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GCSE (9-1)

Examiners' report

MATHEMATICS

J560
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Version 1

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Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects, which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

Paper J560/01 series overview

This calculator paper is the first of the three papers taken by foundation candidates for the GCCE (9-1) Mathematics specification.

Marks for the paper covered almost the full range. Most of the questions appeared to be quite accessible and there was no evidence to suggest that candidates were unable to attempt every question in the time available. The number of areas where no responses were offered seemed to be at a lower level this year and it is quite clear that centres are encouraging candidates to attempt all questions.

Use of calculators

In this paper it is expected that calculators will be used. It is important that candidates show their working and that accuracy is maintained. Calculating percentages on a calculator is an area which some candidates found difficult, and non-calculator methods were seen throughout the paper.

Material not previously included at foundation level caused the greatest difficulty for candidates. Repeated percentage changes, combined probabilities, application of algebra and simultaneous equations all caused difficulty for large numbers of candidates.

Candidates need to be more confident using a protractor and compasses.

When faced with questions that require a written statement to justify or explain a situation candidates need to determine the nature of the response required and write their response in concise terms.

Presentation was generally good. Candidates should be encouraged to ensure their handwriting is legible and to clearly display their working with full calculations shown. Good responses are logical and follow a clearly labelled, systematic process. This enables candidates to be given credit for method where the final answer is incorrect.

Candidates should be aware of the need to check whether their answers are reasonable in the context of the question. Examples such as a hire car that costs tens of thousands of pounds, or a plane that was travelling at either 112 000 km/h or around 10 km/h, were very common.

Question 1(a)(i)

1 Here is a list of numbers.

2 8 5 12 6

(a) From this list, write down

(i) the odd number,

(a)(i) ..... **[1]**

The majority of candidates got the correct answer of 5.

(ii) the cube number.

(ii) ..... **[1]**

Question 1(a)(ii)

The majority of candidates correctly wrote 8 as their answer.

(b) Using the same list of numbers, work out

(i) the median,

(b)(i) ..... **[1]**

Question 1(b)(i)

A small number of candidates confused median with mean and gave an answer of 6.6.

(ii) the range.

(ii) ..... **[2]**

Question 1(b)(ii)

This part was usually correct.

Question 2(a) and (b)

2 Here are the first four terms of a sequence.

2 4 8 16

(a) What is the next term in the sequence?

(a) ..... **[1]**

(b) Explain how you worked out your answer.

..... **[1]**

A large majority of candidates scored both marks here and only a small number did not spot the next number in the sequence. Answers of 24 (from 16 + 8), 26 and 28 (adding 4 to the difference) were occasionally seen.

The most common reason~~s~~ for the loss of the mark in part (b) was incomplete or inadequate explanations. Two and four times tables were quoted on a few occasions and "times the number by itself" also appeared with some regularity.

Question 3(a)

3 **(a)** Write 48 as a percentage of 200.

(a) ..... % **[1]**

Candidates with a good understanding of percentages answered the whole of this question effectively. The most common error was to double 48 rather than halve it. Occasionally they misunderstood the question and found 48% of 200.

Question 3(b)

(b) Work out $\frac{1}{4}$ of 80.

(b) ..... **[1]**

This was one of the most accessible questions on the paper and the majority of candidates scored full marks. A small number found 20 before subtracting from 80 to get an answer of 60.

Question 3(c)

(c) Decrease 650 by 40%.

(c) ..... **[3]**

The majority scored full marks in this part. Some candidates simply found 60% of 650 using their calculator while a large number discarded the calculator and adopt the "breakdown" method with mixed results. It was common to see a misconception regarding the value for either 10% or 1%. The most common error was not fully answering the question; some candidates found 40% (260) but then did not subtract this value from 650. Candidates should be encouraged to use a calculator method.

Question 4

4 Patrick writes down a number.

He says

If I find the square root of that number and then add 15, I get 27.

What number did Patrick write down?

..... **[2]**

Many candidates managed to arrive at an answer of 144, the most common approach starting with 27 – 15. At this point most found the square of 12 leading to a correct response while others found the square root leading to 3.464 or 3.5. Other responses involved trial and improvement with a reasonable level of success.

Question 5(a)

5 **(a)** Write 12 : 54 as a ratio in its simplest form.

