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GCSE (9–1)

Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/02 Summer 2022 series

Version 1

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Contents

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. A selection of candidate answers is also provided. 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 and the mark scheme can be downloaded from OCR.

Advance Information for Summer 2022 assessments

To support student revision, advance information was published about the focus of exams for Summer 2022 assessments. Advance information was available for most GCSE, AS and A Level subjects, Core Maths, FSMQ, and Cambridge Nationals Information Technologies. You can find more information on our website.

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Paper 2 series overview

This non-calculator paper is the second of the three papers taken by Foundation candidates for the Mathematics GCSE (9-1) specification.

General numeracy was quite secure however when working through longer problems sometimes small errors in the four operations, with multiplication and division in particular, resulted in lost accuracy marks. Some candidates displayed good techniques to make calculations easier, e.g. 5 × £8.99 = 5 × £9 – 5p and 2.50 × 50 = 5 × 25. However, a lot of repeated addition was used instead of multiplication and division which is a more time-consuming process and is more prone to errors.

Checking the reasonableness of answers is good practice, e.g. in Question 9 a total ticket price in the thousands should have been considered as too high.

Overall, candidates displayed a good level of mathematical communication in their work, particularly when the questions had multiple marks. Where working was well ordered, clearly communicated and concise, generally most or all marks were awarded.

Candidates who struggled to structure their responses logically presented working that was difficult to understand and follow. A few words to describe or label the steps as they were attempted, e.g. area = , cost of adult tickets = , number of red marbles =, would have helped with communication.

When writing figures, it is important for candidates to take care. On some scripts the formation of figure 4s were difficult to differentiate from 9s, on other scripts this was the case with 1s and 7s. This led to errors resulting from misreading their own writing, for example writing 2.4 in one part of working but then misreading it later as 2.9. It is also important for candidates to make sure decimal points are very clearly written.

For quite a proportion of candidates there were a number of questions not attempted particularly through the second half of the paper. Questions where this was most evident were those on the topics of: calculation with a mix of decimals and a fraction (Question 8 (b)), powers and roots (Question 13 (b)), bearings and algebra (Question 16), relative frequency (Question 17 (b)), finding the equation of a straight line from a parallelogram on a coordinate grid (Question 20) and ruler and compass constructions (Question 22).

It would appear that most candidates had enough time although the last question was quite often blank, however this may have been due to its difficulty.

Candidates who did well on this paper generally did the following:	Candidates who did less well on this paper generally did the following:
• attempted most of the questions • followed the instructions in questions carefully • set out working clearly and logically • showed calculations for every step of their working rather than just stating numerical results • demonstrated secure numeracy skills • wrote responses to comment questions clearly and concisely.	• had a high number of no response question parts • missed specific instructions within questions • had disorganised and unclear working when answering questions worth 5 or more marks • made basic numerical errors in their working • confused and misread their own figures • reversed numbers when working through a division.

Question 1 (a) (i) and (ii)

1 **(a)** Work out.

(i) $4 - 5$

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

(ii) $2 \times {}^{-}3$

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

The majority of candidates were able to answer part (a) (i) correctly, with the most common errors being an answer of 1 or 9. Some candidates drew a number line to help them complete the calculation. Part (a) (ii) was also correct for most. Where the mark was lost the negative sign in the question was ignored resulting in an answer of 6, or rarely ${}^{-}1$ where the calculation was treated as an addition.

Question 1 (a) (iii) and (iv)

(iii) $\frac{1}{7} + \frac{2}{7}$

(iii) .... **[1]**

(iv) $\frac{1}{2}$ of $1\frac{1}{2}$

(iv) .... **[1]**

The majority of candidates gained the mark in part (a) (iii). The most common misconception seen was candidates adding the numerators and denominators to get an answer of $\frac{3}{14}$. The correct equivalent fractions of $\frac{6}{14}$ and $\frac{21}{49}$ were occasionally seen. Part (iv) of (a) candidates found most difficult. One method was to separate the mixed number and halve 1 then halve the ½, this generally led to the correct answer of ¾. Occasionally it led to incorrect answers such as $\frac{0.5}{4}$. A common incorrect answer of 1 implied that candidates mistook the word "of" for "off" so subtracted ½ from 1½. Those that recognised they needed to divide $\frac{3}{2}$ by 2 often left their answer in the incorrect form $\frac{1.5}{2}$. Few changed the question to $\frac{1}{2} \times \frac{3}{2}$.

Question 1 (b)

(b) Write down the largest prime factor of 30.

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

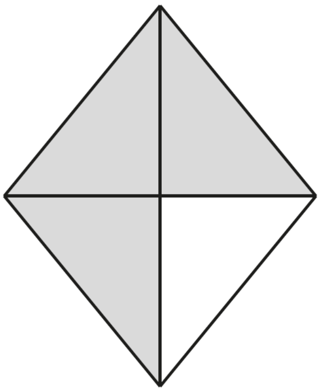
Many candidates seemed confident with factors and it was rare to see multiples. Prime numbers were also identified by a good proportion of candidates. The most common methods seen used either a factor tree or lists of the factors of 30. Although not all candidates chose 5 as the highest common factor, many gained 1 mark for selecting 2, 3 or all three of the prime factors. Common errors from listing factors of 30 were to choose 15 or 10 as the answer. A small minority misunderstood factor, and wrote the largest prime number under 30 although this error was sometimes compounded by the choice of 27. Some others wrote a factor pair as their answer such as 5 and 6 or 3 and 10.

Question 2 (a) and (b)

2 **(a)** What fraction of this shape is shaded?

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

(b) What percentage of this shape is shaded?



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

The vast majority of candidates gave a correct answer in part (a). The most common error was ⅓ as a result of giving the fraction "unshaded" rather than "shaded". Rarely, a ratio was given rather than a fraction and a few attempted to write their answer as a percentage. Part (b) was answered less well. A significant number of candidates missed that the question required a percentage so answered in the same way as for part (a) with the fraction of ¾. Less common errors were wrong percentages, 25% again from considering "unshaded" but also 80%, 85% and 90% were seen.

