INFORMATION TECHNOLOGY

Paper 9626/11
Theory

Key messages

Candidates showed some general understanding but there were areas of the syllabus where more detailed knowledge was required.

On much of the paper some expansion and detail are required. It is not sufficient to give brief answers.

Evaluation requires candidates to discuss the importance, weigh up the advantages and disadvantages, judge the overall effectiveness, and weigh up their opinions, of a number of options. It is important that comparisons are made rather than just giving features or uses. 'Analyse, including the effectiveness of' something requires candidates to explain the effectiveness in detail as well as identifying the main characteristics. Analyse and evaluate questions proved challenging and candidates are advised to develop these higher order thinking skills so that answers go beyond just recalling information.

Questions that required a recall response were generally answered well, particularly those which required short answers. Questions that required candidates to apply their knowledge and understanding proved more challenging, with many responses needing greater accuracy and detail.

Candidates should ensure that handwriting is clear in order that all responses can be read and given appropriate credit.

General comments

Rather than rush into giving an answer, candidates could improve their answers by listing their thoughts in rough before choosing, and elaborating on, items appropriate to the question.

Candidates are reminded that brand names must not be used and that technical terms should be used accurately when answering questions.

Comments on specific questions

Question 1

Responses indicated that the topic of data sources was unfamiliar to some candidates, with many incorrect responses seen, particularly in **parts (c)** and **(d)**.

(a)   Some correct responses to this question were seen. The incorrect answers were spread out among the other three options.

(b)   Many correct responses to this question were seen though the incorrect answer 'Information, when arranged to make meaningful output, becomes data' was seen on occasion.

(c)   This part proved challenging, with few responses containing more than one valid point. Many answers were vague and covered accuracy and speed with no qualification. Responses that gained credit related the data to its relevance to the study.

(d)   This part also proved challenging, with few responses containing more than one valid point. Many answers referred to the cost with no qualification.

Question 2

(a)   Some correct responses to this question were seen. A popular incorrect answer was 'A sensor is used to store data for later use'.

(b)   Few correct responses to this question were seen. The incorrect answers were spread out among the other three options.

Question 3

This proved to be a very challenging question. Responses indicated that the topic of https was unfamiliar to most candidates. Few responses contained a valid point, and this was often in reference to other users being unable to read or understand encrypted data.

Question 4

This question proved quite challenging. Few responses contained more than one valid point. Points correctly made usually related to examples of application or system software.

Question 5

This question was quite well answered, with the majority of responses gaining at least partial credit, although stronger responses were seen to **part (a)** than **part (b)**.

(a)   Many responses gained credit for giving benefits of custom written software. Popular correct points related to it being tailored to the user's needs, there being no unnecessary features and companies being able to make any required modifications to the software.

(b)   Fewer responses gained credit for giving the benefits of off-the-shelf software. Where responses did gain credit, it was usually by referring to the software's availability and the degree of support offered.

Question 6

This question was quite well answered, with the majority of responses gaining at least partial credit. Candidates are to be commended on their use of continuous prose in this question in a good attempt to produce a proper evaluation. Many responses correctly noted that it was not necessary for residents to be home if computers are controlling devices or that residents can control devices remotely. The cost of purchasing such devices was often correctly identified as a disadvantage.

Question 7

This question was fairly well answered. Many responses contained possible health problems, but few contained the detail required to answer the question fully. This question included the information that while one method of prevention was taking breaks the responses should concentrate on other methods. Many responses described the need for taking breaks for which no credit was given. Despite this, most responses gained at least partial credit.

Question 8

This proved to be a challenging question. Few responses contained more than one valid point. Points correctly made usually described the security aspects of the network and, less frequently, encryption and the tunnelling protocol employed.

Question 9

In both parts of this question, many candidates gained partial credit.

(a)   Many responses gained credit for defining the internet but did not go on to discuss the technologies involved

(b)   Responses often only contained one valid point, that relating to needing to work from home. A significant number of responses described the features of video-conferencing rather than explaining why video-conferencing is more popular now.

Question 10

Overall, this question proved challenging, although stronger responses were seen to **part (a)** than **part (b)**.

(a)   Stronger responses gained credit for being able to accurately describe what absolute cell referencing and relative cell referencing are. They also used examples to support their descriptions. However, very few responses referred to why both are used.

(b)   This was the more challenging part of the question and very few responses gained credit. Responses suggested that some candidates could name the characteristics but were unable to elaborate on how they would be used in this spreadsheet for modelling purposes.

Question 11

This proved to be a challenging question. Stronger responses referred to data redundancy. Where responses did not demonstrate understanding of what normalisation is, they could not go on to give its advantages.

Question 12

Both parts of this question proved very challenging. Responses indicated that the topic of expert systems was unfamiliar to most candidates.

(a)   Very few responses gained credit. Many responses referred to either the general interaction of a user with a computer or how problems with printers could be solved without the use of an expert system.

(b)   Responses were often too vague. They often referred to a knowledge engineer using their knowledge to solve problems with printers making little reference to expert systems.

Question 13

This question proved challenging. Responses indicated that candidates were unfamiliar with the term compound key, although stronger responses did gain credit for giving an example. Where responses did not demonstrate understanding of what a compound key is, they could not go on to analyse its effectiveness.

Question 14

This question was well answered, with **part (b)** being slightly better answered than **part (a).**

(a)   Most responses gained credit for describing the need to remove unwanted parts of a video clip. Stronger responses were also able to identify other points including how the desired effect could be achieved.

(b)   Most responses gained credit for referring to making videos more accessible to viewers with hearing disabilities and also for translation purposes if the language used in a video is foreign to the viewer.

INFORMATION TECHNOLOGY

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Paper 9626/12
Theory

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Key messages

Candidates showed a fairly high level of general understanding but there were areas of the syllabus where more detailed knowledge was required.

On much of the paper some expansion and detail are required. It is not sufficient to give brief answers.

Evaluation requires candidates to discuss the importance, weigh up the advantages and disadvantages, judge the overall effectiveness, and weigh up their opinions, of a number of options. It is important that comparisons are made rather than just giving features or uses. Discussing the benefits and drawbacks requires responses to give both sides of an argument and should be in continuous prose rather than just a list of points. Discuss and evaluate questions proved challenging and candidates are advised to develop these higher order thinking skills so that answers go beyond just recalling information.

