MATHEMATICS

Paper 0580/12

Paper 12 (Core)

Key messages

Read questions carefully in order to answer what is asked in the question. Observe accuracy guidelines and avoid over rounding during working and in answers.

General comments

There was a very positive response to this paper by the vast majority of candidates. Marks were often lost due to carelessness rather than lack of understanding, often caused by the reasons mentioned in the key messages above. Most candidates seemed to have a good grasp of what to do in questions although there were certain fairly straightforward questions where there was a large number of nil responses. It is vital that candidates cover all parts of the syllabus. Presentation of work was clear in almost all cases, but where working was needed it was not always shown, often resulting in loss of possible method marks.

Comments on specific questions

Question 1

Although the majority of candidates gained this mark there were quite a lot of errors made. In particular the first '1' was missing, giving 7017 or the zero was absent, giving 1717.

Answer: 17 017

Question 2

This question was generally very well answered but quite a number of candidates missed out the zero, giving an answer of 5.4.

Answer: 5.04

Question 3

The calculator question tests order of operations and although this was generally well answered, some candidates did not realise that just putting in the figures as given would calculate the following:

$8.2^2 - (52.48 \div 7.38) - 6.18$ which gives 53.94. Also seen was $\frac{123}{10}$ written as the answer, presumably from thinking that the answer needed a numerator and denominator.

Answer: 12.3

Question 4

Many candidates found this time question challenging since it required changing the form of one of the times so that both were 24-hour or 12-hour. Consequently this was not well answered. An answer of 173 from 1926 – 1753 showed no attention to time being 60 minutes in an hour. Some did not change a correct time of 1 hour 33 minutes to minutes which was asked for in the question. Otherwise there was a great variety of incorrect responses, even with the occasional negative one.

Answer: 93

Question 5

This was quite a demanding question and many did not realise that the cube root of 1331 needed to be found. Division by 3 was seen quite a number of times and even division by 4 was offered. Others took volume to be surface area and so divided by 6 before finding the square root. There were a considerable number of nil responses to the question.

Answer: 11

Question 6

This question was not answered well with many responses indicating a lack of understanding that rounding means giving an approximate value to the number given. There were many cases, in both parts, of values with 3 figures or decimal points. In **part (a)** responses of 800 and 700 as well as the truncated value 6 700 were quite common. In **part (b)** 6800 and 7000 were seen but most common was a missing zero giving 679 or even 67.9. Some candidates even gave the last 3 figures, 789. Again, the truncated form 6780 was seen at times.

Answers: **(a)** 6 800 **(b)** 6 790

Question 7

In isolating the $5w$ term, incorrect signs for either or both of the y term and the constant were often seen. The vast majority of candidates realised a division by 5 was needed but one or both marks were often lost on the first step.

Answer: $\frac{3y-7}{5}$

Question 8

(a) While most candidates gained this mark, a response of 4 was seen quite a number of times. Some thought that there had to be a bracket with $(-6 + 2)$ for example to fit in with the question style.

(b) There was quite a large number of nil responses for this basic skill question. However, nearly all candidates who understood what was required gained the mark.

Answers: **(a)** -4 **(b)** 154

Question 9

(a) Although this probability was quite straightforward, a significant number of candidates gave a decimal answer when the question probability was a fraction. This often led to a 2 significant figure or 2 decimal places response which was not sufficiently accurate. Therefore answers of 0.67, 0.66 or 0.666 did not gain the mark. Almost all who gave a fraction response gained the mark although $\frac{1}{3}$ and even $1 - \frac{1}{3}$ were seen occasionally.

(b) A far better response was seen than for **part (a)** with few not knowing the method of solution. The main error was to assume this part was following on from the probability answer in **part (a)** producing the response 132. A few candidates multiplied by 3 instead of dividing which produced the impossible answer of 594 when there were only 198 days altogether.

Answers: **(a)** $\frac{2}{3}$ **(b)** 66

Question 10

The ordering question was quite well answered but many candidates only gained 1 mark. It is essential to find decimal equivalents of the square root and fraction to enough decimal places (in this case a minimum of 4) to decide on the order. Many candidates did not show this working or enough places in the working. Those who did show full working almost without exception gained the 2 marks. Largest to smallest was rarely seen but the most common errors were 0.239 and $\frac{11}{46}$ or $\sqrt{0.057}$ and 23.85% in the wrong order. Some candidates put the decimal forms in the answer, which could score, but not in the cases where it could not be seen which items they referred to.

Answer: 23.85% < $\sqrt{0.057}$ < 0.239 < $\frac{11}{46}$

Question 11

This question was well understood by the vast majority of candidates but a few tried to combine the parts of the answer by adding the 7 and 8. A numerical answer of 15 was also seen and a few had the two parts added.

Answer: x^8y^7

Question 12

(a) A number of candidates gave responses of 17 or 0. However, nearly all gained the mark.

(b) Explanations generally cause problems for candidates and this was no exception. Although some had the main expected reason, most were incomplete in their responses. Many stated that it was a decimal answer to many places, which of course did not consider the recurring decimal situation. There were a considerable number of nil responses.

Answers: **(a)** 1 **(b)** e.g. it cannot be written as a fraction or a non-terminating and non-recurring decimal

Question 13

Most candidates understood the proportion method. The main error was to add the difference of 21.7 and 12.4 to 5.2 to give the answer 14.5. A significant number attempted to apply Pythagoras' theorem but candidates should have realised that with no right angle indicated, even if one angle looked close to 90°, this was not going to be appropriate.

Answer: 9.1

Question 14

(a) Apart from a few cases of completely incorrect components or an attempt at a 2 by 2 matrix, the vast majority gave components which included 1 and 5. However, there were many incorrect answers with various combinations of any two of 1, −1, 5 and −5. Probably the most common error was to give the vector from *G* to *F*, $\begin{pmatrix} 1 \\ -5 \end{pmatrix}$. This is a clear case of the need to read the question carefully.

(b) Many candidates did not attempt this part even though it is a standard question on vectors. Of the attempts, while many were correct, there were numerous cases of incorrect counting of squares with *H* marked at (−3, −2) or (−2, −3) most commonly.

Answers: **(a)** $\begin{pmatrix} -1 \\ 5 \end{pmatrix}$ **(b)** *H* marked at (−3, −3)

Question 15

Most candidates recognised that trigonometry using the cosine ratio was needed to find this angle but there were a significant number who attempted Pythagoras' theorem, and not just for a long method to find side *BC* first. The main error was to round off the value of the cosine (commonly 0.25) prior to using inverse cos to find the angle. This produced an inaccurate angle. Some gained the method mark but then just gave the answer 75° without any more accurate value in the working. The rubric states that angles should be given to 1 decimal place.