Question 2 (c)

(c) Write 0.2 as a fraction.
Give your answer in its simplest form.

(c) .... **[2]**

A good number of correct answers with almost everyone gaining 1 mark, usually for $\frac{2}{10}$ but answers of $\frac{20}{100}$ and $\frac{5}{25}$ were quite common. A common error was $\frac{2}{100}$ although SC1 was often earned from correctly simplifying this to $\frac{1}{50}$. On rare occasions 20% was stated.

Question 2 (d)

(d) Work out 80% of 30.

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

Well answered by many. Successful candidates found 10% then multiplied by 8 to get the correct answer. Some wrote down 0.8 × 30 first then listed e.g. 10% = 3, etc. If errors were made it was usually as a result of starting with 50% = 15, leading to 25% = 7.5, but then candidates found difficulty proceeding as these weren't the simplest of numbers to deal with. Others attempted 50% + 10% + 10% + 10%, some successfully but this latter method appeared more prone to arithmetic errors. Seen less frequently were place value errors with 0.8 × 30 leading to 2.4 or 240.

Misreading "of" as "off"

Unfortunately, some correct methods were spoiled by going on to subtract 24 from 30, giving the answer 6. Whether this was a misread "80% OFF 30" rather than "80% OF 30", or whether candidates assumed it was a percentage change question is unclear. This same error has been identified in previous series.

Question 3

3 Bananas cost 25p each.

How many bananas can be bought for £2?

.... **[2]**

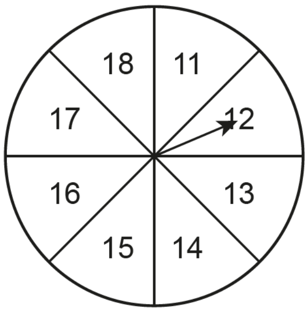
Most candidates were able to answer this correctly. Various methods were used, though the most common was by chunking 25s to a total of 200. A few struggled to add 25 repeatedly, with addition errors made. Others didn't keep a track of their chunking method, producing answers of 7 or 9. Those whose working was more chaotic often lost marks because they gained an extra banana or lost a banana as they started a new vertical column. Another successful method was to indicate that 4 could be purchased for £1 then doubled the amount for £2. Other common errors included when candidates were unsure of the total of 200p for £2, and working out an answer of 4 for £1 but then not doubling this for £2.

Assessment for learning

Candidates should be encouraged to recognise the pattern of the 25 times table, repeating every hundred, and how it relates to quarters as decimals and percentages.

Question 4 (a) and (b)

4 A student makes a fair 8-sided spinner.
They write the numbers 11, 12, 13, 14, 15, 16, 17 and 18 on the spinner.



(a) Write down the probability of the student's spinner landing on a number which is less than 12.

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

(b) Find the probability of the student's spinner landing on a multiple of 3.

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

Part (a) was successfully answered by many candidates. Wrong representations of probability were evident with frequent errors of 1 : 8, 1 to 8, 1 in 8, 1 out of 8. Incorrect fractions included $\frac{1}{7}$, $\frac{1}{18}$ from assuming all numbers from 1 to 18 were used and $\frac{2}{8}$ as a result of including both 11 and 12 for "less than 12". Some gave word answers such as "unlikely". Where candidates did not achieve full marks in part (b), M1 was often awarded either by writing out 12, 15, 18 in the part (b) answer space or clearly indicating that these were selected on the spinner, or in the list of numbers stated in the question. Those that answered with an incorrect representation of probability, or in words for part (a), generally gave answers in the same incorrect format in part (b).

Question 5

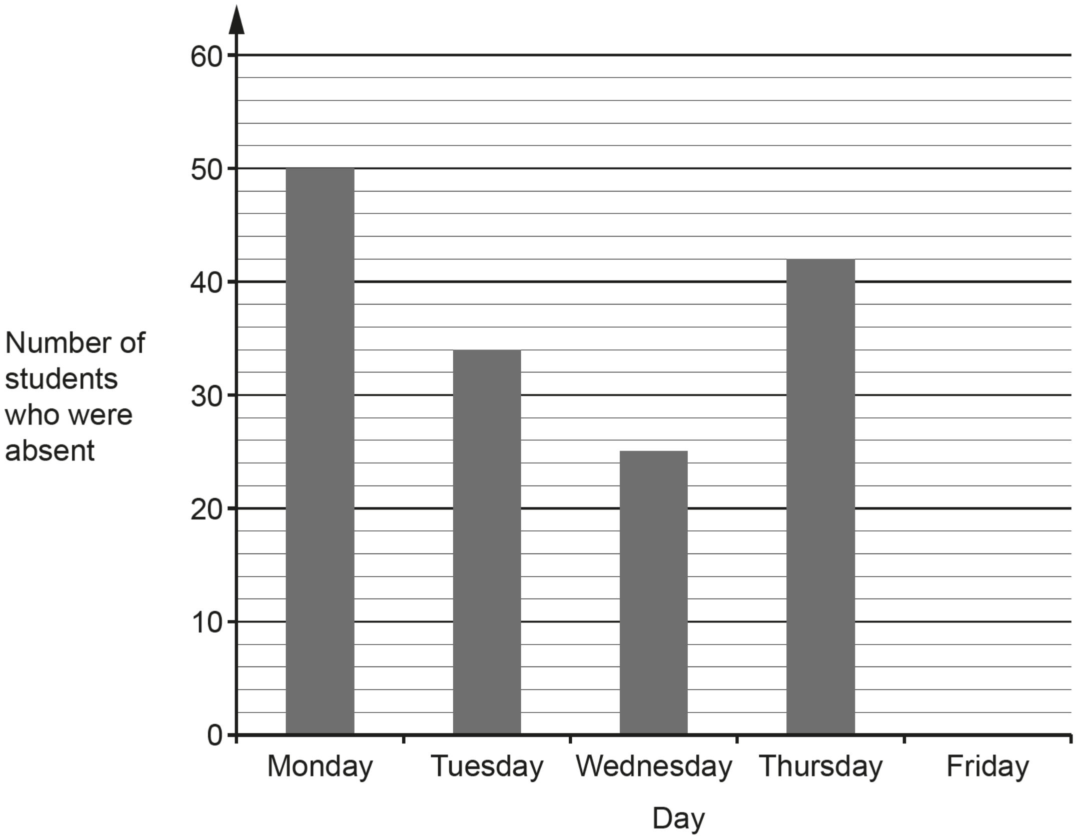
5 Write the ratio $5 : 7\frac{1}{2}$ in its simplest form.