Questions that required a recall response were generally answered well, particularly those which required short answers. Questions that required candidates to apply their knowledge and understanding proved more challenging, with many responses needing greater accuracy and detail.

Candidates should ensure that handwriting is clear in order that all responses can be read and given appropriate credit.

General comments

Rather than rush into giving an answer, candidates could improve their answers by listing their thoughts in rough before choosing, and elaborating on, items appropriate to the question.

Candidates are reminded that brand names must not be used in responses and that technical terms should be used accurately when answering questions.

Comments on specific questions

Question 1

Responses indicated that the topic of system software was unfamiliar to some candidates, with many incorrect responses seen, particularly in **part (c)**.

(a)   Many correct responses to this question were seen. A popular incorrect answer was 'One printer driver can control any printer.'

(b)   Slightly fewer correct responses to this question were seen. The incorrect answers were spread out among the other three options.

(c)   This part proved very challenging, with few responses containing more than two valid points. Many answers were vague and gave examples of different operating systems, often involving the use of brand names, thus not answering the question. Responses that gained credit related to an operating system running software managing hardware resources and the allocation of memory.

Question 2

Responses often provided a general overview of user interfaces, but many answers to **part (c)** did not provide a detailed understanding of the layout of such an interface.

(a)   The majority of responses to this question selected the correct response. The incorrect answers were spread among the first two options.

(b)   Slightly fewer correct responses to this question were seen. The incorrect answers were spread out among the other three options.

(c)   This part proved challenging, with few responses containing more than one valid point. Responses did not indicate understanding of the layout of a graphical user interface. Many responses described the components of a GUI interface rather than its layout. The strongest answers correctly identified that the interface would be used for entering data and responded accordingly.

Question 3

This question was fairly well answered, particularly **part (a)**.

(a)   Many responses made at least three good points and some responses gained full credit. Candidates clearly understood the relationship between data and information with many providing good examples. Fewer responses identified a context for the data/information.

(b)(i)   Most responses gained credit for identifying that information needs to be up to date. Few responses gave detail about the possible effects on companies, but where examples were used this provided an excellent framework for a good answer.

(ii)   This part proved more challenging than **part (bi)** with many responses concentrating on the amount of information used rather than its detail.

Question 4

This question was quite well answered with the majority of responses gaining at least partial credit. Many responses included at least three differences between asymmetric and symmetric encryption. Most correctly identified that asymmetric is the more secure though few responses explained why this is the case. A minority of responses confused asymmetric with symmetric and mixed public and private keys.

Question 5

Overall, this question was fairly well answered. Responses gained credit for a comparison of speed of data entry and for the cost of purchasing equipment. Many responses mentioned costs without going into sufficient detail to merit credit.

Question 6

This question proved challenging. Few responses addressed the keeping data confidential aspect of the question and many concentrated on the security aspect. This question described various methods of keeping data secure and then asked for other methods to be described. Many responses included a description of the methods given in the stem instead of concentrating on the alternative methods of security.

Question 7

This question was fairly well answered. However, this question required responses to explain the purpose of storage devices. Many responses consisted of a comparison of the devices given in the question. Despite this, most responses gained at least partial credit. Common correct answers included storing data for later use and making backups. Another popular correct answer related to storing data even when the computer is turned off.

Question 8

This proved to be a challenging question. Many responses consisted of a list of points rather than a reasoned discussion as required by the question. The strongest answers were written in full prose style and

including points which were expanded upon such as 'client-server networks are expensive to set up as they require the buying of expensive hardware such as servers.' Other correctly expanded points included 'With a client-server network, users do not need to worry about making backups because these are managed by a network manager.'

Question 9

Part (a) of this question was quite well answered but **part (b)** proved very challenging.

(a) Most responses gained at least partial credit with many describing at least three services. Some responses concentrated on the world wide web and gave repeated answers and a small minority only listed services without describing them. The question required responses which described the services in detail.

(b) This part of the question proved to be one of the most challenging on the paper. Some responses identified the use of data packets but were often too vague in the rest of the response and these descriptions lacked the use of technical terms. A significant number of responses erroneously referred to the setting up of a video conference with the equipment required.

Question 10

Overall, this question proved very challenging and few responses gained credit. Many responses referred to the components of an expert system and its general operation rather than concentrating on the inference engine. Stronger responses correctly referred the inference engine comparing the input symptoms to those in the knowledge base and how the inference engine uses IF...THEN... statements

Question 11

Overall, this question proved challenging, although stronger responses were seen to **part (a)** than **parts (b)** and **(c)**.

(a) Most responses gained credit. The stronger responses scoring very highly usually correctly completed three of the four columns correctly. This was mainly because of a lack of understanding of the format column.

(b) This proved to be a very challenging question, with few responses containing more than one valid point. The most common correct answer related to the removal of data redundancy.

(c) This part of the question, together with **9b**, proved to be one of the most challenging on the paper. A significant number of responses erroneously referred to dynamic and static data rather than queries. Very few responses referred to a parameter query providing a prompt to enter data whereas a static query needs to be rewritten to respond to a different input.

Question 12

This question was quite well answered with most responses gaining at least partial credit. Most responses indicated some knowledge of the features of sound editing software but were unable to provide much detail. Stronger responses were able to identify the features and then describe their use.

INFORMATION TECHNOLOGY

Paper 9626/13
Theory

Key messages

Candidates showed a fairly high level of general understanding but there were areas of the syllabus where more detailed knowledge was required.

On much of the paper some expansion and detail are required. It is not sufficient to give brief answers.

Evaluation requires candidates to discuss the importance, weigh up the advantages and disadvantages, judge the overall effectiveness, and weigh up their opinions, of a number of options. It is important that comparisons are made rather than just giving features or uses. 'Analyse the effectiveness of' something requires candidates to explain the effectiveness in detail as well as identifying the main characteristics. Discussing the benefits and drawbacks requires responses to give both sides of an argument and should be in continuous prose rather than just a list of points. Analyse, discuss and evaluate questions proved challenging and candidates are advised to develop these higher order thinking skills so that answers go beyond just recalling information.

Questions that required a recall response were generally answered well, particularly those which required short answers. Questions that required candidates to apply their knowledge and understanding proved more challenging, with many responses needing greater accuracy and detail.

Candidates should ensure that handwriting is clear in order that all responses can be read and given appropriate credit.

