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FOREWORD

This booklet contains reports written by Examiners on the work of candidates in certain papers. **Its contents are primarily for the information of the subject teachers concerned**.

UNIVERSITY *of* CAMBRIDGE
International Examinations

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MATHEMATICS

Papers 0580/01 and 0581/01

Paper 1 (Core)

General comments

There was a wide variety of marks on this paper but it proved to be well within the capabilities of the majority of candidates. Many Centres clearly understand the nature of the examination and teachers are preparing candidates very well for this assessment. On the other hand, there was a significant number gaining very low marks and much work remains to be done with lower ability candidates in order that all may gain some feeling of success in mathematics.

The presentation of work was in general clear and most candidates showed their methods where appropriate. The spaces for working are felt to be adequate but some Centres allowed rough paper to be used. This often results in no working in the spaces provided. Method marks, when answers are incorrect, cannot be awarded without evidence. The use of correction fluid, though not very common, should also not take place. Work crossed out, but readable and not replaced, is marked.

There was evidence of a lack of knowledge of certain topics by some candidates. Paper 1 always covers a wide selection of syllabus topics and candidates should be prepared for this.

The importance of clear writing is emphasised in order that Examiners can easily determine what is intended by the candidates.

Comments on specific questions

Question 1

Although this was quite well answered, many did not fully understand that the mantissa had to be between 1 and 10. Also stating it as 1.0 instead of 1.01 often lost the mark. Only a few made the formerly common errors of a power of -4 or an abbreviated calculator notation.

Answer: 1.01×10^4.

Question 2

A lack of understanding of factorisation was evident in this basic question. Many candidates tried to take out 2 common factors or combine the terms within the bracket formed. With only 1 mark candidates should expect just one process.

Answer: $x(3y - 2)$.

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Question 3

Once again this topic was not understood well, and far too many candidates simply subtracted 20 from 6960. There were also many other incorrect answers and very few correct ones.

Answer: 6950.

Question 4

The question asked for **one** to be chosen but many candidates gave more than one response, and consequently lost the mark. Types of numbers include the terms rational and irrational, and although the latter term was not used in the question candidates are expected to appreciate the difference. Many clearly did not understand rational and the most common incorrect responses were 7 and $\sqrt{81}$.

Answer: $\sqrt{5}$.

Question 5

The linear equation was done well but a common error was to achieve an answer of 5 after $5x = 15$. The main error was to subtract 7 from 8.

Answer: 3.

Question 6

Although division of fractions was intended, many candidates could achieve the correct answer without showing working. Some, with incorrect working, produced extremely unlikely answers such as fractions less than 1. Candidates need to look at their answers and consider whether they are sensible for the question.

Answer: 12.

Question 7

Although many did well on this question, a considerable number of weaker candidates had difficulty sorting out what was required. In part **(a)** some felt they had to work out an average of the temperatures or simply quoted the range. Although part **(b)** was more successful, many were again confused by what was actually required.

Answers: **(a)** 10; **(b)** 12.

Question 8

More able candidates coped well with this question but many made errors in at least one of the two stages. A common error after $2a = P - 2b$ was to get $a = P - b$. Mistakes of signs as in **Question 5** were evident often as well as combining terms resulting in, for example, $P = 4ab$.

Answer: $\frac{P-2b}{2}$ or equivalent.

Question 9

Some candidates put an ordered list in parts **(a)** and **(b)** which was not what the question asked. Part **(c)** was correct for the vast majority of candidates, but in general the question was quite well done. Many candidates showed conversions to decimals alongside the list, which was a good method, but the answer spaces should have the original form. Although this was not penalised in parts **(a)** and **(b)** a mark was not awarded in **(c)** for 0.072 and 0.072.

Answers: **(a)** $\frac{7}{100}$; **(b)** 72%; **(c)** 0.072 and 7.2%.

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Question 10

A number of candidates gave answers outside the range or did not give an actual value. It is important that candidates read the stems of the questions carefully and avoid answers such as 9×7 for **(b)** or 8^2 for **(c)**. The expected errors of 63 and 69 for **(a)** were evident but parts **(b)** and **(c)** in particular were done well.

Answers: **(a)** 61 or 67; **(b)** 63; **(c)** 64.

Question 11

Part **(a)** of the question was done well by most candidates who showed an understanding of the addition of vectors. Many candidates in part **(b)** indicated the point (2, –3) but did not draw the vector from (0, 0) to that point. A triangle drawn was not penalised if the required vector was clearly identified. For a correct single line lack of an arrow was not penalised but the indication should be encouraged.

Answers: **(a)** $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$; **(b)** Straight line from (0, 0) to (2, –3).

