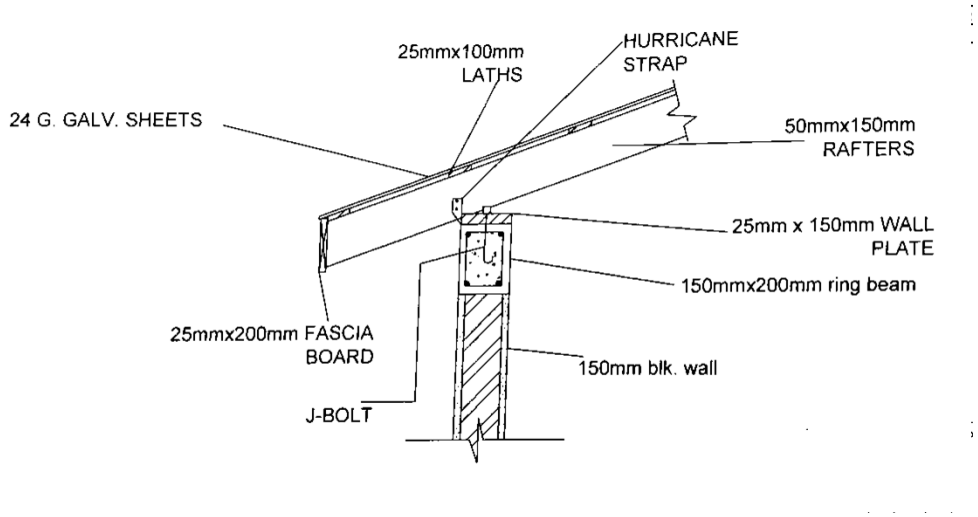
A Candidate's Answer to Question 2



Examiner's Comments

This candidate's response reflects an excellent understanding of an orthographic sectional detail of a closed eave. Standard conventions for the eave members required were identified and correctly labelled. The sketch was done in proportion with all labels amply spaced and identifiable. Correct line types and line weights were applied to identify different components on the sketch. The drawing was proportional.

A Candidate's Answer to Question 2



Examiner's Comments

This candidate's response reflects a clear understanding of an orthographic sectional detail; however, a closed eave was not indicated as was required by the question. All other standard conventions for the eave members required were identified and correctly labelled. The sketch was done proportionally with all labels amply spaced and identified. Appropriate line types and line weights were applied to denote the different components on the sketch.

Recommendations

Teachers are reminded of the following:

- This is the "working drawing" section of the examination. As such, standard practices and conventions for completing working drawings are to be followed rigorously.
- Students need to be exposed to a wide array of orthographic sectional details used in building drawing as indicated in the syllabus.
- Emphasis should be placed on line thickness, drawing correct symbols on the appropriate drawings, dimensioning techniques with respect to extension and dimension lines, and the placement and size of the dimension.
- Teachers are also encouraged to emphasize the proper/correct conventions, for example, labelling ensuring that leader lines and arrow heads touch the identifying component/object.
- Classroom practice should focus on the following:
  - Sketching to a good proportion (both in traditional and CAD)
  - Using the correct font size in CAD

PAPER 02 OPTION B – MECHANICAL ENGINEERING DRAWING

Section I — Assembly Drawing

Question 1

Candidates were presented with simple instructions accompanying orthographic views of five components that were to be assembled to produce a lever assembly. The components included the following:

- Part 1 — (Plan and Elevation) of the Lever
- Part 2 — Spindle
- Part 3 — M16 Bolt
- Part 4 — Collar
- Part 5 — Taper Pin

Candidates were required to:

- draw to full size, in either first-angle or third-angle orthographic projection, the following views of the assembly:
  - A Plan, showing all hidden details
  - A full sectional front elevation on cutting plane A-A.
- show six main dimensions to include a length, a diameter, a radius and a metric screw thread specification
- print the title 'Lever Assembly' and the scale used; show appropriate symbol and the projection method used.