General comments

Rather than rush into giving an answer, candidates could improve their answers by listing their thoughts in rough before choosing, and elaborating on, items appropriate to the question.

Candidates are reminded that brand names must not be used and that technical terms should be used accurately when answering questions.

Comments on specific questions

Question 1

This question was quite well answered, with the majority of responses gaining credit. **Parts (a), (b)** and **(c)** were answered well with **part (d)**, however, proving rather challenging.

(a)   The majority of responses to this question selected the correct response. The incorrect answers were spread out equally between two of the other three options with 'It never leads to the coarsening of data' being largely ignored.

(b)   Many correct responses to this question were seen. The incorrect answers were spread out among the other three options.

(c)   This part produced some good responses, with many containing two or more valid points. Most responses were able to correctly explain the code P4395 and many provided sensible suggestions for improving the code.

(d)   This part proved challenging, with few responses containing two valid points. Many responses indicated an understanding of encryption but not in sufficient depth to be able to analyse its effectiveness. Responses did not indicate understanding of the topic of codecs, referring, instead to the type of coding found in **part (c)**. Few responses contained the correct technical terms, with 'decryption' and 'encryption' often missing and 'private' or 'public' often missing from 'key'. Codecs were rarely described and when they were, the description was often inaccurate.

Question 2

This proved to be a challenging question with responses to **part (a)** stronger than those to **parts (b)** and **(c)**

(a)   Many correct responses to this question were seen. The incorrect answers were spread out among the other three options.

(b)   Few correct responses to this question were seen. A popular incorrect answer was 'Control software is an example of system software'.

(c)   This part proved challenging, with few responses containing two valid points. Responses did not indicate understanding of spreadsheets, with many discussing databases rather than spreadsheets. Some of the points in responses should have been expanded so, for example, where graphs or functions were mentioned the benefits and drawbacks of using them by the company should have been explained.

Question 3

This question proved challenging, with few responses making one point. Most responses demonstrated knowledge of phishing, but few were able to adequately describe methods of preventing it.

Question 4

This question was fairly well answered with many responses making more than one point. Popular correct answers included never giving out personal details to people they do not know, using a nickname when online and not posting/sending photos of themselves to people they do not know. Many responses gave general methods of keeping data secure rather than the guidance parents should give as required by the question.

Question 5

This question was quite well answered, with the majority of responses gaining at least partial credit. Popular correct answers referred to an intranet being a private network, only workers within the organisation being able to access it and it tending to be a LAN, although some candidates tended to spend a lot of time expanding on this last point to the detriment of the remainder of their response

Question 6

Overall, this question proved challenging, and a significant number of candidates omitted it with few responses able to identify the components of an expert system. Where responses did not demonstrate knowledge of the names of an expert system's components, they could not go on to describe them.

Question 7

This question proved very challenging, with a significant number of candidates omitting it. Responses did not indicate understanding of the topic of testing validation rules. Many responses listed alternative validation checks, rather than data that could be used to test the range check.

Question 8

This proved to be a very challenging question. Where responses did not demonstrate understanding of how an interpreter works, they could not go on to evaluate its use. Many responses contained a re-wording of the question, stating that an interpreter translates a program written in a high-level programming language into a lower-level language. Some responses indicated the interpreter was human.

Question 9

This question was well answered, with many responses gaining credit. Most responses identified that the example in the question was just a list of numbers separated by commas and was therefore data. Another common correct answer given was that data has no meaning or context. Responses very often did not then go on to explain that knowledge followed from giving information some understanding.

Question 10

Overall, this question was well answered, although stronger responses were seen to **part (a)** than **part (b)**.

(a) Many responses gained credit for correctly describing and identifying the various types of relationship. Many were able to describe the one-to-many and one-to-one relationship though few referred to the many-to-many relationship.

(b) This was the most challenging part of the question and few responses gained credit. Where candidates did gain credit, it was usually for correctly stating that either of the fields Customer_ID or Account_ID could have been set up with different data types in their related tables

Question 11

This question was quite well answered, with the majority of responses gaining at least partial credit. Many responses described the differences between static and dynamic sources, but few had the similarities. Popular correct answers described the currency of the information, the reasons for accuracy and the degree to which information can be changed.

Question 12

This question proved to be the most challenging on the paper with a similar level of response provided in each of the three parts. A significant number of candidates omitted all three parts. Responses did not indicate understanding of the topic of query selection.

(a) Few responses gained credit. Where they did, it was usually because the response referred to the use of multiple criteria but many of these responses did not go on to mention the use of Boolean operators.

(b) Responses that gained credit usually did so because they referred to a nested query being a query within another query. However, many responses did not go on to elaborate on this.

(c) Responses that gained credit gave examples of the functions used within a summary query but without saying what a summary query is.

Question 13

This question was very challenging for candidates. Very few responses described a mental model. Where responses did not demonstrate an understanding of mental models, they could not go on to give the benefits of their use. Stronger responses identified that a user interface that matches the user's mental model will be easy to learn and easy to use.

INFORMATION TECHNOLOGY

Paper 9626/02
Practical

Key messages

For this examination, the main issues to note are as follows:

- Candidates need to ensure that clipping does not occur when amplifying audio tracks.
- Candidates need to apply specific timing to their video files when these are specified in a storyboard in the question paper.
- Candidates need to carefully consider their choice of font styles, colour and contrast to ensure that they are appropriate when displaying text within a video clip.
- Candidates need to take great care when examining data files that will be used to create a normalised database and ensure that appropriate duplicate data is removed to achieve 3 NF.
- Candidates need a strong understanding of applying appropriate validation rules to appropriate fields in a database.
- Candidates need to be able to create dynamic parameter queries in a database.

General comments

Most candidates performed well on the audio and video editing questions but less so on the database questions, where the application of their knowledge was not always applied in order to solve a given problem.

Comments on specific questions

Question 1

Almost all candidates created the audio track using both audio clips. Many produced excellent responses when speeding the voice track up to 1.5 times the original speed. Some candidates omitted this instruction. A small number of candidates increased the speed of the track by significantly more than 1.5 times. Almost all candidates cut the correct audio from the end of the voice clip and placed it at the start of the voice clip. Many candidates amplified the voice clip, although many amplified this excessively so that the track was clipped and the audio distorted by the process. Most candidates, having changed the speed of the voice clip, successfully set both tracks to 13 seconds in length with neither loss nor distortion. Many candidates set the clip into stereo with the music in the left channel and voice in the right. A small number of candidates reversed the tracks in the left and right channels. However, a significant number of candidates mixed down the two tracks from stereo into monophonic before they saved their work, rather than saving the stereo clip. A small number of candidates did not export the audio clip in mp3 format.