Question 12

Radians and grads are still evident in answers to trigonometry questions so candidates should be warned of this calculator problem. Most chose the correct ratio but early rounding of sin21 to 0.38 or 1.2sin 21 to 0.4 was common. In converting to metres, either as a first or final step, many multiplied by 100 rather than 1000.

Answer: 430.

Question 13

Nearly all candidates managed to achieve the increase but the more able progressed further. Dividing by the wrong population or total population was common. The alternative method produced 92.6 but many did not then subtract from 100. Again, approximating resulting in 7% lost a mark, or all marks if no working was shown.

Answer: 7.4 or 7.41 or 7.40.

Question 14

Very little working was seen and it would have helped in parts **(b)** and **(c)**. Parts **(a)** and **(c)** correct and **(b)** wrong was very common. Some were confused and put in numerical answers and others assumed that each symbol had to be used once.

Answers: **(a)** >; **(b)** <; **(c)** <.

Question 15

Part **(a)** was intended as a guide to part **(b)(i)** but was often incorrect. Many achieving part **(a)** did not continue to show 1 significant figure in the other numbers and the calculation and answer were required for the mark. Many did not correctly follow the rules for order of operations in both parts of **(b)**. Part **(b)(ii)** was done better provided candidates followed the instruction to give all figures.

Answers: **(a)** 0.5; **(b)(i)** $10 - 6 \times 0.5$ 7, **(ii)** 7.0908.

Question 16

In part **(a)** many candidates gave the answer $3r - 5s$ or $3r + 3s$. The other parts were more often correct but 1 and 4 alone were seen as answers. As expected, powers of 12 in **(b)** and 8 in **(c)** were far from uncommon.

Answers: **(a)** $3r - 3s$; **(b)** q or q^1; **(c)** p^4.

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Question 17

This was not done well although it was noticeable that low scoring candidates often gave correct answers to this question. In part **(a)** 15 + 17 + 18 was common often with just 50 stated. The follow through mark for part **(b)** of 5 could not be given if no working was shown. Many in part **(b)** simply subtracted 12 from their total for part **(a)**.

Answers: **(a)** 60; **(b)** 9.

Question 18

The question was poorly done with many confusing the parts as to when the use of π was required. In **(a)** an answer of 80 was common, and 240 was also seen. Few candidates managed to achieve part **(b)** even with a follow through being available.

Answers: **(a)** 160; **(b)** 50.9 or 51.

Question 19

Parts **(a)** and **(b)** of the question were done well by the vast majority but part **(c)** caused many problems. There were not many candidates doing the intended division of part **(a)** answer divided by 2.20 although nearly all did not leave the answer containing a fraction of a bag. The common method was to try numbers multiplied by 2.20 but this usually resulted in an incorrect answer. Also in this question there was confusion about whether to multiply or divide, and using 2.5 kg in part **(c)**.

Answers: **(a)** 29.25 or 29.2 or 29.3; **(b)** 18; **(c)** 14.

Question 20

Most candidates scored well on this question with many cases of full marks. The main error in part **(a)** was to calculate the amount left rather than the deposit. (Again the general point about reading questions carefully.) In part **(b)** the payments was almost always correct but it was common to see 315 + 900 = 1035 or 720 + 900 = 1620 as the final answer.

Answers: **(a)** 315; **(b)** 135.

Question 21

Parts **(a)** and **(b)** of this question were done correctly by the vast majority of candidates, although 60 and 61 were often seen in part **(a)**. In part **(c)** there was a lack of care in drawing a clear straight line from (0, 0) to and through (5, 80) resulting in the loss of a mark. Other common errors were short lines, lines not through (0, 0), and in some cases lines parallel to the given line. Most gained the final mark even though for many this was by way of a follow through.

Answers: **(a)** 62; **(b)** 2.5; **(c)(i)** Single straight line from (0, 0) and through (5, 80), **(ii)** 5.

Papers 0580/02 and 0581/02

Paper 2 (Extended)

General comments

The level of the paper was such that most candidates were able to demonstrate their knowledge and ability. Less than 5% of the candidates scored under 10 marks, but this was a little higher than last year. The paper was slightly more challenging at most mark intervals this year with a limited number of candidates scoring over 65 marks and hardly any scoring full marks. The paper was able to differentiate across the entire mark range and provide a challenge for all candidates. There was no evidence that candidates were short of time. The general level of performance was slightly lower than last year due to one or two more demanding questions. Most Centres now seem to have their entry policy between Core and Extended Level correct but there are still a few Centres where some candidates are not entered at the correct level. Failing to use an accuracy of 3 significant figures in the answer, as required by the rubric and the syllabus, was a large problem again this year.