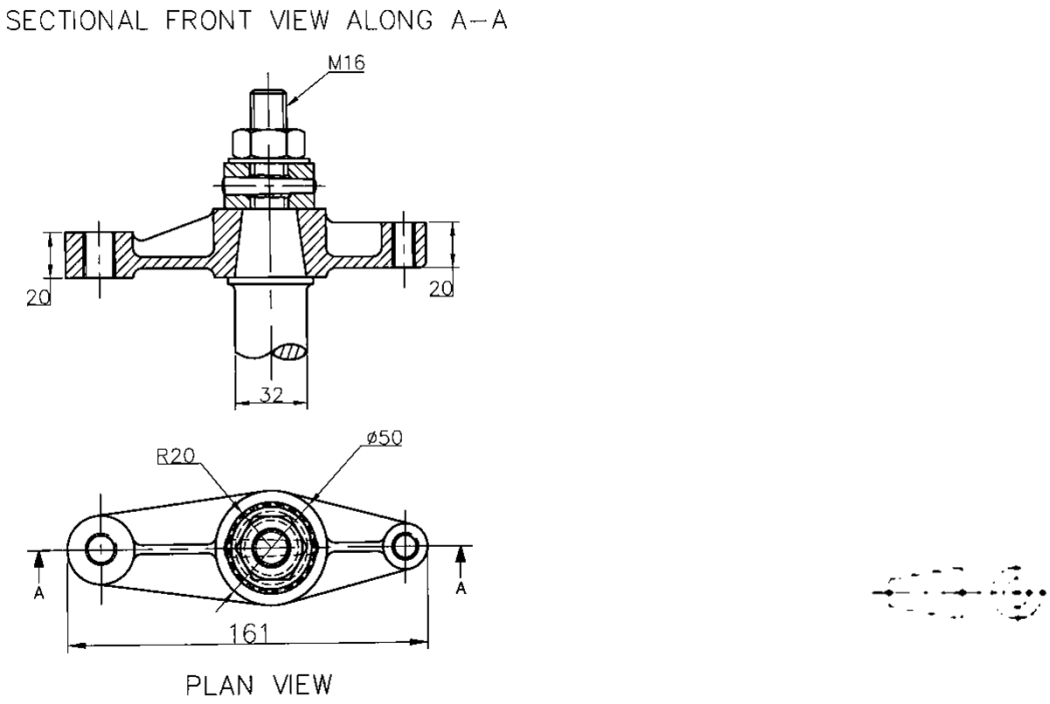
Candidates' solutions were expected to reflect their knowledge and understanding of standard drawing practices and conventions for working drawings, and with illustration of all fillet radii being 3 mm. Approximately 30 per cent of registered candidates selected Mechanical Drawing which suggests that mechanical drawing is the least popular option. Also, a vast majority of the responses to this option were done in AutoCAD which augurs well for the future of students' drawing experiences in the classrooms as related to dynamic, technological trends.

This question was mandatory and most candidates who attempted it reflected good knowledge and understanding of orthographic projection, and the assembling of mechanical components. Generally, candidates assembled components correctly resulting in a workable lever assembly. However, many solutions proffered for the sectional elevation of the lever assembly manifested candidates' difficulty in differentiating parts, as well as in accurately treating with webs when sectioned. Further, most candidates' hatching of the sectional elevation did not correctly illustrate the M14 and M10 tapped holes on the lever.

The dimensioning of the lever assembly drawing was well done by most candidates. However, the proffered responses were devoid of a dimension that adequately illustrated candidates' understanding of the convention

for dimensioning radii. Most candidates' responses adequately met the requirements of printing: title; scale; symbol representing the projection method used. However, it was observed that candidates seemingly lacked proper knowledge and understanding of the manipulation of the CAD functions as was evidenced by the proffering of some inappropriate line types, and the printing of the lever assembly drawing in the wrong scales.