Answer: 75.1

Question 16

This was poorly answered by many candidates and not attempted by a significant number. The meanings of *m* and *c* were not understood by a lot of candidates. Of those who did understand what was required, many wanted to use the two ends of the line for their points. Unfortunately the top point of the line could not be read accurately and a point such as (1, 2), chosen by quite a few candidates, usually produced a correct answer. There were many cases of points chosen which were not actually on the line showing some weakness in reading co-ordinates of points.

Answer: $3x - 1$

Question 17

(a) Nearly all candidates gained this mark but some were determined to do a calculation and so subtracted 47 from 180.

(b) This was well answered but a significant number of candidates correctly worked out $360 - (85 + 115 + 97)$ but then gave 63 as the answer.

Answers: **(a)** 47 **(b)** 117

Question 18

The fraction addition was quite well answered with most candidates showing the required working. The essential first step was to attempt to correctly transform to a common denominator, with appropriate multiplications of the numerator values. Most did this successfully and apart from a few making errors in the arithmetic, the vast majority reached a single improper fraction. The last mark was missed quite often by not going any further, not getting the lowest terms or, quite often, putting the answer in decimal form.

Answer. $2\frac{7}{30}$ with complete working

Question 19

Although the question was answered well, there were a significant number of candidates who gave more than one response in a part. Although there are questions where there is more than one response possible, candidates should observe the instruction 'one' to avoid the possibility of one correct and one incorrect which would score zero.

(a) Almost all responses were correct in this part.

(b) 16 was often seen and either alone or with the correct response. 27 was also seen a number of times.

(c) There was some confusion with square numbers so 16 was quite common. Otherwise 27 was a common incorrect response.

Answers: **(a)** 35 **(b)** 64 **(c)** 19

Question 20

(a) The vast majority of candidates answered this part correctly.

(b) While there were a considerable number of correct responses, a lack of understanding of the algebraic expression required was also seen. Many candidates attempted to work from $a + (n - 1)d$ but either they had an incorrect formula ('+' often missed) or did not know which values to substitute. Many candidates realised that part of the expression was $6n$ but could not work out the rest while a large number gave $n + 6$. Just a constant term was seen in quite a number of responses.

Answers: **(a)** 65 **(b)** $6n + 29$

Question 21

(a) The number of completely correct responses was not very high but all those who understood how to factorise almost always scored 1 mark for one of the 6 possible part factorising responses. Only a few did not seem to understand the question.

(b) The vast majority gained the 2 marks in this part and only a few spoiled an otherwise correct response by attempting to combine it to one term.

Answers: **(a)** $6x(3x - 4)$ **(b)** $3x^2 - 4x$

Question 22

(a) Product of primes was not fully understood by many candidates. Submitting the three prime factors as the final answer was quite common, even from some who had fully correct working. The repeated division method included division by non-primes (9 was common) by quite a number of candidates. A significant number of solutions were spoiled by incorrect division, usually $2016 \div 2 = 108$. Also commonly seen was just one division by 2, 3 or 7. There were quite a large number of nil responses to this part.

(b) This mark was gained by many candidates although the '0' was often missed out. Some candidates gave 20.16×10^2 or 201.6×10^1 but a major error was rounding the mantissa to 2.0 or 2.01

Answers: **(a)** $2^5 \times 3^2 \times 7$ **(b)** 2.016×10^3

Question 23

(a) Most understood that the range was a single value but a few did give $9 - 2$ or just 9.

(b) Nearly all candidates knew what the mode was and gave the correct answer, although a few wrote 6. There were a few candidates who were confused between these averages and attempted the median in this part.

(c) While this part was generally well answered, a significant number of candidates simply gave the answer 8 as that was the middle number in the given list. Some who showed an order missed out a value; it would be good advice for candidates to check that the number of items they have put in order is the same as the number in the original list. Otherwise, the main error was to find the mean instead of the median.

Answers: **(a)** 7 **(b)** 2 **(c)** 5

Question 24

(a) Many candidates seemed to find this question challenging with a significant number not using the 123° angle. Various incorrect calculations using 41, 123 and 360 were seen.

(b) 75° was often written on the diagram and often given as the answer to the question. Many used the protractor incorrectly and found an answer of 35 from the angle 105°.

Answers: **(a)** 120 **(b)** 25

MATHEMATICS

Paper 0580/22
Paper 22 (Extended)

Key messages

To succeed in this paper candidates need to have completed full syllabus coverage, remember necessary formulae, show all necessary working clearly and use a suitable level of accuracy.

General comments

The level of the paper was such that all candidates were able to demonstrate their knowledge and ability. There was no evidence that candidates were short of time. Candidates were very good at showing their working and there were few occasions where candidates wrote just the answers. Presentation of work was usually very clear. Candidates generally had good knowledge of formulae required, with the main exceptions being to estimate the mean from a grouped frequency table and the cosine rule with the cosine of the angle being the subject.

Comments on specific questions

Question 1

Most candidates had the correct answer. A few did not write the correct signs, the most common incorrect answer being –7 and 4. Some candidates complicated things by multiplying the brackets out and then attempting to solve usually by using the formula and occasionally by factorising again. These candidates usually made errors.

Answer: 7, –4

Question 2

This question was very well answered. Only a small minority partially factorised and an equally small number were incorrect. The most common incorrect answer was $2x(- 2y)$.

Answer: $2x(1 - 2y)$

Question 3

The vast majority of candidates chose the correct trigonometric ratio to reach the correct answer. There was some premature rounding of the ratio to e.g. 0.25 and 0.26 which led to inaccurate answers. Candidates are advised to learn efficient calculator use so that they don't have to re-type the rounded ratio. A number of candidates used the more inefficient method of finding length *BC* from Pythagoras' theorem and then found the angle using a different function or found the other angle in the triangle then subtracted it from 90°. They usually still obtained the method mark if sufficient clear working was shown. However it was more common for these candidates to lose the accuracy mark often due to the premature rounding of the length *BC* to 3.38; the answer 74.95 commonly arose from this. A small number of candidates used the incorrect ratio, usually sine.

Answer: 75.1

Question 4

Those candidates who kept the n on the right hand side, by subtracting $6n$ as their first move, usually got the correct answer, writing $1.5 > n$. Those who rearranged by subtracting $8n$ to have n on the left hand side often obtained $-2n > 3$, forgetting the minus sign in front of the 3. If they did write $-2n > -3$, it was very common to see $n > 1.5$ as their answer, because they forgot that division by a negative number means the inequality sign needs to reverse.

Answer: $n < 1.5$

Question 5

The majority of candidates answered this correctly. Only a very small number did not use the correct method and instead used e.g. a method involving adding lengths. In a few cases, premature rounding led to an answer that was inaccurate.