(a) ..... : .....**[2]**

This was generally well answered. An answer of 6:27 was quite common due to the incomplete cancellation of 12 : 54 and some candidates arrived at 2 : 9 before incorrectly reducing further to 1 : 3. A small minority did not score any marks.

Question 5(b)

(b) The ratio 400 g : 1 kg can be written in the form 1 : *n*.

Find the value of *n*.

(b) *n* = ... **[2]**

Candidates who realised the need to equate the units usually went on to obtain the correct ratio, with only a small number gaining just one mark for failing to progress beyond 400 : 1000. Some applied 400 ÷ 1000 (instead of 1000 ÷ 400) to obtain 0.4.

Question 5(c)

(c) Amanda and Wim share some money in the ratio 2 : 5.
Wim receives £115.

Calculate how much money was shared.

(c) £ ..... **[3]**

It was clear that many candidates had experience of adding the two elements of a ratio when calculating the value of each "part". However, some candidates incorrectly calculated 115 ÷ 7 (= 16.428…), rather than 115 ÷ 5 (= 23), which then led to incorrectly quoting Amanda's share as £32.86. Many used a pictorial method (boxes) to visualise the seven parts and placed 23 into each box with some success. Some, despite having a good understanding of the process, found the correct amount for Amanda (£46) but did not add this to Wim's share to get the total amount of money shared.

Question 6

6 A leopard is running with a velocity of 3 m/s.
It then accelerates at 2 m/s^2 for 4 seconds.

Use the formula

$v = u + at$

to work out the final velocity of the leopard.

..... m/s **[2]**

Candidates who understood the nature of the substitution usually scored both marks. Many candidates used 2^2 as a value giving v = 3 + 2^2 × 4 = 19. Other common errors came from 2^2 + 4 and 2^2 + 3.

Question 7(a)(i) and (a)(ii)

7 **(a)** Solve.

(i) $4x = 56$

(a)(i) $x =$ ..... **[1]**

(ii) $\frac{126}{x} = 7$

(ii) $x =$ ..... **[1]**

Parts (a)(i) and (a)(ii) did not cause many problems as only one operation was required to obtain the answer. The only common, incorrect response was 882 in part (a)(ii) from 126 × 7. Some candidates embedded the correct answer in the working before writing 7 in the answer space.

Question 7(a)(iii)

(iii) $8x - 6 = 46$

(iii) $x =$ ..... **[2]**

This was well answered by many candidates. Those who were not able to arrive at a correct response of 6.5 rarely used algebra and consequently lost method marks. The most frequent error was to give an answer of 5 from (46 – 6) ÷ 8 but, unless an algebraic method was shown, this was unlikely to score.

Question 7(b)

(b) Solve by factorising.

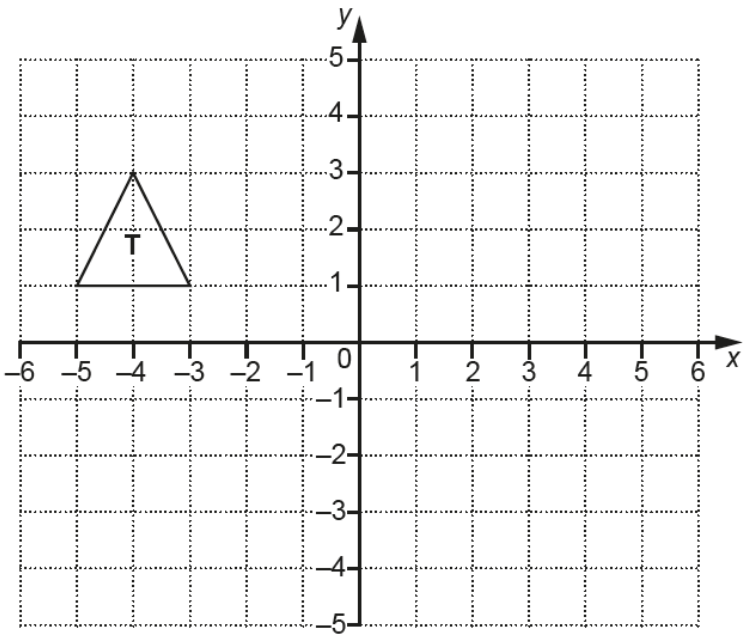
$x^2 + 11x + 30 = 0$

(b) $x =$ ..... or $x =$ ..... **[3]**

Only a minority of candidates understood the requirements for answering this question. Of those who did, several gave the roots as 6 and 5 failing to realise the significance of $x + 5 = 0$ and $x + 6 = 0$.