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

Many found this question difficult due to the presence of a fraction in the given ratio. Quite often candidates just converted 7½ to 7.5 and stated their simplified ratio as 5 : 7.5. The most common methods seen among scoring candidates was either recognising that both sides could be divided by 2.5, or multiplying both sides to make sure two integers were used and then dividing down, e.g. multiplying by 2 to get 10 : 15 and then dividing by 5 to get 2 : 3. There were a significant proportion of candidates who gave answers of 1 : 1.5 or equivalent, therefore identifying that they needed to make one side of the ratio "1" to correctly simplify. Many who attempted to simplify by dividing both numbers by 2 first, either got to 2.5 : 3.75 but struggled to proceed, or made an error that led to 2.5 : 3.5.

Question 6 (a)

6 Taylor has collected data on the number of students who were absent from their school last week. The bar chart shows the results for the first four days.



(a) On Friday there were 54 students who were absent from the school.

Show this information on the bar chart. **[1]**

Many candidates completed the bar chart correctly using ruled lines. Although widths of the bars weren't always similar to the other four days, they always remained within the gap for Friday, sometimes taking up the full width. It was rare for the scale to be misunderstood with just the occasional bar drawn to a height of 58. Some candidates did not use a ruler and some bars were quite untidy but most provided a clear indication of the correct bar. Occasionally this part was missed although parts (b) and (c) were attempted.

Question 6 (b)

(b) Taylor says

On Monday 150% of the students were absent from my school.

Could this be true?
Explain how you decide.

....

....

.... **[1]**

Good answers used concise language with a clear understanding that 150% was impossible and reference to the context/numbers of students was made. Common errors in non-scoring statements were:

- Wrong interpretation of the graph, i.e. graph showing numbers of students present and/or total number of students taken as 60.
- Confusing/interchanging numbers of students with percentage of students.
- Answers gave no reference to the context: some showed a clear understanding of 100% and 150% but without reference to context the mark was lost.

Question 6 (c)

(c) There are 600 students in Taylor's school.
Find the percentage of students who were absent from Taylor's school on Thursday.

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

A real mix of responses. Some candidates used incorrect values, often taking the number of absent students on Tuesday instead of Thursday. Several got as far as $\frac{42}{600}$ but were not sure how to progress. The best responses used equivalent fractions to simplify $\frac{42}{600}$ to $\frac{7}{100}$. Another successful method was calculating 1% = 6 and then scaling up to 42 = 7%. Numerous candidates misinterpreted the question as calculate 42% of 600. Many who correctly stated 42, subtracted it from 600 rather than dividing to try to find the percentage. There appeared to be very little checking of whether an answer was reasonable.

Question 7 (a)

7 **(a)** Multiply out.

$5(x+2)$

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

The vast majority of candidates gave the correct answer. However, a few approaches led to incorrectly multiplying out $5(x + 2)$ to give $5x + 2$, $2x + 5$, $5x + 7$ or $7x$. Others ignored the + sign giving $5(2x) = 10x$ or spoiled the correct answer, $5x + 10 = 15x$. A small minority attempted to solve as an equation: $5x = 2$ so $x = \frac{2}{5}$.

Question 7 (b)

(b) Rearrange this formula to make r the subject.

$$p = 3r - 5$$

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

Many candidates struggled with this question and far too many attempted to go straight to an answer without showing the step in between. A number of these got to an answer which contained either $p + 5$ or $p \div 3$ but without seeing the previous line of working method marks were lost. Some just swapped p and r, sometimes changing the sign too, which led to incorrect answers of $r = 3p - 5$ or $r = 3p + 5$.

When there was evidence of using a balancing method, errors arose such as stating "+ 5" as a first step, but incorrectly processing this, often resulting in $5p = 3r$ as their first line of working. Some did go on to achieve M1 for correctly dividing by 3 as a second step, but often they ended up with $5p - 3 = r$ indicating a clear misunderstanding of inverse operations. Far less common was attempting to divide by 3 first but in nearly all cases candidates forgot to divide the 5 by 3 as well.

Assessment for learning

Some attempted to use a flow diagram, but many put p and r in the wrong place which led to the wrong answer. Centres need to instruct candidates that there are no method marks available for using a flow diagram so standard presentations need to be learnt and practised.

Question 8 (a) (i) and (ii)

8 **(a)** Work out.

(i) 3.08 + 0.82

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

(ii) 7.7 ÷ 11

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

Almost all candidates answered part (a) (i) correctly, either without working or with column addition shown. Often the answer included the unnecessary 0 at the end. Rare incorrect answers seen were 4.00, 3.810 or 3.09 but there were very few no responses. Although most gave the correct answer to part (ii), there were also a lot who incorrectly gave 1.1, 0.77, 7.7 or 7 as their answer. On occasion, the numbers were subtracted rather than divided.

Question 8 (b)

(b) Work out.

$(2.1 - \frac{3}{5}) \times 0.3$

Give your answer as a decimal.