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Comments on specific questions

Question 1

This was generally very well answered, but substituting $n = 4$ was a common error.

Answer: 210.

Question 2

This was reasonably well answered but a substantial number of candidates used premature approximation to both cosine and sine and therefore produced inaccurate answers. If candidates wish to write down intermediate values in a calculator question they would be advised to record and use at least 4 significant figures.

Answer: 0.5.

Question 3

The response to this question was very varied. Some candidates did not know how to multiply two matrices together and those that did mostly produced answers of the orders (1 x 3), (3 x 1) or even (3 x 3). The most common incorrect answer was (12 12 –24) with candidates failing to add the terms.

Answer: (0).

Question 4

This was very well done. The few errors that were seen came in **(a)** with a failure to subtract 2 from 0.2 correctly.

Answers: **(a)** –1.8; **(b)** 21.

Question 5

Most candidates ignored the word **months** despite it being in bold print so the common incorrect answer was 120. However, even those candidates proceeding correctly with the simple interest formula usually converted 5/12 into a decimal and failed to retain enough accuracy in their working. A final group of candidates confused the word interest with amount and 810 was also a frequent incorrect answer.

Answer: 10.

Question 6

Most candidates were able to answer **(b)** correctly but many candidates were unable to deal with $(0.8)^{\frac{1}{2}}$. This was often converted into 0.4 and therefore became the smallest value. Many Examiners reported that candidates were trying to write the numbers in order in the answer space.

Answers: **(a)** $(0.8)^2$; **(b)** $(0.8)^{-1}$.

Question 7

Part **(a)** was usually correct but only the very able candidates answered part **(b)** correctly.

Answers: **(a)** 3.16; **(b)** 0.

Question 8

This topic proved to be a source of difficulty for many candidates. Less than half of the candidates were able to attempt this question correctly and in many of these cases poor use of brackets led to wrong answers. A large number of candidates did not understand how to start the question or how to use vector notation.

Answers: $\frac{1}{2}\mathbf{a} - \frac{1}{2}\mathbf{c}$.

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Question 9

This was generally well answered although parts **(a)** and **(c)** were not as well answered as part **(b)**. Extra zeros were incorrectly given by many candidates. The answers must be exactly as set out below.

Answers: **(a)** 2380; **(b)** 2381.60; **(c)** 2400.

Question 10

Most candidates scored some marks on this question and standard form is understood well. Candidates had problems with the fraction $\frac{1}{95}$ and many used $\frac{1}{94}$ or $\frac{94}{95}$. Some candidates divided by 95 instead of multiplying by 95. There were also quite a few candidates failing to give the answer to the required accuracy.

Answer: 5.7×10^{26}.

Question 11

This question was reasonably well answered. The most common error was for candidates to find the area of the table despite the use of the word perimeter in the question. Some candidates also rounded their answer up, instead of down, to the nearest whole number.

Answer: **(a)** 23.

Question 12

Almost all candidates were able to attempt this question correctly. The common errors made by candidates were that they failed to multiply both sides by 2 correctly if this was their first operation. Those moving the 5 first then also usually failed to multiply by 2 correctly. Many candidates were poor at setting out their answers in a form that was easy to follow and so it became difficult to allocate marks to their working. It is essential that candidates show each step in the process clearly if they are to be awarded all the method marks.

Answer: $d = \sqrt[3]{(2c - 10)}$.

Question 13

Very few candidates were able to score full marks on this question and probably the majority scored no marks at all. $F = k/d$, $F = kd$, $F = d^2/k$ were common incorrect methods with candidates failing to use both the inverse and the square nature of the proportion. The correct method of starting with $F = k/d^2$ was not always completed correctly once the value of k had been found.

Answer: 7.5.

Question 14

This was generally well answered although failure to factorise completely was the usual error.

Answers: **(a)** $7a(c + 2)$; **(b)** $6ax(2x^2 + 3a^2)$.

Question 15

This was very well done, with no common errors seen by Examiners.

Answers: **(a)** 54°; **(b)** 42°; **(c)** 78°.

Question 16

Apart from the candidates who tried to split the inequality into two separate easier inequalities, this question was well understood by most candidates. Many candidates did not know that the inequality is reversed when dividing by a negative number.

Answer: $x > -\frac{4}{7}$.

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Question 17

This was generally well answered with very few candidates failing to score some marks. The weaker candidates sometimes confused interior with exterior and vice versa.

Answers: **(a)** 72°; **(b)** 36°.

Question 18

Only the most able candidates were able to do this question. There was a general lack of understanding of the rules of indices.

Answers: **(a)** $\frac{x^{18}}{9}$; **(b)** $2x$.