Question 2

Most candidates set the aspect ratio to 16:9 and exported each video clip into .mp4 format. Not all candidates used the required resolution of 854 × 480 during their export process. A small number of candidates merged the two clips together and saved it as a single file.

Question 3

Many candidates completed this task with few challenges. Candidates must ensure that the timings given in the storyboard are adhered to exactly as specified. Where text was added to the frames, the position, colour and contrast of the text was not always carefully considered. An example of this was the selection of (the package's default) white text onto the pale background, making the text more difficult to read than where

candidates had changed the text colour to increase the contrast. A small number of candidates considered this and produced excellent results by selecting, for example: black text, red text, white text with a black border to each letter, or black text with a white border to each letter. A small number of candidates did not use a consistent sans-serif font, often opting for a serif font, or in some cases a scripting font (which was more difficult to read). Few candidates retained the position of the title text when the subtitle text was introduced, and this text often contained typographical errors. A significant number of candidates did not consider the relative sizes and positions of the title and subtitle text. Some candidates introduced the still video frame image at the same time as the audio clip (8 seconds) instead of at 10 seconds. Not all candidates used transitions between the various parts of the final video clip, the most noticeable omission being between the image n21TEC3 and the video file n21TEC4. Whilst many candidates used the video n21TEC4 as the background for the credits, a significant number had a black background or displayed a still image. Credits did not always scroll up the screen. Most candidates included their candidate details but did not always include the details of the recording of the original clips, and spacing between these items was often not consistent.

Question 4

Most candidates exported the video as specified.

Question 5

This question elicited a wide range of results, with many candidates creating only two (one-to many) related tables using the source files provided. Candidates who had carefully examined the data files and recognised duplicate data as required for a database to 3 NF, often added a Drive or Drive_Type table with its associated one-to many relationship. Very few candidates had examined the data in sufficient detail to identify the need for a model field, where each model had a single body style. The few candidates who did identify the need for a Model table often created the correct one-to-many relationship between this table and the Car table. Some candidates created several additional tables, often unnecessarily separating items such as address and contact details from the customer table and then trying to link these back to the customer table. Candidates often recognised the need to change the table and field names so that they contained no spaces and were short and meaningful. More challenging for candidates was the setting of appropriate data types (especially where these were required to be integer values for the Price and Year fields), field lengths (where fixed length data was used) and appropriate validation routines. Few candidates applied appropriate validation routines to appropriate fields in the tables.

Question 6

This challenged most candidates and elicited a variety of responses with a wide range of associated marks attained. Few candidates created a correct dynamic parameter query. A number added parameters to a query which asked for responses from the user, but these were not then applied to the selection of the records. Candidates also found the production of the report to match the example in the question paper a challenge, with the Drive Type often replaced by the Drive Type code. Most candidates did not recognise the need for the report title to be black text on a grey background. The completed report was required to have one row containing the field labels and three data rows but many candidates either omitted the last two data rows or included the data labels for these rows. Often the field names or data were truncated on the report. Most candidates created the two required pdf files although not always saved as specified or on a single page with the correctly selected records.

INFORMATION TECHNOLOGY

Paper 9626/31
Advanced Theory

There were too few candidates for a meaningful report to be produced.

INFORMATION TECHNOLOGY

Paper 9626/32
Advanced Theory

Key messages

Answers are expected to be in some detail at A Level. Candidates should have detailed knowledge of the topics in the syllabus so that they can answer questions in sufficient detail to gain credit. Good responses to the questions were seen from many candidates and some demonstrated good subject knowledge. It is necessary for candidates to apply their knowledge to the given scenarios or to the context set in the questions and to ensure that their answers are not vague or generic.

While some marks can be awarded for generic answers, it is vital that candidates read the information given in the short scenarios very carefully and apply their knowledge when answering the subsequent questions. Even candidates who know the syllabus content well will only be able to gain maximum credit when they apply their knowledge appropriately to the scenario in the question and answer the question as set.

Candidates are reminded not to look for, or 'spot', 'key words' in the question and not to write answers based solely on those key words. Candidates should read the whole of each question carefully and apply their knowledge to the scenario in the question.

Candidates are also advised that repeating the statements made in the questions will not gain credit. Restating the question should be discouraged.

General comments

The syllabus contains a list of 'command words' that are used in the questions and the list explains what each word requires from candidates. It is very important that, when answering questions, candidates read the rubric and answer the question in the appropriate manner. Responses that ignore the command words used in questions that require free responses will gain very little credit.

Also, candidates who create numbered bullet points or dashed lists for questions that required free responses do not often gain credit because the use of bullet points rarely produces little more than simple points or short statements with no descriptions, explanations or comparisons. Candidates who write in full sentences and use paragraphs usually produce responses that gain more credit. When answering questions that ask candidates to 'explain', 'describe', 'evaluate', 'analyse' or 'discuss' a topic, candidates should write in continuous prose to be able to expand and elaborate their discussions.

Attention is drawn to the glossary on p.45 in the 2022 – 2024 syllabus as the meanings for the command words have changed in the syllabus for March/June 2022 onwards and, as such, will be applicable in November 2022.

As noted above, candidates are expected to answer the questions in some detail. Many answers were superficial and vague and did not gain credit. At A Level, candidates are expected to be able to formulate answers that properly convey their knowledge and understanding of the topics.

Few candidates omitted questions. Candidates should always be encouraged to attempt all of the questions. While there is usually ample space for answers on the lines provided, if additional space is required, candidates should not write in the margins or in the blank spaces on the pages between or after questions. The best place to write answers that will not fit on the supplied response lines is on additional paper with clear cross-referencing. Most candidates who used the spare pages, or additional pages, properly cross-referenced their answers. This makes sure the Examiner knows which question the response relates to so that the appropriate credit can be awarded.

A good examination technique, to be encouraged by centres, is to clearly cross though any writing or answers which candidates do not want to be marked and to add a note to indicating where the intended answer is to be found. This assists the Examiner in marking the work.