(b) .... **[3]**

Many misconceptions and mistakes were highlighted by this question. Answered less well than part (a) with only a few candidates managing to get full marks, a good number gained some B marks. Many struggled with converting ⅗ to a decimal, commonly coming up with an incorrect decimal such as 0.75 or changing to a percentage and using 60 or 3.5. Others tried to find ⅗ of 2.1 and some attempts to expand the brackets most frequently led to further errors. Multiplication by 0.3 was rarely done correctly, usually resulting in an answer 10 times too big, due to misplacing the decimal point. Some attempted to progress using fractions such as starting with $\frac{21}{10} - \frac{6}{10}$ but then were unsuccessful in attempts to multiply their result by 0.3. Some candidate responses were quite chaotic with little structure to the setting out of their working, often with steps jumping all over the page.

Question 9

9 A local theatre is putting on a show.
50 child tickets are sold.
The ratio of the number of child tickets sold to the number of adult tickets sold is 5 : 2.

The cost of a child ticket is £2.50.
The cost of an adult ticket is £5.00.

Work out the **total** amount paid for the tickets.

£ .... **[4]**

Most candidates attempted this question and many were able to score some method marks, even if their final answer was incorrect. Those who did not get the correct final answer and showed insufficient working often lost method marks. Many missed the cue to scale up the ratio and didn't realise they needed to work out how many adult tickets they needed before trying to calculate the cost. So, responses scored M2 for 2.50 × 50 + 5.00 × n, or just M1 for 2.50 × 50. A common approach was to use the ratio given and work out the cost of 5 children and 2 adults. Some who dealt with the ratio aspect successfully, struggled to multiply 2.50 by 50. Some attempted to split this into 2.50 × 5 then × 10 but without a calculator found this difficult.

Check the reasonableness of answers by use of estimation

Candidates would benefit from reinforcement of their understanding of place value in relation to such calculations. Some gave solutions with clearly incorrect magnitude. Candidates should therefore be encouraged to check their answers by estimation.

Exemplar 1

child adult
5 : 2
~~1=5~~
50 tickets : 10 tickets. 60 total tickets

2.50 × 50

	20	5
5	100	25
10	200	50

= £37.50 → £37.50 (Children)

5 × 10 = £50.00 adult.

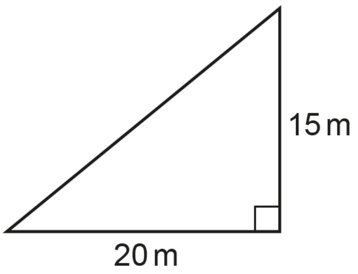
37.50
+ 50.00
= 87.50

£ 87.50 **[4]**

Their final answer comes from adding £37.50 and £50.00. This scores M2 for 50 × 2.5 + (their 20) × 5. Although arithmetic errors have been made, their communication supports correct steps of working. They have clearly labelled the number of adult tickets so we can see where 5 × 10 comes from and they have stated 2.50 × 50 even though they incorrectly calculate this as £37.50. Finally, they show the addition of their child ticket total and their adult ticket total. A total of 2 scored.

Question 10

10 The diagram shows Kai’s garden.
It is in the shape of a right-angled triangle.



Not to scale

Kai is going to spread grass seed on the garden.

- A bag of grass seed covers an area of 35 m^2.
- Each bag of grass seed costs £8.99.

Kai can only buy whole bags of grass seed.
Kai buys the least number of bags needed for the garden.

Calculate the cost of buying the bags of grass seed that Kai needs.
You must show your working.

£ .... **[6]**

There were some very good responses to this multi-stage question, and the majority of candidates showing the three parts of the working set them out in a clear way using identifying words such as “Area =”, “number of bags =” and “cost =”. Finding the area of the triangle proved difficult for quite a few candidates and in some cases Pythagoras and/or a perimeter were attempted. The most common error in calculating the area of the triangle was to forget to halve after attempting 20 × 15. However, regardless of their area, many were then generally able to work out the number of bags needed. Higher scoring candidates attempted the division of their area by 35, often checking the results below and above the area by multiplication. Others used a list of multiples of 35 from which to choose the number of bags needed. Many gained marks for *k* × 8.99 evaluated correctly, often finding *k* lots of £9 and subtracting *k* pence.

Exemplar 2

area = ½ × b × h
area = ½ × 20 × 15
area = 600m²

20 × 15
100
200
300

300 × 0.5 = 600

35 × 9 = 315
35 × 12: 70, 350, 420
35 × 20: 00, 700
35 × 19: 315, 350, 665
35 × 18: 280, 350, 630

he needs 18 bags.

18.00
× 8.99
0162.00
1440.00
£1602

£ 1602 **[6]**

The steps of working for the 3 parts to this question are clearly shown.

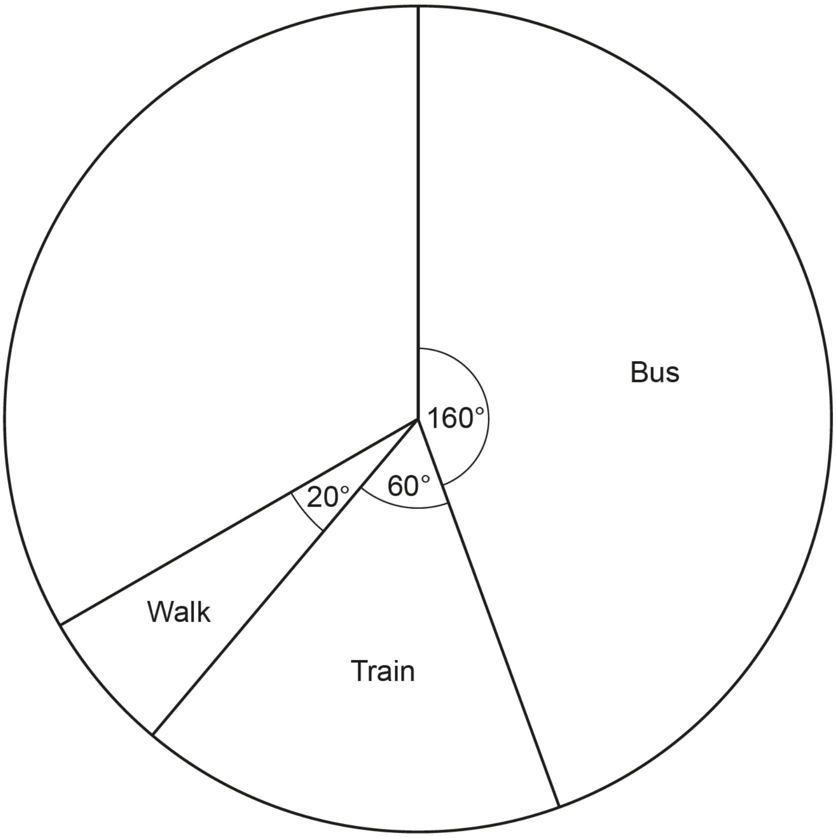
The correct formula for the area of a triangle is stated, however the answer of 600 is incorrect. M1 A0 is scored at this stage.