Answer: 9.1

Question 6

There were many correct answers and candidates were using efficient methods to find the fraction. Some showed no working, possibly because they were familiar with the decimal. The most common misconception was to treat the decimal as terminating, using either 0.4, 0.44 or more commonly 0.444. This led to answers such as $\frac{444}{1000}$ cancelled down to $\frac{111}{250}$. Candidates were also seen attempting a correct method but not appreciating that the number of 4s recurred and that the subtraction should eliminate all recurring parts, instead using terminating decimals e.g. $x = 0.4$, $10x = 4$, $9x = 3.6$ then $x = \frac{3.6}{9}$.

Answer: $\frac{4}{9}$

Question 7

This question was well answered. The errors usually involved omitting the sin 25, so evaluating ½×22.3×27.6 or omitting the ½ so 22.3×27.6×sin 25. Occasionally sin 25 was replaced with cos 25.

Answer: 130

Question 8

This was a well answered question with the correct answer usually seen in one form or another. Most candidates scored 1 or 2 marks on this question. A few did not find the correct adjoint matrix and the most common error in finding the determinant was to make an error in working out $ad - bc$ which was usually a sign error the equivalent to $ad + bc$ and so $\frac{1}{37}\begin{pmatrix} 7 & 2 \\ 8 & 3 \end{pmatrix}$ was a common incorrect answer.

Answer: $\frac{1}{5}\begin{pmatrix} 7 & 2 \\ 8 & 3 \end{pmatrix}$

Question 9

The majority of candidates demonstrated a good understanding of adding fractions and many were most efficient in their choice of 60 as the lowest common multiple for the denominator. Although most did reach the correct answer, there were many using larger numbers than necessary e.g. $\frac{380}{240} + \frac{156}{240}$. Some candidates did not obtain the final mark because they missed the instruction in the question to give their answer as a mixed number in its simplest form and they left their answer as the improper fraction $\frac{134}{60}$ or $\frac{67}{30}$ or did not cancel down and gave $2\frac{14}{60}$.

Answer: $2\frac{7}{30}$

Question 10

This question was a good discriminator. Many correct answers were seen but there were also many incorrect answers or answers scoring 1 mark. The common errors were in converting cm^2 to m^2 where many used 100 and not 100^2. A significant number of candidates also used 20 000 as the scale factor rather than $20\,000^2$; consequently most incorrect answers involved the figures 32.

Answer: 64 000

Question 11

Most candidates knew the correct arc length formula and hence 3 marks were scored in many cases. It was also quite common to see 2 marks awarded for a correct answer that had not been rounded to 4 significant figures, as requested in the question. A small number used an incorrect formula, or the formula for the area or perimeter of the sector. Some of these correctly rounded their more accurate answer to 4 significant figures to score the 1 mark.

Answer: 16.58

Question 12

There were many completely correct responses to this question. Of those candidates not scoring 3 marks, many understood that bounds should be used in the calculation and often gained a mark for showing one of the correct bounds. 500.5 was seen correctly used more often than 5.75; quite often the upper bound of 5.85 was used. The bound to 500 was often confused, with 505 and 550 seen. A number of candidates decided to convert both values to mm which led to problems such as 5000.5 being used. Some thought that the units were different and so converted the 500 into mm. Candidates could gain a mark for understanding that their answer should be truncated to a whole number and those who used both correct bounds usually gained the final mark for this. This mark was often obtained by those using incorrect bounds if they showed their working i.e. their more accurate value first. However many left their answer as a decimal or rounded up.

Answer: 87

Question 13

In **part (a)** many used a method involving repeated division of primes. It was common to start with 2, but a significant proportion worked out 2016 ÷ 2 and wrote 108 instead of 1008. Those who did write 1008 usually went on to reach the correct answer. Occasionally numbers that were not prime were included in the answer e.g. $2^5 \times 9 \times 7$. There were a few candidates who did not attempt this question or had an attempt with no clear understanding of what to do. **Part (b)** was usually correct; the most common errors were 2.016×10^{-3}, 0.2016×10^4, 20.16×10^2 and 201.6×10^1.

Answers: **(a)** $2^5 \times 3^2 \times 7$ **(b)** 2.016×10^3

Question 14

Part (a) was usually correct. A small number multiplied the indices to give $x^{15}y^{12}$ and others demonstrated a misunderstanding that the question was about factorising and attempted to extract a common factor to give $x^3y^3(y \times x^2)$. **Part (b)** was also well answered but answers of $9p^6m^{15}$ and $3p^6m^{15}$ were both seen quite often as candidates were unable to deal with the number correctly. The unfinished answer $3^3p^6m^{15}$ was also commonly seen.

Answers: **(a)** x^8y^7 **(b)** $27p^6m^{15}$

Question 15

The most successful candidates were those who knew the cosine rule with the angle as the subject of the formula. Many gained 1 mark for correctly stating the implicit version of the formula with a side as the subject but then made errors rearranging it. The most common of these was from $28.09 = 20.8 - 20.16 \cos p$ to $28.09 = 0.64 \cos p$. A number of candidates went on to subtract their correct answer from 180°.

Answer: 111.2

Question 16

A significant number of candidates struggled with this question. A large proportion of candidates used the class widths instead of the midpoints and 14.4 was the most common incorrect answer. Some candidates wrote down the midpoints and then added them up and divided that sum by 70, whilst others used one of the boundary points in place of the midpoints. Of those who used the correct method, a few made arithmetic errors or, following the correct answer in their working, lost the final mark because they wrote $40 < h \leq 50$ on the answer line.

Answer: 44.1

Question 17

Most candidates were able to use the quadratic formula correctly to obtain the correct roots for the equation. The accuracy requirement in the question, which asked for answers to be given to 2 decimal places, was often missed or ignored with answers regularly given to 3 significant figures or occasionally to 1 decimal place instead. Incorrectly rounded answers were seen quite often, usually 3.25 and sometimes 0.40. Working was usually shown clearly, however it was fairly common for the discriminant to be written as $\sqrt{-11^2 - 4 \times 3 \times 4}$ with the brackets missing around $(-11)^2$; in many cases, this was recovered in subsequent working.

Answer: 0.41 and 3.26

Question 18

It was rare to see an incorrect answer to **part (a).** There was a small minority who took 47 from 180 or 90 to give 133 or 43 as their answers. **Part (b)** was also very well attempted. The most common misconception was to think that the quadrilateral was a cyclic quadrilateral; consequently a common incorrect answer was 115°. **Part (c)** was the most challenging part of the question and 116 was a common incorrect answer. Candidates stated that angles at the centre were double the angle at the circumference but did not appreciate that they were not working out the correct angle. Although the diagram is not to scale candidates are advised to check the common sense of their answer; a clearly reflex angle would not be less than 180°. 122° was another common incorrect answer arising from 180 – 58.