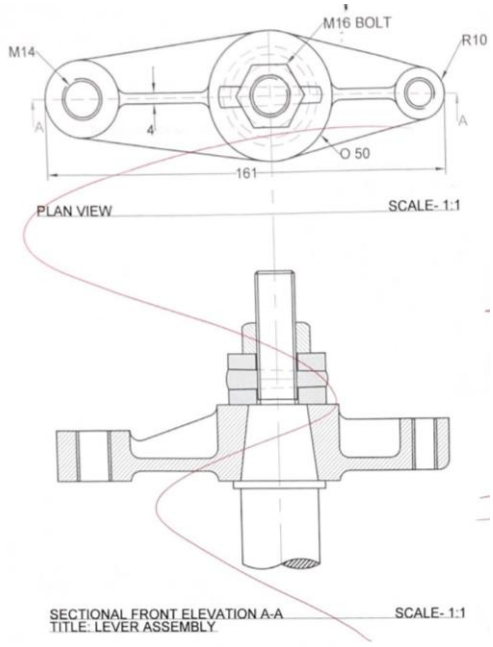
A Candidate's Answer to Question 1



Examiner's Comments

This candidate's response reflects an excellent understanding of the orthographic views of the parts that create the lever assembly. Moreover, orthographic projection and alignment of views were well depicted. The candidate also had an excellent grasp of assembling parts and so produced an accurate response. In the sectional elevation, the treatment of webs, the hatching lines to indicate different parts as well as the sectioning of the threaded end of the spindle, nut and taper pin were appropriately illustrated. Required dimensioning was correctly addressed in terms of the conventions for dimensioning as well as the technique. However, while line types and line weights were adequately addressed, the candidate neglected to indicate the proper convention for *cutting plane line*. The printing and scaling of the drawing was also handled suitably. Overall, this was an excellent CAD response to the question.

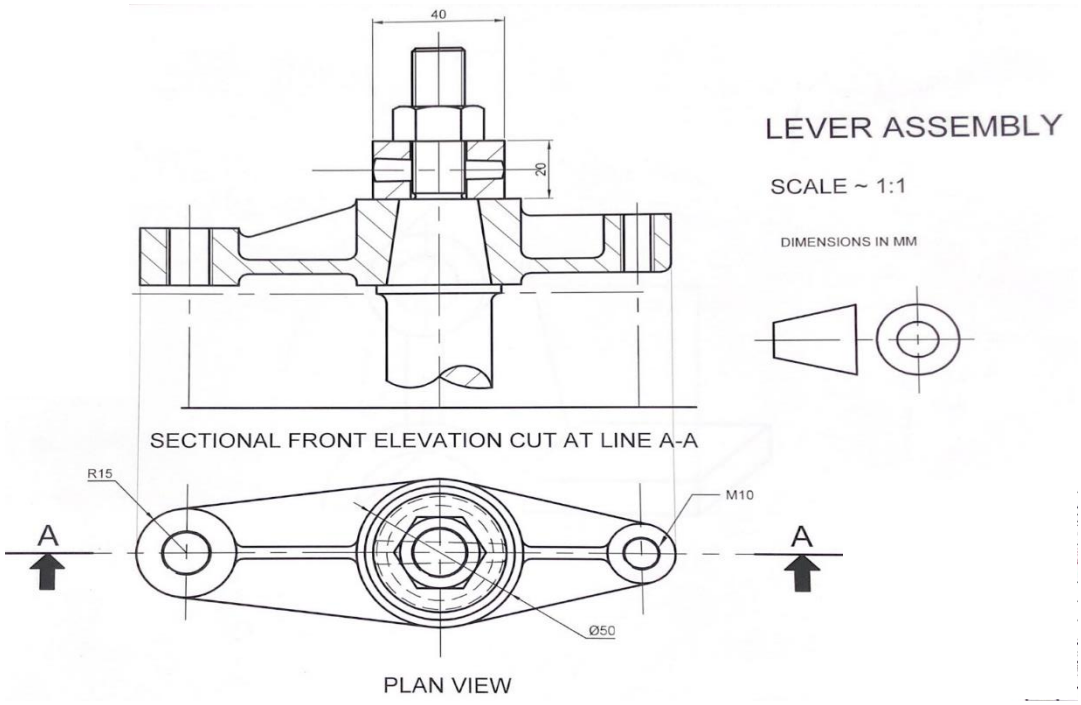
A Candidate's Answer to Question 1



Examiner's Comments

This candidate's response reflects an excellent understanding of the orthographic views of the parts that create the lever assembly. Additionally, orthographic projection and alignment of views were well depicted. The candidate also had an excellent grasp of assembling parts and so produced an accurate response. In the sectional elevation, while the treatment of webs was appropriate and hatching lines were used to indicate different parts, the sectioning of the threaded end of the spindle, nut and taper pin were not accurately demonstrated. Furthermore, while all required dimensioning was placed on the drawing, they were not all accurately produced in terms of the conventions for dimensioning as well as the technique. Also, while line types and line weights were adequately addressed, the candidate neglected to indicate the *cutting plane line*. The printing and scaling of the drawing was also suitably handled. Overall, this was a good CAD response to the question.