Question 8(a)

8 Triangle **T** is drawn on a coordinate grid.



(a) Rotate triangle **T** through 180° about (0, 0).
Label your image **A**. **[2]**

The transformation required allowed many candidates to score at least one mark as they were credited for a correct 180° rotation in any position. Many candidates also understood the need to use the centre of rotation and scored full marks.

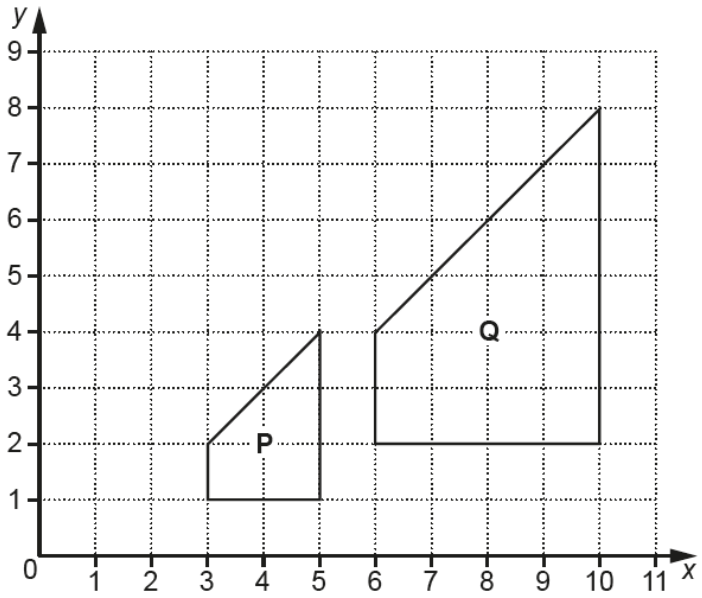
Question 8(b)

(b) Reflect triangle **T** in the line $x = -1$.
Label your image **B**. **[2]**

This part was less well answered with a large number either reflecting the triangle in the *y* axis or in a horizontal line - often the *x* axis with points at (-5, -1) (-3, -1) and (-4, -3). Most candidates labelled the triangles as required but a small number lost marks for not doing so and offering a choice of answers.

Question 9

9 Two shapes are drawn on the grid below.



Describe fully the **single** transformation which maps shape **P** onto shape **Q**.

.....

..... **[3]**

The majority of candidates were able to name enlargement but frequently lost marks for stating a second transformation (translation) often referring to a move three places to the right and one up. Only a minority of candidates scored all 3 marks for a complete description of the enlargement - the centre (0, 0) was usually the missing element leaving 2 marks for the name and scale factor. Another frequent error was to give the centre of enlargement as (5, 1) or (3, 1). Comments relating to "double the size" were rejected as this is not true for area.

Question 10

10 Reuben hires a car.
It costs £150, **plus** 85p for each mile he travels.

When Reuben hires the car, its mileage is 27 612 miles.
When Reuben returns the car, its mileage is 28 361 miles.

How much did Reuben pay to hire the car?

£ ..... **[4]**

There were some excellent responses to this question, showing all the required steps, dealing with units of pounds and pence correctly and reaching a correct solution.

The majority of candidates made an attempt at this question, with many scoring at least 1 mark for attempting to calculate the distance covered. Multiplication by cost per mile was usually applied correctly using £0.85 or 85p. If marks were subsequently lost it was often due to not equating the units of pence and pounds when adding to the standing charge of £150. Many simply did not add at all and stopped at a value obtained from their multiplication (636.65 if calculated correctly). There were a number of candidates who did not check that their answer was reasonable in the context of the question and offered unreasonable amounts for the cost of hire.

Question 11(a)

11 Pippa owns a snack bar.

(a) She uses $\frac{3}{5}$ of a kilogram of spread each day.

Spread costs £3.20 for a 1 kilogram tub and £6.15 for a 2 kilogram tub.

Pippa buys enough spread to last for 14 days.

What is the lowest price Pippa can buy this spread for?
Show your working.