The next step is to work out how many bags are needed. Following through from their incorrect area, the best method would be to work out 600 ÷ 35. Here they have trialled different multiples of 35. They have got to the correct number of bags for their area so score M1 A1, however their method is more time consuming.

The final step is to work out the cost and they have attempted a long multiplication made more difficult by using 18.00 rather than 18. On a non-calculator paper it may have been better to do 18 × £9 and then subtract 18p. Here they score M1 for showing the calculation 18.00 × 8.99 but lose the final mark available. A total of 4 scored.

Question 11 (a)

11 Some students were asked how they travel to school.
Each student gave one answer.
The pie chart shows the proportion who travel by bus, by train or walk.



(a) All of the remaining students travel to school either by bike or by car.
The ratio of the number who travel by bike to the number who travel by car is 2 : 3.

Complete the pie chart.
You must show your working. **[6]**

This question was well attempted and often resulted in full marks. A small minority didn't label their sectors or labelled incorrectly. Occasionally the only mark lost was for drawing the line on the pie chart in the wrong place after 48° or 72° seen. Most used a ruler, but some freehand lines, losing this mark, were seen. Those not scoring full marks often gained M2 for finding the remaining 120°. The most common error after this was to divide 120 by 2 and 3, leading to 60° and 40°. Others only did 120 ÷ 2 = 60 then assumed the other angle was also 60°. These candidates didn't consider the unequal aspect of the ratio while some that did gave the two sectors as 70° and 50°. Arithmetic errors when calculating 240° and 120° were made by some, however many went on to gain a further method mark for the next step of finding $\frac{2}{5}$ and $\frac{3}{5}$ of their 120°. Others used the ratio to 'count up' to find angles that summed to 120, e.g. 2 : 3, 4 : 6, 40 : 60, etc. rather than dividing by 5. Working out appeared less well set out in this question with some methods scattered all over the page.

Question 11 (b)

(b) Which way of travelling to school is the mode?

.... **[1]**

Generally answered correctly, 160 was seen most commonly in place of a correct response. Train, the median rather than the mode, was sometimes seen and there were a few who did not attempt this part.

Question 12 (a)

12 Dinosaurs first appeared on Earth 2.4×10^8 years ago.
Dinosaurs became extinct on Earth 7×10^7 years ago.

(a) Explain why it is appropriate to use standard form for these numbers.

....

....

.... **[1]**

Most candidates attempted this comment question, with few no responses seen. Many answers showed an understanding of what standard form is used for, mentioning "large numbers" or "a lot of zeros" or how long it takes to write out. The most common error was to mention that standard form made the numbers "easier to read" without explaining why. Other frequent errors were statements about accuracy such as "it is more accurate" or estimates such as "it's better for estimation", or to focus on how long ago the dinosaurs were around. Handwriting in some cases was difficult to decipher. Some responses contained incorrect statements or values alongside a comment that would have been sufficient to score, e.g. "there are lots of zeros in 24 billion years".

Question 12 (b)

(b) Use the given information to work out how long dinosaurs existed on Earth.
Give your answer in standard form.

(b) .... **[3]**

Only a minority of candidates achieved full marks. The vast majority attempted to convert standard form to full numbers and in many cases, this gave them the opportunity to achieve a mark for at least one correct conversion. Where conversions were incorrect, most made errors by including additional zeros. More gained the mark for 70 000 000 being correct than 240 000 000, the latter error leading to the common answer of figs 233. Some didn't realise the calculation required them to subtract rather than add the numbers, while there were others who attempted to do the subtraction in the wrong order, often due to incorrect numbers of zeros shown in their expanded numbers. Very few attempted the calculation in standard form. Common incorrect answers were 1.7×10^7 or 17×10^n or 2.4×10^8.

Question 13 (a) and (b)

13 **(a)** Complete this statement by writing the missing power in the box.

$$784 = 2^{\square} \times 7^2$$

[1]