Question 19

This question was well done and a large number of candidates scored 3 or 4 marks. The most common error was in part **(a)** where the negative nature of the gradient was often omitted.

Answers: **(a)** $-\frac{1}{2}$; **(b)** $y = -\frac{1}{2}x + 5$.

Question 20

The answers to this varied more between Centres than between candidates. Some Examiners were reporting that they were seeing high scoring answers whilst others were reporting that candidates could not answer the question correctly at all. Where candidates were scoring no marks they were trying to use the formula distance = speed x time instead of using the area under the graph to find distance.

Answers: **(a)** 80.6; **(b)** 7.

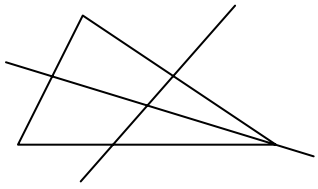
Question 21

This question was generally well done and a large number of candidates scored high marks. Those that failed to score full marks either failed to use Pythagoras correctly (and $8^2 + 4^2$ was quite common) or were using inaccurate figures following premature approximation.

Answers: **(a)** 6.93; **(b)** 60.5 or 60.6.

Question 22

This was very well done by most candidates with many superb, accurate constructions produced. Some candidates did not understand that they are not allowed to measure *AC* to find the mid point when constructing the perpendicular bisector. A few candidates clearly did not have a pair of compasses and were trying to use a ruler and protractor.

Answers: **(a)**  ; **(b)** arc centre C radius 7 cm; **(c)** shading.

Question 23

Whilst all candidates knew what was required in this question it was surprisingly badly done by many. In part **(a)** 2 x 0 = 2 was a very common error. In part **(b)** the common errors were 144 + 12, taking *b* as +2 instead of –2, dividing only the square root by 2 and failing to write answers to the required accuracy. Very few cases of an incorrect formula were seen.

Answers: **(a)** 3.6; **(b)** –0.3 or –11.7.

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Papers 0580/03 and 0581/03

Paper 3 (Core)

General comments

The majority of candidates were able to attempt all of the questions set, and were able to do so in the allotted time. Most papers were well presented and legibly written. Some candidates lost marks for showing no working; no credit can be given for a wrong answer, but correct working when shown can earn method marks even when the answer is wrong. Method marks were available in **Questions 1**, **2**, **3**, **4**, **5**, **6**, **7**, **8** and **9**. It is also preferable that this working is by the relevant question in the paper rather than on spare paper provided by the Centre. Candidates should read the rubric on the front page of the question paper with particular reference to the use of significant figures in their answers. Candidates should also answer the graph questions set on the paper and should not be given separate sheets of graph paper unless in exceptional circumstances. An individual breakdown of questions follows.

Comments on specific questions

Question 1

(a) This reflection proved to be the easiest of the transformations with most candidates scoring both marks. A small number used a different line of reflection or drew the reflected shape with incorrect dimensions.

(b)(i) The transformation given was generally recognised as a rotation. The direction of the rotation was a common omission. A significant number of candidates failed to correctly identify the centre of rotation with the phrase “about the origin” being a common error.

(ii) Again the transformation given was generally recognised as an enlargement and the correct scale factor stated. However, a significant number failed to identify the centre of enlargement correctly and accurately.

(iii) The term “translation” appeared less well known, with reflection being a common error. The correct use of the descriptive vector was varied with common errors being the use of coordinate form, and the incorrect positive direction used.

Answers: **(b)(i)** rotation, 90 degrees clockwise, centre of rotation marked or described,
(ii) enlargement, scale factor 3, centre of enlargement marked or described,
(iii) translation, vector $\begin{pmatrix} -7 \\ -5 \end{pmatrix}$.

Question 2

(a)(i) Generally well answered, although a significant number of candidates did not attempt this question on the use of trigonometry. Those who did generally recognised the tangent ratio although the use of 4/6 rather than 6/4 was a common error. As the answer was an angle it should have been given correct to 1 decimal place.

(ii) The majority of candidates recognised the follow through required in this part, although the use of 90–**(a)(i)** and 360–**(a)(i)** were common errors.

(b) The recognition and correct application and calculation of Pythagoras were generally well done, although a number of candidates lost the accuracy mark by not giving their answer correct to 3 significant figures.

(c) The units were often omitted, even though specifically requested. A variety of incorrect formulae were seen for the calculation of the area of the triangle, with the use of b x h = 6 x 4 being the commonest.

Answers: **(a)(i)** 56.3, **(ii)** 123.7; **(b)** 7.21; **(c)** 17.2 m; 12 sq.m.

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Question 3

(a)(i) Generally well answered, apart from the value for $x = -2$ where –3 was commonly seen instead of +5.