(a) £ ..... **[4]**

Candidates were required to show that 14 × 0.6 = 8.4, meaning that 9 kg of spread was needed as it was only available in 1 kg or 2 kg tubs. Many realised this and calculated the cost of 4 × 2 kg and 1 × 1 kg with an overall cost of £27.80 giving this amount as the cheapest option. Many simply used 9 × 1 kg arriving at a total cost of £28.80. Others arrived at 8.4 and assumed that this quantity could be purchased arriving at a cost of £26.88. This approach did not deal with the "real life" situation where part of a tub cannot be purchased.

Question 11(b)

(b) In 2016, Pippa paid £1650 rent.
In 2017, the rent increased by 14%.

Calculate the amount of rent she paid in 2017.

(b) £ ..... **[3]**

The majority of candidates scored some marks on this question. While most realised the need to find 114% of 1650, either directly or by finding 14% and adding it to 1650, some candidates used a non-calculator method which often led to errors. Some calculated 14% (231) and then forget to add this to the original amount.

Question 12

12 A circle has radius 6 cm.

Calculate its circumference.
Give your answer in centimetres, correct to 1 decimal place.

..... cm **[3]**

Many candidates did not know the correct formula to use, so answers involving attempts at area, or $2\pi r^2$ were not uncommon. Those who found an area or a value from an incorrect equation and rounded to 1 decimal place without writing down the figures shown on their calculator missed out on the mark for rounding.

Question 13(a)

13 **(a)** Show that the highest common factor (HCF) of 18 and 63 is 9. **[2]**

Many candidates did not know how to show that 9 was the highest common factor and incomplete explanations were frequently seen. The approaches taken varied from factor trees, to Venn diagrams, to listing factors. Most candidates gained 1 mark for showing working that indicated that 9 is a factor of both numbers. In order to score both marks there had to be a clear demonstration of why this figure was identified as the HCF, either by multiplying common prime factors or having a complete list of 6 factors for each number. Some candidates simply listed multiples and showed no indication that they understood what is meant by a factor.

Question 13(b)

(b) Find the lowest common multiple (LCM) of 18 and 63.

..... **[2]**

In this part, many candidates appeared to be looking for factors, with a final answer of 3 or 1 being the usual outcome. Many repeated their working from part (a). Candidates who gained full marks generally did so by listing the multiples for each number to find 126. Very few candidates multiplied prime factors to find the LCM correctly.

Question 14

14 Aditi, Becky and Calli collect coins.
Aditi has 6 **more** coins than Becky.
Calli has 1 **less** coin than Aditi.
Altogether they have 71 coins.

How many coins do they each have?
Show all your working.

Aditi has ..... coins

Becky has ..... coins

Calli has ..... coins
[5]

A large number of correct responses were seen for all three sets of coins with a high proportion coming from trial and improvement. Some candidates formed expressions and equations involving *x* with some success while others used expressions with different variables eg A = B + 6 using the initials of the people involved. The expression for Calli caused the most problems with many using eg *x* – 1 rather than x + 6 – 1.

Question 15(a)

15 Lee wishes to find out if there is a relationship between a person's age and the time it takes them to complete a puzzle.

Lee decides to conduct an experiment.
She asks 12 people to complete the puzzle.
She records each person's age and the time taken to complete the puzzle.

(a) Make one criticism of Lee's method.