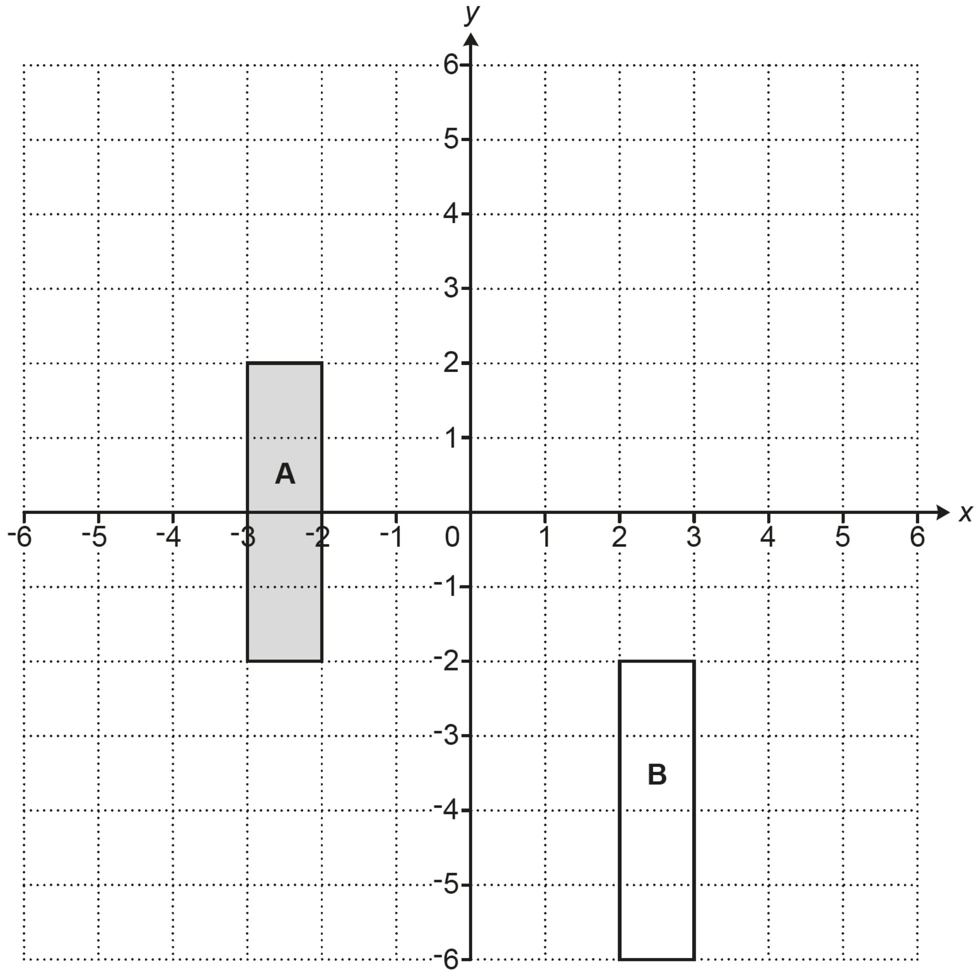
(b) Use your answer to part **(a)** to find the value of $\sqrt{784}$.

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

The common method in part (a) was trial and improvement with extensive working often seen. This indicated that candidates spent quite a lot of time on this, however the correct answer was not common. Working often showed 49 × 2, then 49 × 4 and so on. Those who got to 49 × 16 = 784 then struggled to convert 16 to 2^4. Some were successful but the rest made errors somewhere in the trials. Only a few attempted a method that started with 784 ÷ 49. Many did not attempt part (b) and very few responses showed understanding that the prime factors could be used to find the square root of 784. Some reached the correct solution by trials of different numbers, however non-scoring responses of 7 or 14 were quite common. 392 was the most common incorrect response resulting from the misconception that square rooting is the same as halving.

Question 14

14 Rectangle **A** and rectangle **B** are drawn on the coordinate grid.



Describe fully **two** different **single** transformations that map rectangle **A** onto rectangle **B**.

1 ....

....

....

2 ....

....

....

[6]

A slight change in the format and style made this a demanding question for many candidates. "**Two** different **single** transformations" was misunderstood or misinterpreted by many. Answers were spoiled because some thought they had to provide two transformations for each point while others spread their single transformation over the two sections provided. Only a very small minority gained all 6 marks. Candidates struggled to use the correct terminology: rather than "translation" many used "move" or "transform". They described the translation using "5 right" which scored a mark or "5 across" which didn't, and "4 down", rather than giving the vector. Rather than "rotation" they referred to "turning". Others described how coordinates had moved, the position of the shapes, and referred to the positive and negative aspects of the coordinate grid. A significant number did not respond to the question at all.

Question 15

15 y is inversely proportional to x.
$y = 20$ when $x = 3$.

Find the value of y when $x = 12$.

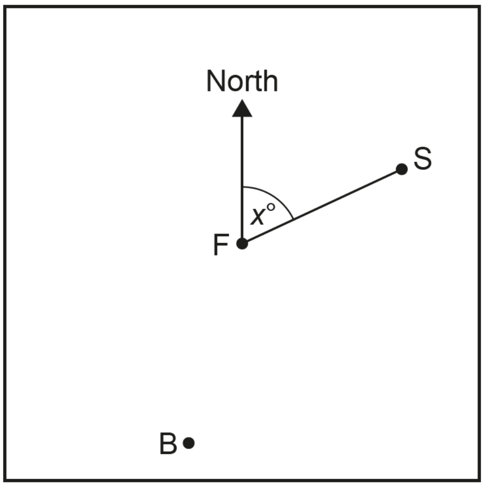
$y =$ .... **[3]**

Most candidates ignored the inverse proportionality aspect of this question with the majority working through the question by treating y as directly proportional to x, hence getting an answer of 80 was very common. This earned them 1 mark for identifying the multiplier of 4. Some used a table or arrows between the pairs of values of y and x. An algebraic method was very rarely seen. Other errors were (20 – 3) = 1, 17 + 12 = 29 or starting with 20 ÷ 3 = 6.6. There were a significant number of candidates who did not attempt this question.

Question 16 (a) and (b)

16 A town square has a fountain (F) at the centre.
There is also a bell tower (B) and a statue (S).

The bearing of the statue from the fountain is x°.



Not to scale

(a) The bearing of the bell tower from the fountain is 140° more than the bearing of the statue from the fountain.

Write down, in terms of x, the bearing of the bell tower from the fountain.

(a) .... ° **[1]**

(b) The bearing of the bell tower from the fountain is also three times the bearing of the statue from the fountain.

Work out the bearing of the bell tower from the fountain.

(b) .... ° **[4]**

The most common outcome for this question was an incorrect answer in part (a) followed by part (b) not being attempted. The instruction to answer 'in terms of x' was widely not understood, with the vast majority of candidates giving numeric answers with no reference to x. Numeric answers were varied but included 140, 40 and 220. Some measured the angle despite the "Not to scale" instruction. The most common error for attempts to write the bearing in terms of x was $140x$ or stating $x = 140$. Occasionally letters such as S, B, SF, BF from the diagram were used. It was very rare that a candidate tried and answered part (b) correctly. Some attempted to use their numeric answers from part (a) and those who answered part (a) correctly struggled to continue through this part. It was very rare that candidates attempted to form and solve an equation in order to calculate the bearing, and $3x$ was only seen very occasionally. A common incorrect approach was multiplying the answer to part (a) by three. A rare answer of 210 generally was arrived at without using algebra.