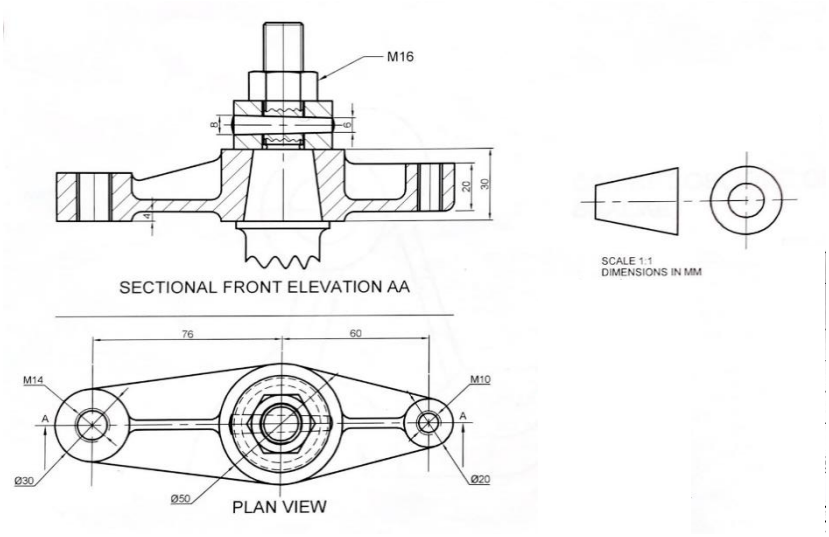
A Candidate's Answer to Question 1



Examiner's Comments

This candidate's response depicts a perfect solution of the given requirements of the question. The given orthographic views in the question were accurately interpreted and the candidate produced the correct assembly. The orthographic views were placed with the details designed. The sectional assembly utilized the hatching lines to portray the different parts to include the treatment of the web. The line work maintained the conventions as did the nut and taper pin. Additionally, the orthographic symbol corresponded with the orthographic projection used.

A Candidate's Answer to Question 1



Examiner's Comments

This candidate's response was very good but not perfect and received a score that fell in the low 90th percentile.

The positive aspects of the lever assembly drawing include the following:

- An excellent demonstration of the combined knowledge of orthographic projection and the assembly of mechanical components
- The understanding of the use and conventional representation of fasteners on drawings, cross hatching, dimension techniques and line work.

However, the drawing was flawed by the inaccurate representation of the following:

- The cross hatching demonstrated in the scrap section of the taper pin when placed into the spindle
- The conventional break of the cylindrical end of the spindle

Recommendations

- Teachers are reminded to encourage students to read questions carefully and to draw to the given specifications.
- During classroom teaching time, teachers are encouraged to use variations of specifications as prescribed in the syllabus.
- Teachers are reminded of the following regrading with CAD drawings:
  - Students will benefit immensely from repeated assignments that challenge them to manipulate the functions of their devices so as to enhance their knowledge and understanding of CAD commands.
  - Instruct students to print to the correct scale, paying attention to line weights, font sizes and hatching where applicable.
  - Instruct students to draw their solutions and not use blocks or templates from the software when answering questions.
- Instructions and practice for page layout and printing to PDF must be carried out in the classroom.

Section II — Sketch and Design

Question 2

Candidates were presented with two views of a bracket in first-angle orthographic projection — Plan and Elevation. Further, candidates were instructed not to reproduce these views. Moreover, candidates were required to produce a proportional cabinet oblique drawing of the bracket, clearly showing how the solution was obtained.