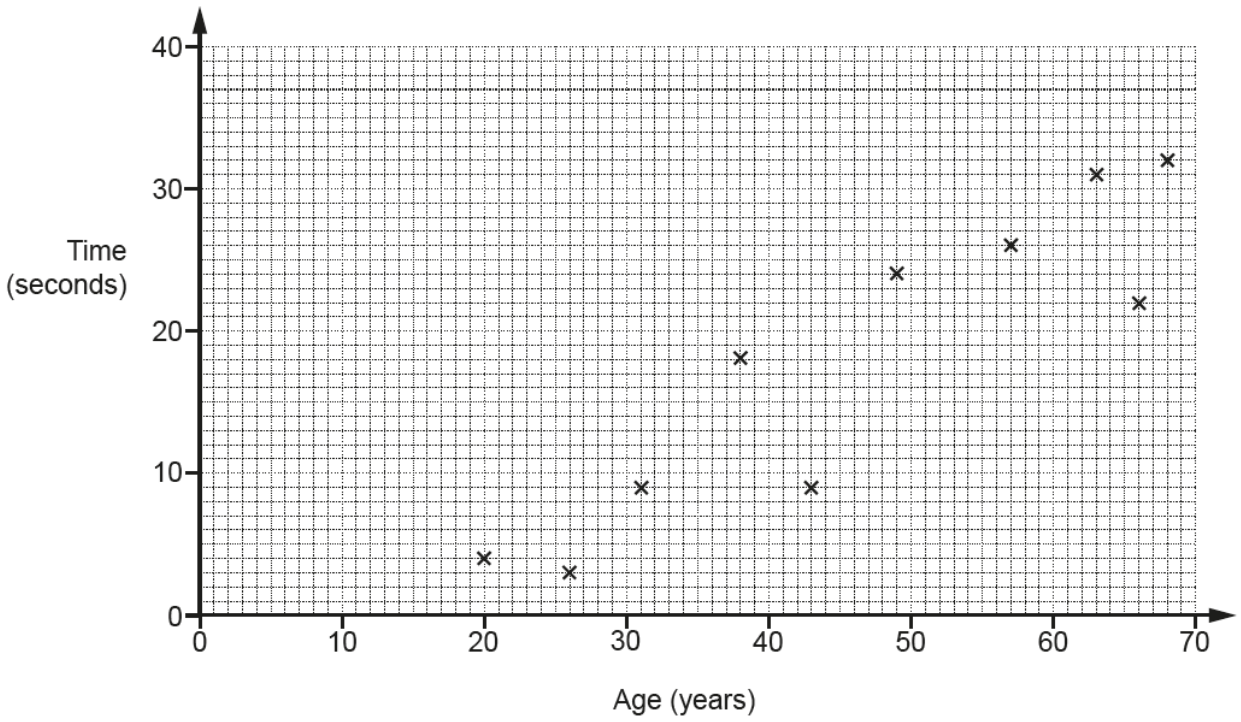
.....

..... **[1]**

It was expected that most would criticise the size of the sample, and several candidates did this. However, others gave different reasons and a variety of answers were allowed.

Question 15(b)

This scatter diagram shows the results for ten of the people in Lee's experiment.



(b) Here are the other two results.

Age (years)	47	60
Time (seconds)	21	34

Plot these results on the scatter diagram. **[2]**

This was well answered, with a number of candidates scoring both marks.

Question 15(c)

(c) What type of correlation is shown in the scatter diagram?

(c) ..... **[1]**

Many candidates gave the correct response. Some described the relationship rather than the correlation.

Question 15(d)

(d) Estimate the time it would take a person aged 35 to complete the puzzle.
Show your working to justify your answer.

(d) ..... **[2]**

The majority of candidates scored at least 1 mark for an answer in the accepted range.

Question 15(e)

(e) Lee says that at least 80% of the 12 people completed the puzzle in under 30 seconds.

Is Lee correct?
Show working to support your answer.

..... **[3]**

The majority of candidates were able to gain a mark for recognising that 9 people had completed the puzzle within the stated time. The simplest and most successful method was to convert $\frac{9}{12}$ to 75%, which was easy to compare with 80%. Those who did this usually went on to score full marks. Some candidates opted to find 80% of 12, usually arriving at the correct figure of 9.6. However, many struggled to interpret this correctly in terms of number of people, so the final conclusion was often incorrect.

Question 16

16 Finn has two bags of counters.
He takes a counter at random from each bag.

The probability that he takes a red counter from the first bag is 0.3.
The probability that he takes a red counter from the second bag is 0.4.

What is the probability that he takes **at least** one red counter?

..... **[4]**

Only a small number of candidates showed an understanding of probability and offered a sound method leading to 0.58, often with the aid of a tree diagram. Very few candidates attempted to use tree diagrams and those that did so were usually incorrect. There were very few fully correct answers. The most common way that candidates scored was to find or state that the probabilities of not getting a red counter in each bag were 0.7 and 0.6, but few went on to find the product of these values.

Question 17

17 The price of a computer was £750.

In a sale the price is reduced by 20%.
On the final day the **sale price** is reduced by a further 12%.

How much is saved in total by buying the computer on the final day of the sale?