(ii) The standard of plotting was generally good. A small number did not gain the C1 mark by drawing "thick" or "double" curves or by the use of straight lines. A smooth single curve going through all the correct points is required.

(iii) This part was generally answered poorly with many candidates giving the x-intercepts, failing to appreciate the required use of $y = -1$. A further error was to include the y coordinate in the answer.

(b)(i) Very well answered.

(ii) The plotting seemed to cause more problems than with the parabola, possibly due to the scale of the axes. The fractional values of x were often plotted as negative numbers and the values of 0.7, 0.5 and 0.4 for y were often plotted inaccurately.

(iii) Generally well answered by those who managed to plot a reasonable hyperbola.

Answers: **(a)(i)** 5, –3, 12, **(iii)** –0.8 to –0.6; 2.6 to 2.8; **(b)(i)** 8, 2, **(iii)** 3.1 to 3.3.

Question 4

This question was generally well answered although a small number of candidates mixed up mean and median but the vast majority were familiar with the mode.

(a) The correct method was generally applied although a number of arithmetic errors occurred resulting in the loss of the accuracy mark although the 2 method marks were generally able to be awarded when the working was shown. The answer should have been given correct to 3 significant figures as 8.36 although answers of 8.357, 8.35, and 8.4 were common.

(b) The correct method was generally applied although the use of a ranking list was not always shown. A small number used the middle figures of the given data without ranking them first. Another common error was the incorrect manipulation of the middle values, with incorrect use of a calculator leading to (6 + 10)/2 becoming 6 + 10 / 2 = 6 + 5 = 11.

(c) Well answered.

(d) The table was generally completed correctly although the frequencies of –4, –4, –4, –4 was a common error as a result of misunderstanding the question. The use of cumulative frequency was another common error.

(e) The probabilities were generally answered well with the majority giving their answers as fractions. Those few candidates giving answers as percentages often omitted the % sign.

(f) This part of the question was generally poorly answered with the majority of candidates finding it difficult to use the relative frequency to project the number of calls made in a 6 week period. Common errors were 24 and 42 (simply the number of days in 6 weeks).

Answers: **(a)** 8.36; **(b)** 8; **(c)** 6; **(d)** 3 4 4 3; **(e)(i)** 7/14, **(ii)** 3/14; **(f)** 12.

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Question 5

(a) In general the drawing of the lengths required was good although the measurement and drawing of the angles was less successful. The use of the given bearing of 100 degrees caused many problems.

(b)(i) The angle was generally correct, or correct on a follow through basis.

(ii) Few correct bearings were seen.

(c) The required length was generally correct or correct on a follow through basis, although a significant number attempted to use Pythagoras to answer this part.

(d)(i) The quality of this construction was very variable. Although most candidates realised that the correct way to pinpoint *P* and *Q* was to draw 2 intersecting arcs, they were not always from the correct centres, the correct radius, labelled or of the correct length.

(ii) This part was well answered by those candidates with the correct diagram in part **(d)(i)**, and a follow through method enabled a significant number to pick up marks in this part.

Answers: **(b)(i)** 37 to 40, **(ii)** 247 to 250; **(c)** 8.9 to 9.1; **(d)(ii)** 4.0 to 4.4.

Question 6

This question proved to be very difficult for the majority of candidates.

(a)(i) Few candidates were able to breakdown the required cross sectional area to be found into manageable shapes of rectangles and triangles.

(ii) Few candidates appreciated the use of part **(a)(i)** in calculating the required volume.

(iii) Few candidates appreciated that the surface area was required to answer this part, with the most common error being the simplistic answer of 2 litres.

(b)(i) Generally well answered with the majority of candidates getting 61.5 and able to correctly convert to 61 hours 30 minutes. Common errors were 61 hours and 50 minutes, and 61 hours and 5 minutes.

(ii) Generally well answered although not always rounded to 3 significant figures.

(iii) Few candidates appreciated the use of **(b)(ii)** in this part of the question and consequently used incorrect values in their calculation.

(iv) A significant number failed to round up their answer.

Answers: **(a)(i)** 10.8, **(ii)** 32 400, **(iii)** 36; **(b)(i)** 61 hours and 30 minutes, **(ii)** 13 500, **(iii)** 3.38, **(iv)** 4.

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Question 7

(a)(i) The correct equation was generally correctly identified.

(ii) Few correct answers seen either by recognition or evidence of a correct method.

(iii) The table was often completed incorrectly. A common error was to use the equation $y = x - 2$ giving incorrect values of –3, –2, –1, 0, 1.

(iv) Answered well if a correct table obtained in part **(a)(iii)**.

(v) Few candidates appreciated how to use the graph to solve the given equations. A common incorrect answer was $x = 1$, $y = -1$.