Comments on specific questions

Question 1

This question asked candidates to describe how the features of CAD can be used. It did not require candidates to describe or discuss the benefits and drawbacks of CAD. Good answers described the use of features to determine the accurate dimensions of rooms using measurements shown on the drawing palette, the use of a stored library of items of furniture that could be placed and moved within the room, the use of 2D views to display a plan of the design and the use of 3D views to assist a customer in visualising a design. Answers that described a feature and then described how it could be used in designing the room gained the most credit.

Common mistakes were describing the benefits and/or drawbacks of the use of CAD which was not answering the question as set, listing the features without describing their use or describing only one feature in detail. Candidates needed to apply their knowledge of CAD to describe how the features could be used. Figures or illustrations are included for a number of reasons, often to assist candidates in answering the question. In this question, many answers could have been gleaned from the illustration in Fig. 1.1.

Question 2

Strong responses explained that the report should contain a description of the test that was carried out, the purpose of the test and how it was carried out. The report should also describe the expected and actual results from the test, whether or not the software passed the test/is ready for use and recommendations for retesting the software. Many candidates described some of these items. Common mistakes included providing lengthy descriptions of normal, abnormal and extreme data with little or no reference to the test plan, describing alpha and/or beta testing and describing possible errors or non-functioning features. Focussing on the question as a whole and not concentrating on key words e.g. error, beta testing, would have produced better answers from some candidates.

Question 3

This question proved very challenging for candidates, particularly **part (b)** and **part (c)**.

Because the question required candidates to 'explain', answers that gave vague references to 'having fewer lines of code' could have been improved by stating that this means 'cleaner or neater code'. Explanations require more than statements.

(a)   Good reasons for this technique are that it makes it easier to avoid global variables being declared by implication as the script is executed and reduces the possibility of unwanted re-declarations of variables.

(b)   Good reasons for finalising variables when they are first declared are that it provides a single place to initialise variables and avoids undefined values.

(c)   A good reason for avoiding the use of eval() is that it can create a security problem because it allows inserted or extra code to be run.

(d)   A good reason for always declaring local variables is that they may inadvertently become global variables unless specifically declared where they are meant to be used.

Question 4

This question asked candidates to describe the benefits and drawbacks rather than to discuss them and was quite well answered. A good description is more than an identification of the benefit/drawback but includes information about it. Weaker answers such as vague references to 'slow' or 'short range' are statements and must be expanded into descriptions in order to gain credit. For example, good descriptions of benefits would be that Bluetooth is cheap or free to use since it is already installed in many devices, there is no need to charge the smartphone so often since Bluetooth uses less power than e.g. WiFi and connections are 'remembered' so repeated usage is simple. Drawbacks could include that Bluetooth only allows for short

range communication between devices and data transfer rates can be slow and unpredictable for large images.

Bulleted lists of points or brief statements do not usually gain credit. Also, responses must describe both benefits and drawbacks where questions, such as this one, ask for both. Only answers that have both can be awarded the highest marks.

Question 5

This question asked candidates to describe how robotics are used rather than to discuss their use. Responses seen to this question illustrated the need for candidates to carefully read the question and to focus their answers accordingly. Previous questions on this topic have asked for discussions of advantages/benefits/disadvantages/drawbacks and this question should have been easier to answer. Poorer answers with vague reference to, for example, 'building the engine' or 'fitting the windshield' needed to be expanded with more details. Good answers needed to describe the various uses of robotics, in any form, in car manufacturing. Examples of this include the use of robotic arms to move heavy parts into places where humans would have difficulties, using robotic end effectors such as grippers, suction pads or nozzles to carry out repetitive tasks such as fitting wheels or installing windscreens, and painting areas with the same amount of each time.

Question 6

Good answers to 'discuss' questions must consist of descriptions or explanations that expand on the point being made. For example, laptops can have a physical keyboard which reduces typing errors compared to the onscreen keyboards of smartphones, the larger screen of a laptop reduces eyestrain when viewing documents or videos, the software applications on laptops have more features and are compatible with college systems and laptops are not as easily lost or stolen because of their larger physical size and the possibility of physically tethering them to objects. Disadvantages could have included laptops not usually making telephone calls and instant messaging being less easy than with a smartphone. Converse answers to the advantages of laptops (i.e. the disadvantages of smartphones) were given credit as long as they did not repeat a previously-made point.

Discussions must have a combination of advantages and disadvantages in order to gain full credit.

Question 7

This question required explanations of how passengers could try to protect their information when using public WiFi. Answers that just listed points did not usually score many marks so candidates should have made a point about the way the user could protect their information and then added a reason for this. Examples of good explanations include logging out of accounts when the user has finished to stop others using the account if they share devices, turning off WiFi or Bluetooth when not using it to prevent unauthorised use of the connections or pairings, using only websites that use HTTPS to ensure that data exchanges are encrypted, the use of a virtual private network (VPN) to ensure that public connections are encrypted to prevent unauthorised users understanding the data, and not logging into accounts via apps that hold sensitive information over public, unsecured WiFi. The weaker answers that listed points would have gained credit if they had added a reason. For example, 'making a smartphone 'forget' a WiFi connection after use' is a point that requires a reason to turn it into an explanation. Adding the phrase *'to prevent the smartphone making unwanted WiFi connections to potentially fake WAPs or to other devices'* makes it into an explanation.

Question 8

This question proved to be the most challenging on the paper, with few responses making valid points about the use of microblogs *for social networking.* The question was not about social networking in general. Answers that referred to the benefits and drawbacks of social networking in general terms would have been improved by focussing on the use of microblogs in that context. Strong answers focused on the benefits and drawbacks of microblogs and included, for example, microblogs being about very specific topics so the reader's focus is kept on topic, microblogs being frequently updated to reflect what is happening now and posts being short and concise so easy/quick to read. Answers about the drawbacks could have included that not much information is given because the word count may be restricted and that viewers/readers may be overloaded with information due to quickly unfolding events so crucial information may be overlooked.

Question 9

Questions on bitmap and vector graphics have appeared in various guises in previous series and candidates showed that they had factual knowledge of this topic. Good answers took this knowledge and used it as a basis for an evaluation. The key word 'Evaluate' in this syllabus requires candidates to *'discuss the importance of, weigh up the advantages and disadvantages, judge the effectiveness, weigh up your opinions'*. Advantages and disadvantages are required but, in addition, candidates should expand on these to explain why these are important or what effect they have.