Question 17 (a)

17 Morgan is playing a computer game.
They can score 0, 1, 2 or 3 points on each turn.
They record their scores for 100 turns.
The table shows the relative frequencies of their scores.

Score	0	1	2	3
Relative frequency	0.08	0.42	0.38	

(a) Complete the table. **[2]**

This was successfully answered by many. Where errors occurred, they were predominantly due to arithmetic errors in the subtraction of 0.08, 0.42 and 0.38, from 1. 0.22 was a very common error and this was often seen without working so a method mark for 1 – 0.88 = 0.22 could not be awarded. Almost as common was writing 0.88 in the table so the addition was correct but this value was not then subtracted from 1.

Question 17 (b)

(b) Morgan says

I scored more than 160 points **in total** in my 100 turns.

Is Morgan correct?
Show how you decide.

.... **[4]**

Many candidates did not display a sound understanding of relative frequency. A method mark was often gained for 0.42 × 100. This was commonly as a result of adding up the relative frequencies, without first multiplying them by a score, then multiplying the result by 100. Among those attempting the correct method, a common error was 0.08 × 0 × 100 = 8, resulting in the incorrect total mark and comment. Almost all candidates providing a total score were able to interpret their total and make a correct comment for that total. Many with an incorrect value in part (a) gained follow through marks in part (b). There were a significant number of no responses on this question.

Question 18

18 A bag only contains red marbles, blue marbles and yellow marbles.

- The probability of picking a red marble is $\frac{2}{5}$.
- There are nine yellow marbles.
- The probability of picking a blue marble is three times as likely as picking a yellow marble.

Work out the **total** number of marbles in the bag.
You must show your working.

.... **[5]**

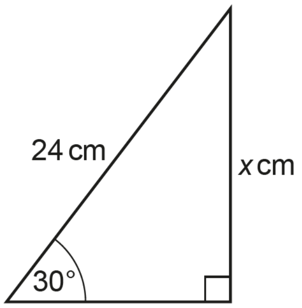
This was a challenging problem solving question and while most candidates attempted it, most gained no more than 2 marks. Many got to the point of showing the number of blue + yellow marbles was 9 + 3 × 9 = 36; most not scoring 2 marks were able to find the number of blue marbles from 3 × 9 = 27 so scored 1 mark. Progressing beyond the value of 36 proved more challenging. Very few candidates were able to use $\frac{2}{5}$ and $\frac{3}{5}$ successfully to find the number of red marbles. A few identified the connection between 36 and $\frac{3}{5}$ but some went on to calculate $\frac{3}{5}$ of 36. Other errors included: using 36 to calculate the number of reds by either dividing it by 2, or by attempting to find $\frac{2}{5}$ of 36; making $\frac{2}{5}$ = 40% = 40 reds, leading to 76 as an answer.

Question 19 (a) and (b)

19 (a) Circle the value of sin 30°.

$\frac{1}{2}$ $\quad$ $\frac{\sqrt{3}}{2}$ $\quad$ $\frac{1}{3}$ $\quad$ $\frac{\sqrt{3}}{3}$ $\quad$ $\frac{1}{4}$ **[1]**

(b) Here is a right-angled triangle.



Not to scale

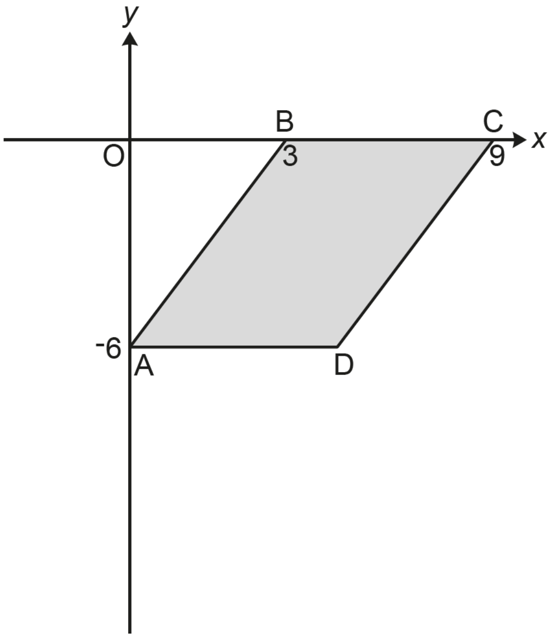
Work out the value of *x*.

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

It was rare to see any method used for part (a), with the occasional lists of sin, cos and tan with 0, 30, 45, 60 and 90 seen. ⅓ was a popular incorrect choice. A significant number of candidates didn't attempt to circle any of the values. Choosing the correct answer, in most cases, unfortunately did not lead to success in part (b). Many recognised that trigonometry was needed for the question and "SOH CAH TOA" was often seen among these candidates. Quite a few also recognised that "sin" was the trigonometric ratio required. These were often able to set the equation up, sin 30 = $\frac{x}{24}$, but struggled to proceed any further as they either didn't link their method to their answer in part (a) or they incorrectly rearranged the formula in an attempt to make *x* the subject, e.g. $x = \frac{24}{sin30}$. Other incorrect attempts involved subtracting 24, 30 and 90 from 180 to get 36 or attempting Pythagoras but taking the 30° angle as a length.

Question 20

20 The graph shows a parallelogram ABCD.



Not to scale

A has coordinates (0, ⁻6), B has coordinates (3, 0) and C has coordinates (9, 0).

Find the equation of the line that passes through the points C and D, giving your answer in the form $y = mx + c$.
You must show your working.