(b) The algebraic approach to solving the given simultaneous equations was much more successful. The elimination method was more commonly used, although the substitution method was also seen. The majority of candidates were able to score both method marks. However, a lot of candidates lost the accuracy marks due to arithmetic errors in the addition/subtraction of the equations. A number failed to appreciate the exact nature of the answers and gave rounded answers or inexact decimals such as 1.6 or 1.7.

Answers: **(a)(i)** $y = 2x + 3$, **(ii)** 2, **(iii)** 3, 2, 1, 0, –1, **(v)** $x = 1.7$; $y = 0.3$; **(b)** $x = 5/3$; $y = 1/3$.

Question 8

(a) Well answered.

(b) Well answered.

(c) Generally well answered although there was little evidence of the method used. Common errors include 4 x 99 = 396, 3 x 99 = 297 and 300 – 3 = 297.

(d) Fewer candidates were able to give a correct general term for the number of lines with $n + 3$, + 3, 3 x n and 3 being the common errors.

(e) Again generally well answered but with little evidence of the method. Common errors included 3 x 85 = 255, 3 x 85 + 1 = 256, 85 – 3 = 82 and 85/3 = 29.

A significant number of candidates were able to obtain full marks on this question whilst an equally significant number were unable to proceed past part **(b)**.

Answers: **(b)** 13, 16, 19; **(c)** 298; **(d)** $3n + 1$; **(e)** 28.

Question 9

(a) This proved to be a difficult question for many candidates. A significant number gave the answer as 128.6 which is the interior angle. Correct method steps, usually involving the calculation of the interior angle were often seen but rarely carried through completely or correctly. The use of 360/7 was seldom seen.

(b)(i) Generally correct though a variety of spellings were seen, and a wide range of other names were used in error.

(ii) A follow through marking policy here enabled candidates to score well on this part as good understanding and application of some, if not all, angle properties was demonstrated.

(c) A significantly small number of candidates was unable to attempt this part but those who did generally answered it well. Common errors of 115 (180 – 65), 295 (360 – 65) and 205 (360 – 155) were seen.

Answers: **(a)** 51.4; **(b)(i)** isosceles, **(ii)** $p = 50$, $q = 80$, $r = 50$, $s = 50$, $t = 80$; **(c)** 25.

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Papers 0580/04 and 0581/04

Paper 4 (Extended)

General comments

Overall the difficulty of the paper was comparable to previous years. The following questions proved very challenging to most, **2 (d)**, **3 (c)**, **4**, **7 (c)**, **8**, **9 (e)** and **(f)**. There were also a number of questions, however, that were well received by candidates.

There were some excellent scripts, scoring high marks and many candidates were appropriately entered at Extended Tier and achieved success. There were still however substantial numbers entered for the wrong tier in spite of comments made in previous Examiners Reports. They found this paper too challenging and would have had a better experience and more success with the Core examination. Candidates appeared to have sufficient time to complete the paper and omissions were due to difficulty with the questions rather than lack of time. The use of at least three significant figure accuracy unless specified was generally noted by candidates this year but there were some losing accuracy marks by premature approximation particularly on **Questions 3** and **6**.

There are still a small number of candidates that write on both the question paper and their answer paper and Centres need to ensure that all of the work is written on their answer paper. Candidates should also be discouraged from writing answers in two columns on their answer paper. For questions requiring graph paper, 2 mm graph paper should be used and these questions should be answered entirely on the graph paper. Other varieties of graph paper can disadvantage candidates and cause problems in scaling. It should also be emphasised again that some candidates are not showing clear working and in some cases crossing working out or doing it on separate paper. Method marks are available for correct working, and working should be shown along with the solution in the main body of the answer paper.

Comments on specific questions

Section A

Question 1

Most candidates scored reasonably well on this question.

In the first part, almost all multiplied by the exchange rate to get the correct answer. Part **(b)** was also answered well, however a small number of candidates divided the pounds by the euros. Part **(c)** was generally well answered, although there were some common errors including finding the cost in Scotland as a percentage of the cost in Spain, i.e. 84.8% given as the answer, rather than the percentage difference. Also loss of accuracy leading to an answer of 15% was fairly common. In part **(d)**, those that recognised that children accounted for $\frac{1}{7}$ of the total cost of the holiday were successful. Division by 5 was the most common error.

Mixed responses to part **(e)**, those that recognised that the reduced cost represented 90% of the original were always successful. Many candidates did find the reverse percentage in part **(e)** challenging. There was the predictable incorrect answer of €4781.70 for those who did not consider the reverse percentage method, and there were similar incorrect methods shown using 10%, 90% or 110% of €4347.00.