Answers: **(a)** 47 **(b)** 117 **(c)** 244

Question 19

This question was challenging for many candidates. The most common errors were to use the incorrect inequality signs or equals signs. It was common for candidates to use strict inequalities in place of not strict ones or inequality signs reversed. Errors were more common with $y < 2$ and $x \geq -2$ than with the other two inequalities; often these were $x < 2$ and $y \geq -2$. Some candidates were unable to obtain the two equations of the sloping lines, $x + y = 3$ and $y = \frac{1}{2}x + 1$. Those who got these equations correct sometimes put the inequality signs the wrong way round.

Answer: $y < 2$, $x \geq -2$, $y \geq \frac{1}{2}x + 1$ and $y \leq -x + 3$

Question 20

In **part (a)** most candidates gave a correct answer although this was sometimes given as $3^2a + 3b$ or $a3^2 + b3$ rather than $9a + 3b$. Occasionally the answer $9a^2 + 3b$ was given and $an^2 + bn + c$ was another common incorrect answer. In **part (b)** many reached the two correct answers with the most successful candidates using the method of elimination. A few candidates used a substitution method which, in this case, was the more difficult method to choose and this was where most errors were made. A very small number of candidates presented non-algebraic working that was not at all clear; consequently when these methods went wrong it was not easy to award method marks.

Answers: **(a)** $9a + 3b$ **(b)** $a = 3$, $b = -2$

Question 21

Candidates demonstrated a good understanding of probability in this question. There were very few incorrect responses in **part (a)** and these included $\frac{1}{3}$ and $\frac{1}{2}$. **Part (b)** was also usually correct with the most common error being $\frac{6}{8}$ instead of $\frac{5}{8}$. In **part (c)(i)**, the most common incorrect method seen was adding the fractions to give an answer of $\frac{11}{24}$. An answer of $\frac{1}{8}$ on its own was also given by a number of candidates and some gave the probability of being late, $\frac{7}{24}$. **Part (c)(ii)** was also very well attempted. Those who did not give a correct response were often just using the probabilities in the right hand branches of the tree diagram and gave an answer of $\frac{7}{8} \times \frac{5}{8} = \frac{35}{64}$ or $\frac{7}{8} + \frac{5}{8} = \frac{3}{2}$ without an appreciation that the latter must be incorrect because it gave a probability greater than 1.

Answers: **(a)** $\frac{2}{3}$ **(b)** $\frac{2}{3}, \frac{7}{8}, \frac{5}{8}$ **(c)(i)** $\frac{1}{24}$ **(c)(ii)** $\frac{17}{24}$

MATHEMATICS

Paper 0580/32

Paper 32 (Core)

Key messages

To succeed in this paper candidates need to have completed full syllabus coverage, remember necessary formulae, show all working clearly and use a suitable level of accuracy. Particular attention to mathematical terms and definitions would help a candidate to answer questions from the required perspective.

General comments

This paper gave all candidates an opportunity to demonstrate their knowledge and application of mathematics. Most candidates completed the paper, making an attempt at most questions. Although a number of questions have a common theme, candidates should realise that a number of different mathematical concepts and topics may be tested within the question. The standard of presentation and amount of working shown was generally good. Centres should continue to encourage candidates to show formulae used, substitutions made and calculations performed. Attention should be made to the degree of accuracy required and candidates should be encouraged to avoid premature rounding in workings. Candidates should also be encouraged to read questions again to ensure the answers they give are in the required format and answer the question set.

Comments on specific questions

Question 1

All candidates were able to attempt all or part of this question as it offered a range of questions on various areas of mathematics and numeracy involving multiplication, fractions, time and bounds.

(a) This part was generally answered well although not all candidates appreciated the required multiplication was $52 \times 7 \times 3$. Common errors were 364, 156 and 1095.

(b) (i) A significant number of candidates did not appreciate that a conversion of time units was required to combine the 30 minutes and 1½ hours to find the total time exercised. This then led to some unusual fractions being given, including some greater than one. Those candidates who obtained the time of 2 hours were generally successful in reaching the correct fractional answer.

(ii) The majority of candidates recognised the follow through method to be used although this again led to a number of unacceptable fractions.

(c) This part was generally answered well although a small number of candidates have difficulties with the concept of upper and lower bounds. Common errors included 428 and 430, 420 and 430, 400 and 430.

Answers: **(a)** 1092 **(b)(i)** $\frac{1}{12}$ **(ii)** $\frac{11}{12}$ **(c)** $428.5 \leqslant w < 429.5$

Question 2

This question on transformations was generally answered well. Candidates find describing a single transformation challenging with a significant number omitting part of the description or giving a double transformation as their answer.

(a) (i) The majority of candidates were able to correctly identify this transformation as a rotation although reflection was a common error. The angle of rotation was generally correctly stated although common errors of 90˚ clockwise and anticlockwise were seen. The centre of rotation proved more challenging and was often not given.

(ii) The majority of candidates were able to correctly identify this transformation as a reflection although rotation was a common error. The line of reflection proved slightly more difficult and was often not given, with other common errors of y-axis, $x = 0$ and $x = -1$.

(iii) The majority of candidates were able to correctly identify this transformation as an enlargement.

The scale factor was generally correctly stated although common errors of 3, $\frac{1}{2}$ and –2 were seen.

The centre of enlargement proved more challenging and was often not given.

(b) This part, which required the drawing of a translation, proved to be less successfully answered and was often left blank. Those candidates who attempted the drawing either scored full marks or, more commonly, one mark for a correct translation in one direction.

Answers: **(a)(i)** Rotation, 180˚, centre (6, 7) **(ii)** Reflection, in $x = 1$ **(iii)** Enlargement, scale factor 2 , centre (6, 11)

Question 3

This question on statistics proved a good discriminator and the full range of marks was seen.

(a) This part was generally answered well although a significant number of candidates attempted invalid and unnecessary calculations and did not appreciate that students E and F simply needed to be recognised, which then led directly to the required answer of $\frac{2}{10}$.

(b) (i) This part was generally answered well with the majority of candidates able to correctly and accurately plot the 4 points.

(ii) The majority of candidates were able to correctly identify the type of correlation shown.

(iii) The majority of candidates were able to correctly draw the line of best fit although a small number were seen that were not a single straight ruled line.

(iv) With a follow through from their line of best fit, if in an acceptable form, being applied the majority of candidates were able to give the correct value.

(v) This part relied on the interpretation of the scatter diagram and the associated line of best fit and proved challenging for many candidates with the relevance of the valid length not appreciated. Common errors included both answers will be the same; 10 is too low; would not have done Test 2; nobody scored 10 marks; and line of best fit is not accurate.