.... **[5]**

Combining the demand of parallelogram properties with the equation of a straight line, this question was by far the least attempted and proved just too difficult for most. The large majority of candidates picked numbers out of the diagram with some attempting substitution into $y = mx + c$, so answers such as $y = -6x + 9$ or $y = 9x - 6$ were extremely common. The first step of recognising the required line would be parallel to AB and therefore the gradients would be the same was not considered by most. A few did state "change in *y* / change in *x*" but then used the coordinates of the diagonal of the parallelogram, C and A, or used the values given on the *x* axis. A number tried to use the diagram to find the *y*-intercept, but given that it was "Not to scale" the common answer was ⁻12. Occasionally a mark was earned for giving the correct coordinate of (6, ⁻6) for D.

Question 21 (a)

21 (a)

$$(x+4)(x+3) = x^2 + 7x + 12$$

Darcy says that the statement in the box is an equation.
Ellis says that the statement in the box is an identity.
One of them is correct.

Explain which one of Darcy or Ellis is correct.

.... is correct because ....

....

....

.... **[2]**

The majority of candidates did not consider doing anything with the boxed statement so it was rare to see the brackets expanded correctly to gain the method mark. Few candidates were able to explain the features distinguishing an identity from an equation. A significant number of candidates thought that the presence of an = sign meant an equation and so identified Darcy as being correct. Responses that correctly stated Ellis/identity, were mostly not able to provide an acceptable reason. Many just said it was already answered.

Question 21 (b)

(b) Solve by factorising.

$$x^2 + 4x - 12 = 0$$

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

More candidates were able to make an attempt at this part than part (a) with a number of candidates able to factorise the quadratic successfully and subsequently solve it. After correct factorisation it was not uncommon to see the wrong signs in the solutions, i.e. $x = +6$ or $x = {}^-2$. Other attempts to factorise resulted in e.g. $(x + 4)(x - 3)$ gaining a method mark and some went on to earn a further mark for correctly stating the values of x for their factors. Candidates who did not know how to factorise a quadratic attempted other methods to solve the equation with some adding 12 and trying to solve $x^2 + 4x = 12$. A few gave the correct solutions with no working which lost them 2 method marks.

Exemplar 3

$$x^2 + \overset{\text{add}}{4x} - \overset{\text{times.}}{12} = 0$$

$(x + 6)(x - 2) = 0$

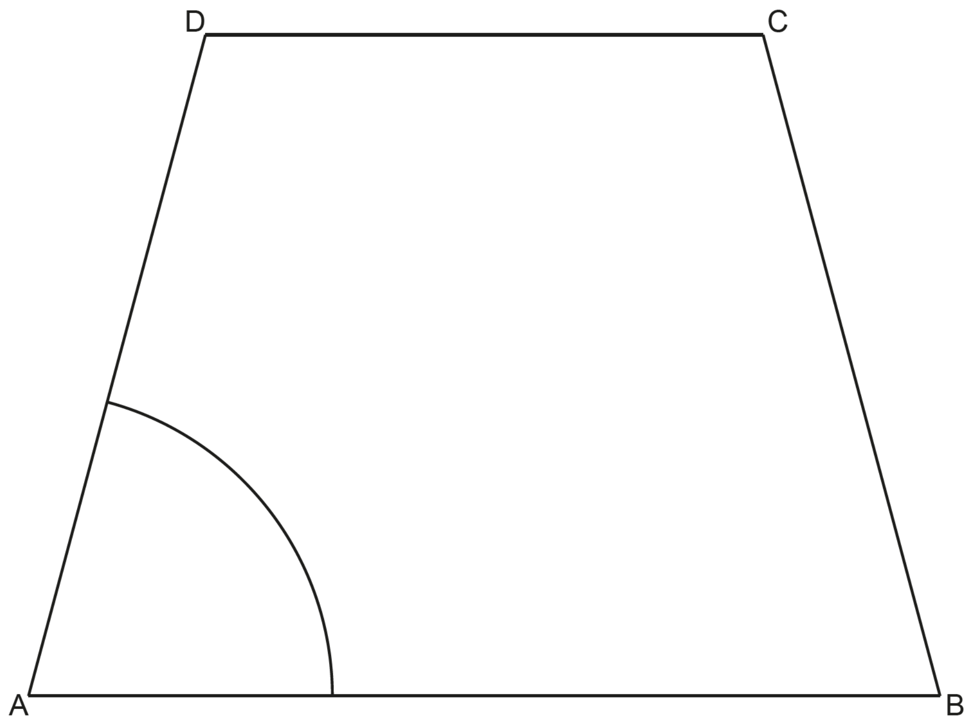
(b) $x =$ ....$^-2$.............. or $x =$ ...6................. **[3]**

The candidate has factorised the quadratic correctly. However, a common error when finding the solutions was to just copy the values from the brackets as in this case rather than writing out the next step of $x + 6 = 0$ or $x – 2 = 0$. Then solving these two equations to get the correct solutions of $x = {}^-6$ or $x = 2$. A total of 2 scored.

Question 22

22 The diagram shows the scale drawing of a sandpit, ABCD.
It also shows the arc of all points in the sandpit that are 80 cm from corner A.

Scale: 1 cm represents 20 cm



A game is played by throwing a ball into the sandpit.
Points may be scored when the ball lands in the sandpit.

- 1 point if the ball lands within 80 cm of corner A,
  and
- 1 point if the ball is closer to side AB than side AD,
  and
- 1 point if the ball is closer to corner A than corner B.

By completing the construction, find and shade the regions where 2 points can be scored.
Show all your construction lines. **[6]**

As the final question on the paper, the context of this construction question provided a challenge. Some candidates were successful in using compasses and a ruler to construct the angle bisector and the perpendicular bisector of AB, however more commonly lines were drawn without using any construction arcs. The angle bisector was the more successful of the two constructions. Of those that drew the correct constructions some recognised that the region closest to AB and more than 4 cm away from corner A was to be shaded, although for others this was spoiled by also shading the region within the 4 cm sector. When correctly shaded sections were given, construction arcs were usually clearly seen.

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