Answers that only stated points or gave brief explanations could have been improved by adding comments on why/how these are important. An example of such an answer, using factual knowledge and an explanation with a comment, is that vector images use data in mathematical calculations to create shapes that can be scaled without loss of quality, so this makes them suitable for use on different size, or resolution, screens. As in other questions of this type, both advantages and disadvantages need to be included for full credit.

It is very important to note, as mentioned above, that the meanings of the command words have changed in the syllabus for March 2022 onwards so attention is drawn to the glossary on p.45 in the 2022 – 2024 syllabus.

Question 10

This question was quite well answered, with many responses gaining at least partial credit. As noted for **Question 6**, good answers to 'discuss' questions consist of descriptions or explanations that expand on the point being made. For example, complex designs can be easily produced without the need for expensive machine tooling and production systems, there is a reduced need to store large quantities of the same component because the component can be 'printed' when required (on demand), or the designs or 3D printing instructions can be stolen and used to make the items by competitors. A common mistake was to write bulleted answers that consisted of lists but did not expand on the points.

Discussions must also have a combination of the benefits and drawbacks to gain full credit.

Question 11

This question proved extremely challenging for candidates, with few correct responses seen. The question asked candidates to describe how a network interface card (NIC) carries out its role. It was worded in such a way as to give candidates an opportunity to demonstrate what they knew about the workings of NICs. At A Level, candidates are expected to include considerable detail in their answers. Descriptions must include more than a brief statement of fact. Weaker answers that stated that *'NICs connect a device to a network'* could have been improved by describing how this is achieved. For example, a NIC carries out its role by providing a physical connection using electronic circuitry between computing devices and a transmission medium, every NIC uniquely identifies itself on a network with a 48 bit address (a MAC address) to ensure that data arrives at the device it is intended for and that other devices 'know' where data has come from, NICs translate data from the CPU into a form that can be transferred by a transmission medium (cable/wireless etc.) and translate data received from a medium into a form useable by the CPU of the receiving computing device.

Question 12

Overall, this question was challenging for candidates, but candidates fared better on **part (c)** than **part (a)** and **part (b)**.

The question was phrased to ensure that candidates were aware of the distinction between GPS and a satnav that *uses GPS*.

(a)   Candidates were asked to describe the benefits and drawbacks of a satnav with GPS in the context of driving vehicles used for the delivery of goods. Answers that merely stated that drivers 'could be told directions to where they were going' or 'could find their way' were considered too vague. Strong answers could have referred to the pinpointing of locations with great accuracy to prove that deliveries were carried out or to routes being planned without the need to consult paper maps or look for directions when driving. References to satnav devices being a visual, auditory or manual distraction when driving or being used to track vehicles and/or drivers without their knowledge and

consent would be good answers as drawbacks. As with other questions of this type, descriptions of both benefits and drawbacks were required for full credit to be awarded.

(b)   Most responses referred to obstacles such as buildings or adverse weather conditions being an issue with GPS. Few candidates gave other reasons. Other possible answers included the satnav being unable to 'see' enough (a minimum of three, preferably four) satellites with sufficient strength to gather data to carry out its calculations or the satnav having low battery power so not being able to carry out its function. As noted previously, explanations must be more than points or statements and must include a reason.

(c)   Candidates were asked to give descriptions that did *not* refer to GPS in vehicles or to the military use of GPS. This was stated in the question with the request *to 'Describe three other ways…'*.. Candidates must read the question very carefully and must not repeat the question, give examples already given in the question or give answers that include references that the question tells them to avoid. Again, descriptions require more than simple points or statements so short answers such as *'geotagging'* do not properly answer the question. Good descriptions could have been about map making (cartography) where GPS is used for accurately determining the position of geographical landmarks, tracking devices (such as smartphones), objects or animals as they move and the geotagging of objects to record their location.

INFORMATION TECHNOLOGY

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Paper 9626/33
Advanced Theory

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Key messages

Answers are expected to be in some detail at A Level. Candidates should have detailed knowledge of the topics in the syllabus so that they can answer questions in sufficient detail to gain credit. Good responses to the questions were seen from many candidates and some demonstrated good subject knowledge. It is necessary for candidates to apply their knowledge to the given scenarios or to the context set in the questions and to ensure that their answers are not vague or generic.

While some marks can be awarded for generic answers, it is vital that candidates read the information given in the short scenarios very carefully and apply their knowledge when answering the subsequent questions. Even candidates who know the syllabus content well will only be able to gain maximum credit when they apply their knowledge appropriately to the scenario in the question and answer the question as set.

Candidates are reminded not to look for, or 'spot', 'key words' in the question and not to write answers based solely on those key words. Candidates should read the whole of each question carefully and apply their knowledge to the scenario in the question.

Candidates are also advised that repeating the statements made in the questions will not gain credit. Restating the question should be discouraged.

General comments

The syllabus contains a list of 'command words' that are used in the questions and the list explains what each word requires from candidates. It is very important that, when answering questions, candidates read the rubric and answer the question in the appropriate manner. Responses that ignore the command words used in questions that require free responses will gain very little credit.

Also, candidates who create numbered bullet points or dashed lists for questions that required free responses do not often gain credit because the use of bullet points rarely produces little more than simple points or short statements with no descriptions, explanations or comparisons. Candidates who write in full sentences and use paragraphs produce responses that gain more credit. When answering questions that ask candidates to 'explain', 'describe', 'evaluate', 'analyse' or 'discuss' a topic, candidates should write in continuous prose to be able to expand and elaborate their discussions.

Attention is drawn to the glossary on p.45 in the 2022 – 2024 syllabus as the meanings for the command words have changed in the syllabus for March/June 2022 onwards and, as such, will be applicable in November 2022.

As noted above, candidates are expected to answer the questions in some detail. Many answers were superficial and vague and did not gain credit. At A Level, candidates are expected to be able to formulate answers that properly convey their knowledge and understanding of the topics.

Few candidates omitted questions. Candidates should always be encouraged to attempt all of the questions. While there is usually ample space for answers on the lines provided, if additional space is required, candidates should not write in the margins or in the blank spaces on the pages between or after questions. The best place to write answers that will not fit on the supplied response lines is on additional paper with clear cross-referencing. Most candidates who used the spare pages, or additional pages, properly cross-referenced their answers. This makes sure the Examiner knows which question the response relates to so that the appropriate credit can be awarded.