Answers: **(a)** $\frac{2}{10}$ **(b)(ii)** positive **(iv)** 46 to 48 **(v)** not in range of the recorded test one scores

Question 4

All candidates were able to attempt all or part of this question as it offered a wide range of questions on various areas of mathematics and numeracy involving ratio, compound interest, division, percentages and calculation of the mean, all within a themed context.

(a) (i) This part was generally answered well.

(ii) This part was again generally answered well although a significant number of candidates did not appreciate that the ratio of 5 : 3 could be changed to 45 : 27 which could then be used to work out the extra number bought. Common errors included 27, 60 and 40.

(b) (i) This part on the use of compound interest was generally answered well. Candidates who answered with the use of a single valid calculation and those who used the three step method seemed to be equally successful. Common errors included the use of simple interest, stating the interest only, and the interpretation and use of the given rate of 4%.

(ii) With follow through marks available throughout this part for full marks, candidates generally scored well with the majority recognising the required mathematical operations to be used.

(c) Although many good answers were seen, a significant number of candidates did not appear to read the question carefully and did not subsequently appreciate that the only calculation required was 96×0.18. Common errors included 113.28, 18.75 and 114.75.

(d) This part on statistics that involved the calculation and use of the mean was generally not answered well, with a significant number of candidates finding it difficult to understand and interpret the information given.

(i) A number of candidates did not appreciate that this grouped frequency table meant that the required calculation was $(1 \times 0 + 4 \times 1 + 12 \times 2 + 3 \times 3) \div (1 + 4 + 12 + 3)$. Common errors included $\frac{38}{20}$, $\frac{20}{4}$, $\frac{20}{3}$, $\frac{20}{6}$, $\frac{37}{4}$ and $\frac{37}{6}$.

(ii) Many candidates found this part demanding and did not appreciate the mathematical implications of the information given. The reasoning was as follows; the 3 sheep who had 3 lambs went down to having 2 lambs, 3 of the 4 sheep that had 1 lamb went up to having 2 lambs, so the total number of sheep with 2 lambs was the original 12 plus these 6.

(iii) Given the previous problems, many candidates found this part difficult to explain.

Answers: **(a)(i)** 9 : 4 **(ii)** 7 **(b)(i)** 4218.24 **(ii)** 33, 60.24 **(c)** 17.28 **(d)(i)** 1.85 **(ii)** 1, 1, 18
(iii) same total number of sheep and same total number of lambs

Question 5

This question on Pythagoras' theorem, drawing a net of a cuboid, calculating the surface area and volume proved challenging for a significant number of candidates and was a good discriminator with the full range of marks seen. Less able candidates often omitted parts of this question.

(a) Very few candidates were able to give an adequate definition for the word, prism. The fact that a prism has a constant cross section, constant cross-sectional area, or equivalent statement was required and the common answer of "it is a 3-D shape" was insufficient for the mark to be awarded.

(b) There were a number of excellent and clear answers seen which gained full marks. As this was a "show that" question 5^2, 4^2, subtraction, square root and the accurate value of 3 all needed to be seen in the working to gain full marks. Whilst many candidates recognised the use of Pythagoras' theorem not all of these requirements were seen. Other common errors included $5^2 + 4^2$, the use of the given value of 3 in a circular argument, or invalid reasons such as $7 - 4 = 3$.

(c) This part on the calculation of the volume of the given prism was generally answered well although a full variety of incorrect formulae were used, and a small number of candidates did not appreciate that *AB* was of length 3 cm from the previous part. Common errors included $3 \times 4 \times 7$; $\frac{1}{2} \times 4 \times 5 \times 7$; $4 \times 5 \times 7$ and $3 \times 4 \times 5 \times 7$. A small yet significant number omitted the units resulting in the loss of one of the available marks.

(d) A small but significant number of candidates were unable to answer this part suggesting that they were unfamiliar with the terms used in the question. A common error was to draw the net for a cuboid rather than for the given prism. The triangular faces gave more problems than the rectangular face, and were often drawn inaccurately.

(e) The term "surface area" was not universally understood and common errors included finding the perimeter, total length of the edges, the volume, and the area of just the triangular cross-section. Few candidates appeared to appreciate that their net drawn in part **(d)** could have been used.

Answers: **(a)** Constant cross-sectional area **(c)** 42 cm³ **(e)** 96

Question 6

This question tested the candidates' ability to interpret and use travel graphs, and also to calculate a number of related numerical values.

(a) This part was generally answered well with the majority of candidates able to correctly identify the shop.

(b) Many candidates found it difficult to explain the given statement by reference to the diagram. Common errors included reference to shorter time and/or longer distance, acceleration and the time of two minutes.

(c) (i) This part was generally answered well with a variety of valid methods seen.

(ii) This part caused problems for a significant number of candidates who perhaps did not appreciate that the previous part enabled them to complete the vertical scale with numerical values.

(d) The majority of candidates used a correct formula to find the speed but many found it difficult to obtain the correct distance from the graph, and/or to use the correct converted time. The few candidates who used a comparison method of 3 km in 15 minutes, equivalent to 12 km in 1 hour, were largely successful.

(e) This part was generally answered well although the common errors of finishing at 11 00 and 11 02 were seen.

(f) This part proved demanding for many candidates although again there was evidence of the use of a correct formula. Common errors included the use of 8 km rather than 16, the use of 24 minutes rather than 58, incorrect or no conversion to hours, and finding the speeds of the separate parts of the journey and then attempting to combine these answers into an average figure.

(g) (i) This part on finding the circumference of a circle was generally answered well although the common errors of using the area formula, using the radius of 29 rather than the diameter of 58, and using a value of 14.5 were seen. A small number of candidates lost a mark by not giving their answer correct to 1 decimal place as requested in the question. A small number lost an accuracy mark by using the value of pi as 3.14 or $\frac{22}{7}$ contrary to the rubric at the start of the paper.

(ii) This part proved difficult and demanding for many candidates who possibly needed to read the question carefully and put it into the context of the journey completed by Abjit and his bicycle. Common errors included $500 \times 1.822 = 911$, $500 \div 29 = 17.2$ and $500 \times 58 = 29000$. The correct use of $500 \div 1.822$ but with incorrect conversion(s) was also common.

Answers: **(a)** Shop **(b)** graph steepest **(d)** 12 **(f)** 16.6 **(g)(i)** 182.2 **(ii)** 274

Question 7

This question on numeracy, bearings and algebra within a common theme proved challenging for a significant number of candidates and was a good discriminator with the full range of marks seen. Less able candidates often omitted parts of this question.

(a) (i) This part required the recognition that the division operation was needed to calculate the number of buses required. A very common error was that 33 rather than 34 buses were needed. A common sense approach would have shown that an answer such as 90 064 buses was not a practical answer.

(ii) This part required the recognition that a division and a multiplication operation were needed to calculate the cost to each supporter. A very common error was that the cost was \$3.88 rather than \$3.90 (correct to the nearest 10 cents). A common sense approach would have shown that an answer such as \$279.40 was not a practical answer.