The final part was generally well answered by candidates who knew how to deal with the time correctly. Often 3.15 was used instead of 3.25 for the time and occasionally candidates left answers in kilometres per minute. Most candidates used a restart method for the final part and divided the length of the journey in metres by the time taken in seconds. This was perfectly acceptable as a method but it was surprising that so few candidates used their previous answer divided by 3.6. Occasionally the final mark was not scored because of incorrect rounding to 200.

Answers: **(a)** 1216; **(b)** 1.47; **(c)** 15.2; **(d)** 621; **(e)** 4830; **(f)(i)** 723 to 723.1, **(ii)** 200.8 to 201.

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Question 2

The first two parts were answered very well. Candidates generally understood the term translation and were able to translate the original triangle, however a significant number did not interpret the column vector correctly and various combinations of translations involving 9's and 3's were seen.

Many candidates were able to deal with the reflection and rotation correctly, the main common errors were to use an incorrect mirror line such as the *y*-axis, $y = -1$ or $x = \frac{1}{2}$, and to rotate the original triangle with an incorrect centre of rotation, commonly point *A* on the original triangle.

Part **(d)** was often omitted or left incomplete by some candidates, a significant number however were able to complete parts **(i)** and **(ii)** successfully. In part **(ii)** it should be stressed to candidates that the inverse matrix when given in fraction followed by matrix form, does not need to be further simplified to earn full marks. Some candidates tried to simplify, by multiplying out by the fraction or lost accuracy by changing the fraction $\frac{1}{1.5}$ to a decimal such as 0.6. No candidate was penalised for this on this occasion provided the correct unsimplified answer had first been seen. Part **(iii)** was badly answered and the description required the three elements of stretch, equation of invariant line and the scale factor for full marks. Common errors included shear or enlargement with a scale factor of 1.5. A number of candidates gave a direction for the stretch rather than the invariant line and this was insufficient to gain the mark.

Answers: **(a)** Scales correct; **(b)** triangle ABC drawn correctly; **(c)(i)** correct translation drawn, **(ii)** correct reflection drawn, **(iii)** correct rotation drawn; **(d)(i)** correct stretch drawn, **(ii)** $\frac{1}{1.5}\begin{pmatrix}1 & 0\\ 0 & 1.5\end{pmatrix}$, **(iii)** stretch, *y*-axis invariant, factor $\frac{2}{3}$.

Question 3

The more able candidates did very well with this question and were able to demonstrate appropriate trigonometric methods. Others assumed right-angled triangles, however, and scored few marks. Premature approximation was very common however and candidates should realise that in order to give an answer correct to 3 significant figures, they should work to at least 4 figures throughout the calculation.

Part **(a)(i)** was very well answered, and in part **(ii)**, those that chose and recalled the cosine rule correctly, generally used it well although the common error of $(7^2 + 15^2 - 2 \times 7 \times 15)\cos 60°$ was still seen. Others, however, assumed the triangle was right-angled and used incorrect methods. A number of candidates could not correctly recall the cosine rule formula correctly.

In part **(b)**, the first part was well answered and many were able to select the sine rule as the appropriate method and demonstrate a correct substitution and manipulation to an answer. The most common error in using the sine rule was to prematurely approximate the value for sine 55°, leading to a slightly inaccurate value for the angle PQR. Premature approximation is a recurrent problem for candidates particularly on questions requiring the use of trigonometry. Part **(iii)** was often correct in terms of methodology, candidates choosing to use either the sine rule or cosine rule with correct application, premature approximation was again a common error that led to inaccurate answers however.

Part **(c)** was only attempted well by the most able candidates and even then many forgot to round the final answer to the nearest kilometre. The most common errors for others were to assume a trapezium or two right-angled triangles or simply not recall how to calculate the area of a triangle given two sides and the included angle.

Answers: **(a)(i)** 60, **(ii)** 13; **(b)(i)** 145, **(ii)** 61.35 to 61.4, **(iii)** 15.3 to 15.32; **(c)** 139 or 140.

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Question 4

Parts **(a)(i)** and **(ii)** were generally well answered. In parts **(iii)** and **(iv)** however, there appeared a lack of familiarity with the notation used and omissions were common. For others, ambiguous answers were sometimes given such as $n(21)$ for part **(iii)**.

For the probability parts, candidates generally used appropriate probability notation i.e. answers were given as fractions, decimals or percentages. In parts **(a)(v)** and **(a)(vi)**, there was some difficulty in interpreting the Venn diagram and answers such as $\frac{12}{24}, \frac{12}{21}, \frac{19}{24}$, were often given.