A good examination technique, to be encouraged by centres, is to clearly cross though any writing or answers which candidates do not want to be marked and to add a note to indicating where the intended answer is to be found. This assists the Examiner **in** marking the work.

Comments on specific questions

Question 1

This question was quite well answered, with most responses gaining at least partial credit. **Part (b)** in particular was very well answered.

(a)   This question asked candidates to write about the features of online questionnaires, so answers needed to focus on the 'online' aspect rather than on the use of questionnaires in general. Good answers had this focus and described features such as the use of drop-down lists offering a choice of pre-selected answers, the use of validation rules to ensure that only reasonable data is collected from respondents, the inclusion of pop-up boxes to explain the questions in more detail and the provision of multi-lingual options for different languages groups. Weaker answers made statements or points such as '*it can have an opt-out option*' but did not describe what this is for or how it is suitable. Adding an expansion such as *'so that respondents are not invited again to complete the questionnaire'* makes the answer into a good description worthy of credit.

(b)   As for **part (a)**, this question was about online questionnaires and not questionnaires in general. Weaker answers were generic, referring to the drawbacks of any questionnaire, for example *'answers can be anonymous or can be dishonest'*. While these gained some credit, strong answers put the drawback into the context of an online questionnaire, for example *'customers may not give honest answers if they are invited by email with an incentive for responding'* or *'only customers with internet access can be questioned by online questionnaires.'*

Question 2

This question was about 2D barcodes. Many responses gained partial credit, but generic answers and lack of detail meant that few responses were worthy of full credit. Candidates performed similarly on **part (a)** and **part (b)**.

(a)   Most responses described the functional elements of a QR code. Brief statements identifying the elements needed to be expanded with more detail, for example that there are distinct squares at three corners which are positional elements for QR readers to align the QR code and that the small square at the fourth corner is used by the QR reader to calibrate the image for size and orientation.

(b)   Most responses contained some explanation about why damaged QR codes can still be read while damaged 1D barcodes often cannot. The answers that gained credit were those that gave complete explanations, such as detailing the inclusion of error correction which is used to compensate for missing or unreadable information, and deliberately limiting the block size in the QR code so that errors that can be corrected quickly by less complex algorithms.

Question 3

This question proved very challenging, with candidates finding **part (a)** and **part (b)** equally difficult. Lack of detail in responses was often the cause of full credit not being gained.

(a)   This question was about BitTorrent being used in peer-to-peer networking. Weaker answers about peer-to-peer networking in general could have been improved by focussing on the BitTorrent aspect as required by the question. Strong answers gave detailed descriptions, such as explaining that BitTorrent nodes work as both client and server for other nodes when transferring large data files and peers (nodes) share the workload and processing power without the need for a central server, and that sections (fragments) of files can be copied from different nodes at once which increases the overall speed of transfer of a whole file to a node.

(b)   Some responses referred to the use of BitTorrent to distribute files illegally or to avoid copyright restrictions. This itself does not raise security issues. These answers needed to contain information about how these activities may lead to the distribution of malicious code hidden in the files or allow peers to gain access to folders or files on other devices acting as peers. Strong answers focused on this, for example explaining that peers (nodes) are more susceptible to remote attack with their

IP address clearly visible to others so it easier for malicious users to target them, that malicious code can be inserted into files being transferred and that this code can deliberately falsify routing tables of peers (nodes).

Question 4

Good answers to 'discuss' questions consist of descriptions or explanations that expand on the point being made. In the context of this question, a benefit of using CAD is that designs are created in a shorter time because it is quicker to alter and amend designs without redrawing the complete design. However, drawbacks include the high cost of training the designers to use CAD and the long time taken to learn how to use the software. Many responses contained valid points, but these points sometimes needed further elaboration. Discussions must have a combination of the benefits and drawbacks in order to gain full credit.

Question 5

Many of the responses seen to this question contained both advantages and disadvantages, as required by a 'discuss' question. The strongest answers included detail rather than simple statements. For example, an advantage is that satellites are positioned in geostationary orbit so ground stations used for uplink can point directly at them which means that less power is needed and the receiving dishes can point directly at the satellite resulting in less fluctuation in signal. A disadvantage is that satellites in geostationary orbit are about 18 000 km high, so signals must travel some 36 000 km which results in delays and creates latency in data connections.

Question 6

The command word *analyse* in this syllabus expects candidates to *'explain the main points or effectiveness in detail, identify their main characteristics, examine closely'*.

Answers that explained what digital currencies are and/or how they work did not fully answer this question but were awarded some credit. Strong answers explained how effective (that is, how useful, helpful, successful or important) digital currencies are when paying for goods or services. Digital currencies are effective when paying because funds are received faster than with other forms of transaction and international transactions are easier than with other forms of currency, but they are not so effective when it is difficult to understand how to use them and their value can fluctuate which leads to uncertainty about how much is being paid.

Question 7

(a) This question was very well answered, with responses demonstrating excellent knowledge of the hardware required for web-conferencing. Detailed descriptions were seen, including the requirement for a computer system capable of running the appropriate application and of running/multimedia, a router to connect to the internet and speakers (or headphones) to output the sounds of the conference delegates. There were some common mistakes where candidates were inaccurate in their descriptions, for example *'microphones so people can hear what you are saying'*. Such inaccuracy should not be seen at A Level. An accurate description is: *'microphones to capture the audio of what you are saying'* and *'speakers to output the audio so people can hear what you are saying'*.

(b) Many strong responses, containing good descriptions of the features of web-conferencing software, were seen.

Question 8

This question asked candidates to compare and contrast alpha and beta testing, so to gain full credit both similarities and differences were required. Most responses referred to who did which testing and where it would be carried out. Stronger answers included details of, for example, both having a significant impact on the final quality of the product but reliability and security of the software being covered by beta testing but not by alpha testing.

Question 9

This question was very well answered, with most responses describing the features of Gantt charts.

Question 10

This question about exception handling in JavaScript should have allowed candidates to demonstrate their knowledge of coding in JavaScript. Most responses which gained credit referred to the use of 'throw' to trap the exception by testing a block of code, the use of 'try' to determine the program flow when an exception occurs and the use of 'catch' to allow the execution of code after an exception and to generate a custom error message. Answers could have been further extended to explain how the exceptions were reported to the programmer.