(b) (i) This part was generally answered well although a small number of candidates found it difficult to convert the answer to kilometres. A common sense approach would have shown that an answer such as 3 900 000 km apart was not a practical answer.

(ii) Although the drawing of the two given bearings was generally good, many candidates did not appreciate that the position of the football ground was to be found at the intersection of these two bearings.

(c) (i) This part was generally answered well although common errors of 7 or 7*wd* or 24*wd* were seen.

(ii) This part was generally answered well although common errors of 7 or 7*wd* or 29*wd* were again seen.

(iii) Some very good solutions to the simultaneous equations were seen although some less able candidates didn't attempt this part. The majority of candidates used the elimination method to solve their equations. The setting out was generally very clear with very few errors or slips being made and only the rare candidate choosing the wrong operation for the elimination. On the rare occasion when candidates did choose to use the substitution method, most were able to rearrange one of the equations and correctly substitute into the other. However this method did cause more candidates to lose accuracy marks with numerical and algebraic errors leading to incorrect final values for *w* and *d*.

(iv) This part was generally answered well, with a full follow through allowed.

Answers: **(a)(i)** 34 **(ii)** 3.90 **(b)(i)** 3.9 **(c)(i)** 24 **(ii)** $3w + 4d = 29$ **(iii)** $w = 7$ $d = 2$ **(iv)** 38

Question 8

This question on constructions and loci proved challenging for a number of candidates although it proved a good discriminator with the full range of marks being seen. This question had a high nil response rate which may have been due to candidates not being familiar with the terminology used.

(**a)** This was the best attempted part of the question with a good number of correct and accurate constructions seen. A small number of candidates did not appreciate that the only construction required was the perpendicular bisector of *XY*.

(b) (i) A number of candidates did not appreciate that the required locus was equivalent to drawing the bisector of angle *BAC*. A number of the attempted constructions of the required locus contained accuracy errors, insufficient construction arcs, incorrect use of points *B* and *C*, and bisecting the lines *AB* and/or *AC*.

(ii) This part, which was dependent on a line having been drawn from *A* to *BC*, was generally then answered well.

(c) This part of the question caused the most problems for candidates with many not realising that they needed to draw two parallel lines and two semicircles in order to construct the required locus. Common errors included inaccurate constructions often without arcs, two circles centred at *M* and *N*, and constructing the bisector of *MN.*

Question 9

This question gave candidates the opportunity to demonstrate their ability to calculate missing values and to draw a quadratic curve.

(a) The table was generally completed very well with the majority of candidates giving six correct values.

(b) The graph was generally plotted very well. The majority of candidates were able to draw a correct smooth curve with very few making the error of joining points with straight lines although a number of "flat-bottomed" curves were seen.

(c) This part on identifying the lowest point of the graph was generally well answered although a significant number appeared to use the table, even after a correct curve, and gave answers of (1, –3) and/or (2, –3).

(d) (i) The line of symmetry was generally drawn correctly.

(ii) The identification of the equation of this line proved more difficult for a number of candidates with $x^2 – 3x – 1 = 1.5$, $y = 1.5$ or 1.5 being common errors.

Answers: **(a)** 3, –3, –3, –1, 3, 9 **(c)** (1.5, *k*) where $–3.5 \leqslant k < –3$ **(d)(ii)** $x = 1.5$

MATHEMATICS

Paper 0580/42
Paper 42 (Extended)

Key messages

To achieve well in this paper, candidates need to be familiar with all aspects of the syllabus.

The recall of formulae, mathematical facts and techniques in varying situations is required as well as application to problem solving and unstructured questions.

Work should be clearly and concisely expressed with answers written to at least 3 significant figures unless directed otherwise.

General comments

This paper proved to be accessible to almost all of the candidates. Most were able to attempt almost all of the questions, and solutions were usually well-structured with clear methods shown in the working space provided on the question paper.

There were very many excellent scripts with a large number of candidates demonstrating an expertise with the content and showing excellent skills in application to problem solving questions.

Candidates appeared to have sufficient time to complete the paper and omissions were due to lack of familiarity with the topic or difficulty with the question rather than lack of time.

The standard of algebraic manipulation was high and graphs were attempted neatly in pencil. Directed numbers and terms did cause some difficulty for a number of candidates in questions 8 and 11 however.

Almost all candidates followed the rubric instructions with only a small number losing unnecessary accuracy marks by either approximating values in the middle of a calculation or by not giving answers correct to at least 3 significant figures.

The questions on the topics of ratio, construction and loci, speed-time graphs, statistics, transformations, proportion, algebraic manipulation and functions were very well answered by candidates.

Weaker areas were vectors, problem solving with trigonometry and volume and using graphs to solve related algebraic problems.

Comments on specific questions

Question 1

The question included the topics of ratio, simple calculation and fractions and was answered well by the majority of candidates.

(a) Most candidates showed two clear steps in answering this part. A minority did not show the division by 32 and on questions that provide a solution that candidates have to arrive at, it is essential that all calculation steps are shown.

(b) This was almost always answered correctly.

(c) This was very well answered. A few candidates incorrectly used bounds such as 160.5 in the calculation. Most realised the need to round the decimal answer down to 10 in this context but a few did round up to 11.

(d) This part was more challenging for many and those using the fractions alone were more likely to reach $\frac{7}{24}$ after first finding $\frac{17}{24}$ by adding. Those using fractions of 300 were less successful and often got as far as 87.5 then gave this as $\frac{175}{2}$ thinking this was the required fraction in its lowest terms.

Answers: **(b)** 300 and 180 **(c)** 10 **(d)** $\frac{7}{24}$

Question 2

This question on construction was answered very well by almost all the candidates.

(a) Almost all of the candidates recognised that the perpendicular bisector of *AB* was required. Most drew an accurate bisector with two correct sets of intersecting construction arcs. A few drew an accurate bisector but used only one set of intersecting construction arcs.

(b) This was slightly less well answered than **part (a)**, but the majority recognised that the bisector of angle *BAC* was required and most used the correct technique using two pairs of correct arcs for this construction. Some attempted an angle bisector of the wrong angle, usually angle *ABC*. Others attempted the perpendicular bisector of either *AC* or *BC* instead.

(c) Almost all candidates correctly drew a circle of radius 5 cm using the centre *E*, the intersection of their two loci in **parts (a)** and **(b)**. Even when there were errors in the previous parts, the circle was correctly drawn.

(d) This was the weakest answered of all of the parts. A few, having made errors in previous parts, did not have the correct regions available. The most common error was to identify one of the two correct regions. It was usually the smaller region that was omitted.

Question 3

This question on sets and speed-time graphs was very well answered.