The question required the use of standard drawing practices and conventions for a pictorial drawing. Candidates were allowed to sketch with a straight edge or freehand, maintaining scale and proportion in their sketches.

Approximately 65 per cent of candidates who selected the Mechanical Drawing option attempted this question. Most of these candidates, seemingly, had knowledge of oblique projection. However, the remaining candidates attempted an isometric projection drawing of the bracket. Moreover, approximately 25 per cent of candidates who appropriately attempted to produce the required oblique projection drawing of the bracket produced a cavalier drawing, but not the required cabinet oblique projection.

Most candidates demonstrated some knowledge and understanding of producing circles in oblique projection; not all of them were able to construct the require curve on the receding axis. Further, most candidates seemed to have difficulty depicting inclined surfaces such as the two webs on bracket.

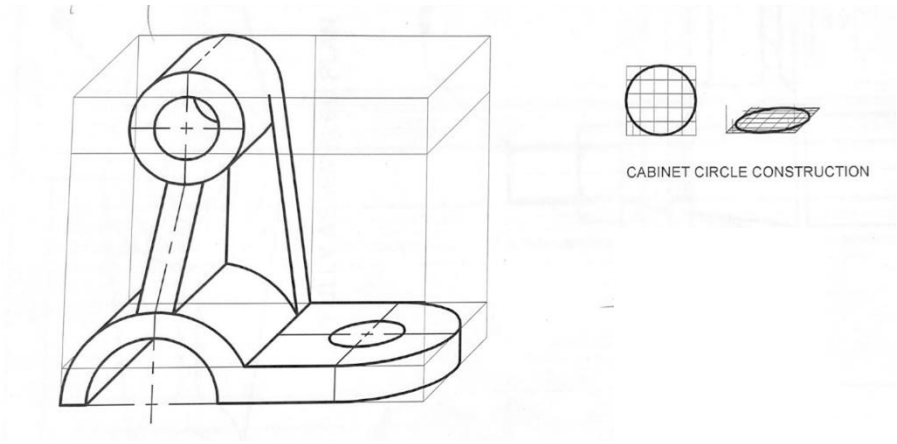
Most candidates who attempted this question demonstrated an appropriate knowledge of proportional drawings whether the drawing was accurately done as a cabinet oblique projection or incorrectly presented as a cavalier oblique projection or an isometric projection.

A Candidate's Answer to Question 2

Examiner's Comments

This candidate's response reflects an excellent understanding and interpretation of the given orthographic views of the block in the question. The question required a proportional oblique sketch of the block using cabinet projection. The candidate's response showed an excellent CAD rendition of the block in cabinet oblique projection by showing the reduced dimensions on the receding axis. The circles were all appropriately depicted in oblique. All line work and jibes types were superbly differentiated.

A Candidate's Answer to Question 2



Examiner's Comments

This candidate's response is a perfect exemplar of the requirements of the question. It shows an excellent interpretation of the given orthographic views to create the oblique 3D drawing. It also shows the accuracy of the sketch which depicts the 45-degree receding line and the cabinet projection. Excellent line work and line type were selected.

Recommendations

Teachers' curriculum delivery should incorporate greater workshop exposure to students so that they become familiar with actual mechanical devices and equipment. Moreover, students may benefit from additional classroom exercises/assignments that help to achieve the following:

- Emphasize the reading of instructions given in questions to elicit the required information prior to formulating solutions.
- Encourage the sketching of solutions prior to attempting to produce the final solution.
- Emphasize the specifics required for sectional details.
- Instruct students in the correct printing to scale, giving attention to the varying of line weights and hatches in working drawings when using CAD.

Note: It was evident that some students using CAD may have used blocks that were already embedded or saved on the computer used for the exam. This proved to be a strong indication that computers were not sanitized before the examinations.

GENERAL RECOMMENDATIONS

- Teachers are reminded that the Caribbean Examination Council (CXC) has developed a learning institute with adequate subject resources available for use and guidance in the classroom. Teachers are encouraged to make greater use of the learning institute.

- Additionally, all cxc communication, whether subject or general, is placed on the CXC website. Teachers are also urged to check the website regularly for updated information.