£ ..... **[5]**

Many candidates scored well on this question. Many gave answers of £528 to score 4 out of 5, but they missed out on full marks through simply not fully reading and answering the question. There were two types of response that scored badly. Firstly, there were those who attempted a written method of calculating percentages and got muddled in their working. Secondly, there were those who calculated 32% of £750, despite the fact **sale price** was in bold in the question. Several candidates did not use a calculator in favour of breaking the problem down into blocks of 10% and 1% with limited success.

Question 18

18 The table below shows the weight, $w$kg, of the bags that people took on a plane.

Weight of bag (kg)	Frequency		
$0 < w \leqslant 10$	16		
$10 < w \leqslant 15$	10		
$15 < w \leqslant 20$	20		
$20 < w \leqslant 25$	8		
$25 < w \leqslant 30$	6		

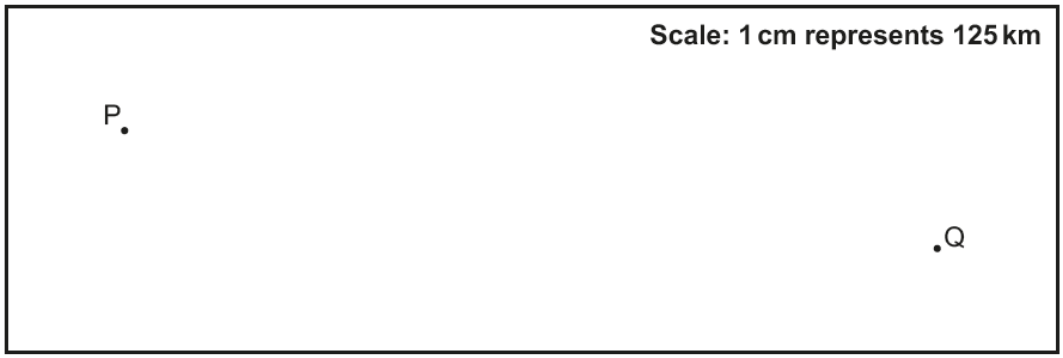
Calculate an estimate of the mean weight of the 60 bags.

..... kg **[4]**

The majority of candidates understood the need to find the midpoints of each interval and completed this task with a reasonable degree of success. A common error was listing midpoints as 5, 13, 18, 23 and 28. Despite this, many were able to obtain a valid sum of the midpoints multiplied by frequency within the terms of the mark scheme and usually understood the need to divide by 60. A number of candidates added the frequencies to get 60, and several divided their value by 5 rather than 60.

Question 19

19 The scale diagram below shows two cities, P and Q.



A plane departs from P at 0947 and arrives at Q at 1207.

(a) Work out the average speed, in kilometres per hour, of the plane.

(a) .....km/h **[5]**

Many candidates scored some marks on this question, but few gained full marks. Most, but not all, measured the distance between P and Q accurately and multiplied by 125 to score B2. However, a few candidates appeared to not have or use a ruler.

Calculating the time proved more difficult. Some candidates attempted column subtraction here, almost invariably leading to an incorrect answer. A small number of candidates came up with flight times of 2 hours 60 minutes. Most of those who reached the stage of having a distance and a time interval managed to divide distance by time, while a small minority multiplied. The main problem was that candidates did not know how to convert a time in hours and minutes to a decimal, so candidates who successfully worked out the time of the flight to be 2 hours 20 minutes often divided by 2.2 rather than 2.333. Others divided by a time in minutes, so had a final answer that was in km/min rather than the correct units of km/h.

Question 19(b)

(b) Give one reason why your answer may be inaccurate.

.....

..... **[1]**

This part was less well answered with many candidates giving reasons relating to speed as a cause of inaccuracy. Many asserted that changes in the speed during the flight were an issue, but did not realise that an average speed over the time accounts for normal variations in speed.

Question 20(a)