Question 11

This question proved to be extremely challenging, with very few responses containing valid points. Answers could have included references to forward-mapping and the setting of control points in the morphing process.

Question 12

While some responses contained valid points, there was much confusion between augmented reality and virtual reality, with many answers including both. Descriptions of the creation of virtual fire scenarios for safe training purposes are the realm of virtual reality where the world is completely computer-generated. Descriptions of virtual reality did not answer this question. Augmented reality is the use of computer-generated information such as images, video, text, sounds and other perceptual information overlaid onto, and enhancing, the user's real-world experience. In the context of this question, the use of augmented reality by firefighters, strong answers would have referred to the overlay of information onto a firefighter's real-world. For example, displays in their mask/helmet system to provide easily visible information when in areas of low visibility such as smoke-filled rooms, providing real-time information and updates of a situation direct to a firefighter, and overlaying navigational information in smoke-filled areas to enhance the safety during firefighting.

INFORMATION TECHNOLOGY

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Paper 9626/04
Advanced Practical

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Key messages

Centres had to prepare candidates for this paper in challenging circumstances. It will have been difficult to provide normal opportunities for the practice, guidance and the experience necessary for fully successful solutions for some of the tasks in this session.

It is important that candidates examine any images shown in the question paper very closely and note all the important steps or conditions described in any task. This will help candidates gain some of the marks that are easy to overlook when working under pressure.

General comments

Most candidates attempted all the tasks, and many were successful with the main elements. Complete solutions, however, were rare and centres would benefit from prioritising the development of problem-solving skills when devising programmes of study for this paper.

Comments on specific questions

Task 1 – Graphics

Candidates were provided with a background as a source file and were tasked with duplicating the image shown in the question paper. Stronger solutions cropped the background to the same extent shown in the question paper. Close inspection of the source file and the image in the question paper was necessary for solutions to be fully successful.

Similarly, the size of the circle for the lens had to occupy a similar area of the final image and the area inside the lens had to appear magnified to the same degree. Candidates need to be aware of the level of accuracy needed for fully successful solutions to tasks such as these.

The creation of the lens blooms was not done well in many solutions and centres might need to ensure that transparency attributes of vector images is covered in more detail.

Task 2 – Vector Graphics

The creation of the two very simple vector drawings posed very few problems but few of the solutions were sufficiently accurate.

Suitable darker grey elements of the clouds were particularly rare. The outline of the cloud needed to be followed clearly and without gaps or overlap. The most accurate solutions to the darker grey areas could be created by manipulating duplicate copies but this was not a method used by many candidates.

Care also needed to be taken when creating the lightning bolt. Stronger solutions matched the parallel lines in the 'Z' angles. This detail was important for gaining full credit.

Task 3 – Animation

The animation task was quite well done and it was clear that centres had provided suitable experience for the basic elements of the task. There were, however, several elements of the task that were often overlooked.

For tasks such as these, mentally separating each of the elements is important and each element is often best tackled in a separate layer.

For this task:

- animating the backgrounds to alternate between the green and black background proved no problem but not all the timings were consistent
- animating the appearance and path of the bolt was generally well done but solutions needed to show the bolt moving smoothly and exiting completely
- most solutions made the required text appear in the right place at the right time, but it also had to fade in. This last requirement was not often seen.
- animation of the text to 'explode' was seen in most cases but several candidates had not realised that the orientation of some of the individual letters needed to be changed.

Task 4 – Spreadsheets

This spreadsheet task proved very challenging for candidates. Again, it was the problem-solving element that prevented candidates from providing full solutions.

Data validation and conditional formatting posed few issues, but the nested formulae needed to denote the 'wins' were rarely seen in all the appropriate cells. The combination of the IF() and AND() functions seemed to be difficult for candidates to formulate.

A suitable solution for the first row could be:

=IF(AND(F4="x",G4="x",H4="x"),"X wins",IF(AND(F4="0",G4="0",H4="0"),"0 wins",""))

This could then be replicated for the next two rows.

The use of nested IF() and AND() functions might be an area that centres need to address.

Task 5 – Mail merge

This mail merge task was fairly straight forward and only included three mergefields and one conditional rule.

Candidates had very little difficulty with most of the task and it is obviously an area well covered in the preparation for this exam.

The only major issue of which centres need to be aware is that several candidates did not populate the array of labels and thus only one label was prepared on each page.

Also worth stressing is that it is very unlikely that the whole dataset is likely to be present in the final output so candidates should be advised to check whether they have fulfilled the conditions detailed in the question paper. In this case only the labels for sterile bandages were required. This should have resulted in only 7 filled labels.

Task 6 – Programming for the web

This task required candidates to write JavaScript code to count the number of times the button on a web page was clicked. The html source file provided details of the name of the function required and the name of the bookmark where the results of the count should be displayed.

The important elements of the solution scripts were:

- the declaration of a variable to hold the number of times the button was clicked
- the creation of the correct function to increment the count as the button was clicked
- the use of the correct method to display the result of the count with the required text
- the use of the bookmark to display the resulting text in the correct place on the web page.

The second part of the task was to amend the script to match the text 'Item' or 'Items' to the number of clicks.

Most candidates managed to create a counter and use the correct method for incrementing the count.

Some candidates however were not able to display the results on the page and resorted to using an alert or displaying the result on a new page. Displaying results in a fixed position and on the current page is an important feature of tasks such as these.

Only the better candidates managed to amend their code to cope with the need to display 'Item' or 'Items where appropriate. This could have been achieved with a simple 'if' function so need not have been a problem for most candidates.

In conclusion

For this session, the main issues for centres to bear in mind are:

- Candidates need to be aware that accurately reproducing details and proportions shown in the question paper are essential to achieving all the marks in graphics tasks.
- Centres may need to provide further experience with varying the transparency attributes of vector images.
- Many candidates would have benefitted from extended practice with the use of nested IF() and AND() functions.
- Candidates may need opportunities to develop familiarity with the use of labels in a mail merge and in particular the population of the array of labels.
- In a mail merge it is unlikely that the whole dataset is to be present in the final output and candidates need to check whether they have fulfilled the conditions detailed in the requirements listed in the task.
- In JavaScript tasks, candidates need to be able to display results in a fixed position and on the current page.
- Centres may need to provide further practice for candidates in determining and mentally bullet-pointing all the important steps or conditions described in the task.
- The need to prioritise the development of problem-solving skills.