(a) (i) This part was well answered. The most common mark was 2 marks for the values 3 and 6 correctly placed. The other value 8 was the one which was most likely to be wrong with common incorrect answers of 1, 2 and particularly 18 given instead.

(ii) This part was also well answered although it was common to see an answer of 45 for candidates that did not include the 1 in the universal set in their total.

(iii) This part was well answered generally. Some gave 2 as the answer presumably as they could see 2 numbers in the intersection region. Others gave 7, ignoring the 4 in the centre. A few gave 4, 7 as the answer, sometimes in set brackets.

(iv) Many candidates were successful in giving the correct probability. A common incorrect answer was $\frac{3}{19}$.

(b) (i) This part was answered very well. A few candidates incorrectly attempted to divide 200 by 9.

(ii) This part was also very well answered. Most found the correct area using the trapezium formula rather than in sections. A few made slight scale misreads in their calculation but were given partial credit. The only common misconception was to incorrectly find the area by calculating 1500×9.

(iii) This part was nearly always correctly answered and followed through from the previous answer.

Answers: **(a)(i)** 3, 8, 6 correctly placed **(ii)** 46 **(iii)** 11 **(iv)** $\frac{7}{19}$ **(b)(i)** 0.045 **(ii)** 10800 **(iii)** 7.2

Question 4

This question on statistics was answered very well generally.

(a) (i) Almost all gave the correct median with only a very few candidates misreading the scale and giving 62 instead.

(ii) Most were able to identify the correct inter-quartile range with just a few slipping up and misreading the scale for one of the quartiles. A small number identified 15 and 45 as the correct cumulative frequencies needed but then subtracted these to obtain 30 leading to a final answer of 64.

(iii) A majority of candidates were able to obtain the correct value of the percentile. Common errors included misreading the scale to obtain 61 and obtaining the correct cumulative frequency of 24 and giving that as the answer.

(iv) Almost all earned both marks for a correct answer with very few giving 54 as their answer. The misreading of the scale was rarely seen in this part.

(b) Most candidates correctly completed the frequency table. Most errors involved an incorrect frequency for the interval $60 < t \leqslant 70$. The award of no marks was extremely rare.

(c) A majority of candidates were able to complete the histogram, either from the correct frequencies or by following through from their values in the previous part. The most common error involved an incorrect height for the first block.

Answers: **(a)(i)** 64 **(ii)** 16 to 16.5 **(iii)** 62 **(iv)** 6 **(b)** 12, 23, 11, 2

Question 5

This question on percentages, currency and interest was generally answered well. The final part posed a challenge for a number of candidates.

(a) Many correct answers were seen to this reverse percentage question. The most common error involved methods for increasing 6000 by 4% although a few candidates calculated 96% of 6000.

(b) Almost all candidates were familiar with currency exchange and most were able to earn at least 2 marks. Some candidates ignored the instruction to give the answer correct to the nearest euro and lost the final mark.

(c) Candidates were less successful in this part of the question. Although many earned all 5 marks it was common to see errors in the working. The most common error involved the misunderstanding of the answer when using the compound interest formula. Many took this total from the first calculation to be the interest and equated this with the simple interest formula which usually led to an answer of 14.1. Some candidates evaluated $\left(1 + \frac{1.5}{100}\right)^8$ and prematurely rounded this to 1.126 which led to an incorrect value for the amount of interest. It was rare to see candidates calculating the compound interest year on year.

Answers: **(a)** 6250 **(b)** 4441 **(c)** 1.58

Question 6

This question on transformations was answered very well.

(a) (i) The vast majority recognised the rotation and accurately described the required elements to identify the particular rotation. A small number gave 90˚ clockwise and a few did not give the centre of rotation. There were a small number giving more than one transformation in **part (a)(i)** or **(ii)**, for which no marks are awarded.

(ii) This part was also answered well with almost all candidates identifying the transformation as an enlargement. A very small number incorrectly gave the scale factor as –2 and a few omitted to give the centre of the enlargement but the majority scored full marks.

(b) (i) This part was nearly always answered correctly. The few who made an error often earned credit for a translation of 5 units to the left or 3 units up.

(ii) Almost all candidates answered this correctly. The small number who had an incorrect answer to **part (b)(i)** almost always scored full marks by correctly reflecting their triangle in the line $y = 3$.

(c) Some candidates found this part more challenging and it was sometimes omitted although many scored full marks. There are two methods which can lead to a correct answer, both frequently used in this part. Many candidates were able to identify the transformation matrix as representing a rotation of 90° anti-clockwise and then used this to draw the image. A small number used an incorrect centre of rotation and a few used a rotation of 90˚ clockwise. Most of those using the matrix multiplication method carried out the multiplication correctly and so gave the correct image but there were some who wrote down the matrix multiplication in the wrong order.

Answers: **(a)(i)** Rotation, 90° anticlockwise, (4, 4) **(ii)** enlargement, scale factor 2, (5, 1)

Question 7

This question on functions and graphs varied in responses. The graph was usually drawn well but there were challenges then in solving the problems related to the graph.

(a) Many candidates gave the three correct values but some gave one, or both, of the values at $x = 1.5$ and $x = 3$ to two significant figures rather than the required three significant figures.

(b) The majority of candidates plotted the points accurately and took a great deal of care to produce a well drawn smooth curve. A small number plotted the point (3, 3.11) just above $y = 3$ rather than on, or just above $y = 3.1$ and a few ignored the negative signs on the y values when plotting the points at $x = –2$ and $x = –1.5$.

(c) Most candidates answered this correctly with the most common error being the omission of the negative sign.

(d) (i) There was a mixed response to this part. Some able candidates were able to use $y = x + \frac{1}{x^2}$ with $\frac{1}{x^2} = 2.5 - 2x$ to reach $y = -x + 2.5$ and then give the correct values for a and b.

A large number only used $\frac{1}{x^2} = 2.5 - 2x$ and so gave $a = –2$ and $b = 2.5$.

(ii) Those with the correct answers in **part(d)(i)** usually drew the correct line and gave the correct value for x although a small number omitted the negative sign. Some of those with either one or both of the incorrect values of a and b in **part (d)(i)** were able to draw the correct line for their values and earned 2 marks. This part was sometimes omitted.

(e) Candidates found drawing an accurate tangent at $x = 2$ quite challenging. It was quite common to see either a chord or a line that did not quite touch the curve at $x = 2$. Most candidates who did draw an accurate tangent or made a close attempt at drawing a tangent were able to give an accurate answer for their gradient.

Answers: **(a)** 3.5, 1.94, 3.11 **(c)** –0.7 to –0.6 **(d)(i)** –1, 2.5 **(ii)** –0.6 to −0.5 **(e)** 0.5 to 0.85

Question 8

This question tested a number of areas of algebraic manipulation and proportion.