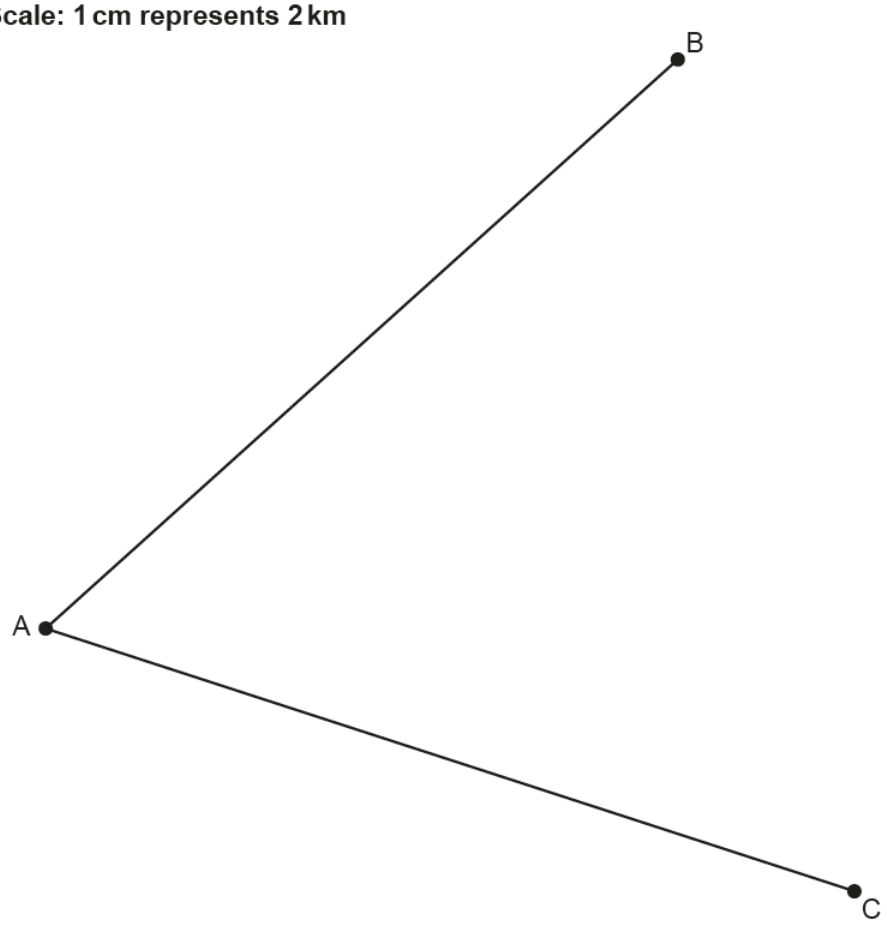
20 The scale diagram below shows towns, A, B and C.
Line AB represents the road from A to B and line AC represents the road from A to C.

A shopping centre is to be built so that it is

- nearer to the road from A to B than the road from A to C,
- less than 14 km from town C.

(a) Using construction, shade the region where the shopping centre could be built.
Show all your construction lines.

Scale: 1 cm represents 2 km



[5]

Only a small minority of candidates knew that they had to construct an angle bisector and an arc to identify the region required. Several candidates scored 2 marks for a radius of 7 cm. The minority who produced both an accurate bisector and arc could usually identify the region correctly. The accuracy of constructions were variable but most attempts were within tolerance. Many candidates shaded arbitrary areas not bounded by any construction lines or drew in straight lines such as BC and used that as a boundary for shading.

Question 20(b)

(b) Explain why the region found in part **(a)** may not be an appropriate site for the shopping centre.

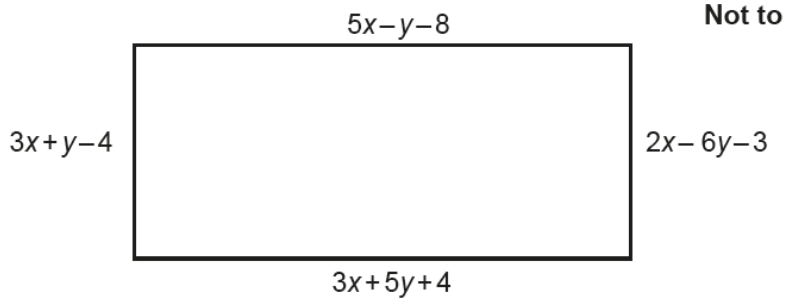
.....

..... **[1]**

Many candidates did not answer this question. Of those who did, several wrote, "it is too far from a road", appearing not to realise that if a shopping centre were to be built then roads could also be built.

Question 21

21 The dimensions, in centimetres, of this rectangle are shown as algebraic expressions.



Work out the length and width of the rectangle.

length = ... cm

width = ... cm

[6]

Many candidates did not understand what was required to answer this question. Some candidates collected like terms from different edges of the rectangle instead of equating them. Some candidates did gain 2 marks by equating either the lengths or the widths or both. After that, few simplified their equation(s).

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