(a) Most candidates answered this part without any difficulty. A few misread the question and made y proportional to the square of $(x + 2)$ instead of the square root. A few used the inverse relationship as well.

(b) A large majority of candidates answered this correctly, factorising both expressions and cancelling the common factor $(x + 6)$. A few made sign/term errors when factorising. Some of the less able candidates attempted to cancel without factorising.

(c) Many candidates started well in this part but were unable to complete correctly. Nearly all began by squaring both sides and then multiplying both sides by a. The next step caused many to go wrong; adding a to both sides frequently gave the result $2aW^2 = X$ instead of $aW^2 + a = X$. Those that avoided this error usually factorised the left hand side and completed the rearrangement correctly.

(d) This was another part where a correct start was often followed by errors. Nearly all candidates used a correct common denominator of $(x + 1)(x - 1)$. Many also wrote the correct numerator $(x - 2)(x - 1) - (x + 1)(x + 3)$. The expansion of the two pairs of brackets was usually correct but a significant number of candidates didn't take into account the negative sign in front of the second pair. This led to many final answers with $x + 5$ as numerator.

Answers: **(a)** 15 **(b)** $\frac{x+6}{x-2}$ **(c)** $\frac{X}{W^2+1}$ **(d)** $\frac{-7x-1}{x^2-1}$

Question 9

With the exception of a few able candidates, the vector question was poorly answered. Candidates generally had very little understanding that the magnitude and the direction are both vital in defining a vector. Thus, for instance, some candidates assumed that the vector along each side of the hexagon was **y** because the sides are of equal length, without taking into account the change of direction of each side. Another misconception among candidates is that, for example, $\overrightarrow{AB}$ is equal to $\overrightarrow{BX} + \overrightarrow{XA}$, while it is, of course, equal to $\overrightarrow{AX} + \overrightarrow{XB}$.

(a) (i) This part was often answered correctly.

(ii) **x** or **y** were often given as the answer here.

(iii) This answer was frequently incorrect although candidates could gain some credit for identifying $\overrightarrow{OS}$ as the position vector of S or for writing a route e.g. $\overrightarrow{OT} + \overrightarrow{TS}$.

(b) In this part, many candidates mistakenly thought that $\overrightarrow{RG}$ was $\frac{1}{3}\mathbf{x}$ instead of $\frac{1}{2}\mathbf{x}$. Here again, credit could be gained for stating a route for $\overrightarrow{GQ}$ e.g. $\overrightarrow{GR} + \overrightarrow{RQ}$.

(c) (i) Many candidates made errors here because of their earlier misunderstanding of the length of *RG.* A sensible start was to trace the route through the vertices of the hexagon, either through the points *O, T, S* and *R*, or through *P* and *Q,* and using the answer to the previous part.

(ii) This part was left unanswered by many candidates. Some tried to concentrate on the vector $\overrightarrow{TQ}$ but it was $\overrightarrow{MH}$ or $\overrightarrow{HG}$ which they needed to find. A minority were able to do so and a few gave the correct expected statement that $\overrightarrow{MG} = 2\overrightarrow{MH}$.

Answers: **(a)(i) y (ii) x + y (iii) x** + 2**y (b)** – (½**x** + **y**) **(c)(i)** 2**x** + 2**y**

Question 10

This question on mensuration and trigonometry in a problem solving situation had a full range of responses.

(a) Many fully correct answers were seen here from commonly using Pythagoras' theorem. A trigonometric approach and area approach were also seen. Occasionally accuracy was lost when $\sqrt{27}$ was given as 5.19. Common errors included correctly identifying the equilateral triangle of side 6 but incorrectly concluding that therefore the height was also 6 or using incorrect dimensions for the triangle such as 6 and base 4 or hypotenuse 8 and base 3. Occasionally the correct values 6 and 3 were used in an incorrect application of Pythagoras' theorem such as $6^2 + 3^2$.

(b) (i) Many candidates scored here by adding 2 to their answer from **part (a)**. A significant number of candidates incorrectly added 1 only or restated their height from **part (a)** and others did not notice the intended connection to **part (a)** at all.

(ii) This part proved to be a challenge for most candidates. The majority of candidates correctly identified the method for finding the volume of a prism, used with a length of 12, and many understood that it was the area of the triangle that was required. A significant number involved the area of the circle in the method. The main source of errors came from incorrectly calculating the side length of the equilateral triangle. The errors of side length equal to 2, 3.15 or 4 cm were frequently seen, coming from the misconception that when a *horizontal* radius was drawn from the centre of the circle to the circumference, this point on the circumference was also the point at which the side of the equilateral triangle met the circle. These candidates then used correct trigonometry but within this incorrect right-angled triangle with an angle of 30 and a side of 1. Some candidates correctly used Pythagoras' theorem or trigonometry in the right-angled triangle formed by the radius meeting a tangent, to find that half of the equilateral triangle side was $\sqrt{3}$, but then mistakenly went on to use this as though it was the whole side length of the equilateral triangle. Some of the more able candidates produced a fully correct method but occasionally lost accuracy by prematurely rounding numbers to 3 significant figures within the working instead of waiting until the final answer.

Answers: **(a)** 5.2 **(b)(i)** 7.2 **(ii)** 62.4

Question 11

Many candidates were able to score well on this functions question. Some struggled to interpret the function notation correctly. Other candidates had issues with directed numbers.

(a) (i) Almost all candidates were able to calculate f(–3) correctly.

(ii) The vast majority of candidates were able to find g(2*x*) correctly. Some less able candidates found 2g(*x*) or even solved g(2*x*) = 0.

(b) The majority of candidates correctly found gf(*x*). Occasionally the error fg(x) was seen and some less able candidates went on to create and solve the equation gf(*x*) =0.

(c) Candidates demonstrated a good understanding of function notation and understood that $3(2 – 3x) = 7$ needed to be solved. The majority of candidates also correctly expanded the brackets and many went on to give a fully correct solution. A small number of candidates spoiled their solution by being careless with negative signs, $x = \frac{1}{9}$ being a common incorrect answer.

Others lost accuracy by writing –0.1 or –0.11 instead of the exact fraction or –0.111, the required 3 significant figure answer.

(d) This part proved to be the most challenging. A number of candidates were unable to interpret the meaning of the function notation and f(x) + 4 was a misconception. The majority of candidates did however correctly set up the required equation. The overwhelming common error in this question was errors with bracket notation compounded by errors when working with negative numbers/terms. A very common starting point was to write $2 – 3(x + 4) – 7x + 3 = 0$ and omit essential brackets, leading to an incorrect answer of −0.7.

Answers: **(a)(i)** 11 **(ii)** $14x + 3$ **(b)** $17 – 21x$ **(c)** $-\frac{1}{9}$ **(d)** –1.3