In part **(b)**, those that were able to interpret the 'without replacement' aspect of this question and record the correct probability for each of the successive events were generally successful in obtaining both correct answers, a few only considered the boy, girl option in part **(ii)** and not the reverse. The majority, however, treated the successive events as independent or gave probabilities out of 24 initially rather than 22.

Answers: **(a)(i)** 12, **(ii)** 3, **(iii)** 21, **(iv)** 2, **(v)** $\frac{14}{24}$, **(vi)** $\frac{12}{19}$; **(b)(i)** $\frac{132}{462}$, **(ii)** $\frac{240}{462}$.

Question 5

There were varied responses for the values of p and q although correct answers were in the majority. A few thought that there were two different values for each to be found and gave a choice of answers. An inaccurate value of 0.8 was also regularly given for p. Squaring negative numbers correctly appeared the most common issue for candidates however.

There were many excellent graphs drawn where some candidates had an awareness of the expected shape of the graph. For some, there were errors in plotting points, ranging from plotting negative y values for the points at (–3, 0.9), (–2, 0.75), (2, 0.75) and (3, 0.9) and also inaccuracies in plotting the points (–0.4, –5.25), (–0.3, –10.1), (0.3, –10.1) and (0.4, –5.25). Candidates are expected to be able to plot points to within 1 mm accuracy for graphs of functions. The most common error was to join both sections of curve together with a line through the y-axis.

Part **(c)** was usually misunderstood and common answers included 0 and –11.

Part **(d)** was well answered although candidates should note that graphs for *linear* functions should be ruled and cover the full range required in the question.

In part **(e)**, candidates most often misunderstood the word 'solution' and instead gave coordinates of intersection for their graphs, for this they were given only partial credit. Others commonly only gave two of the intersections and ignored the third, usually the one at 2.9 to 2.99.

The algebraic manipulation in part **(e)** was only successfully tackled by the most able candidates, and for many others it was omitted or abandoned. For a few who knew how to manipulate the fraction, often a sign error caused inaccuracy in the final answer.

The final part of this question was done well in terms of drawing the tangent and many were able to correctly give the equation of their tangent, although for some, the gradient was calculated rather than deduced.

Answers: **(a)** 0.9 and –10.1; **(b)(i)** correct scales, **(ii)** 12 correct points plotted and curve correct, **(c)** any integer >1; **(d)** correct ruled line; **(e)(i)** –0.45 to –0.3, 0.4 to 0.49, 2.9 to 2.99, **(ii)** $2x^3 - 6x^2 + 1 = 0$; **(f)(i)** Tangent drawn, **(ii)** $y = 2x - 2$ follow through.

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Question 6

The first part concerning planes of symmetry was rarely correct and did not appear a familiar topic to most candidates.

Part **(b)** was usually correct but a surprising number miscopied the formula when substituting and used $\frac{1}{2}$ rather $\frac{1}{3}$.

Parts **(c)**, **(d)** and **(e)** were tackled well by the more able candidates. There were some long methods used for part **(c)** involving Pythagoras and then trigonometry and a number of candidates approximated values early leading to an inaccurate answer rounding to 45°. Many did recognise the isosceles triangle PFM however and simply stated the answer. The best answers seen in part **(d)**, showed clear recognition of the 2 dimensional triangle required to obtain the angle PBF followed by clear step by step working, calculating BF before considering the required angle. A number of candidates did not appreciate what was meant by the angle between a line and a plane.

Candidates that correctly answered part **(d)** invariably scored full marks in **(e)**. A significant number however were unable to extract the required 2 dimensional triangle from the Pyramid for parts **(d)** and **(e)** and used triangle PMF for both parts.

Answers: **(a)** 2; **(b)** 30; **(c)** 45; **(d)** 37.49 to 37.54; **(e)** 4.92 to 4.93.

Question 7

Responses from all but the more able candidates were generally weak for this question. Part **(a)** was very mixed, with many unable to use the hint about trapezium in this part and trying a compound calculation involving a rectangle and triangle, often unsuccessfully. Those that did consider a trapezium, either did not recall the correct formula or were unable to correctly substitute into the formula. For the volume, surprisingly few linked part **(i)** to part **(ii)** and many restarted the calculation indicating that visualising the prism was a problem.

Part **(iii)** was not done well, most candidates simply did not know the conversion of m^3 to litres.

Part **(b)** was answered slightly better than part **(a)** but there were still numerous errors, ranging from using 35 instead of 35.03 to not calculating the area of the floor to be painted first and simply multiplying the length *AB* by the cost. Division by $2.25 was also common. The rounding to the nearest hundred dollars also caused many more problems than expected with nearest dollar and nearest ten dollars common incorrect answers.

The volume of the cylinder was generally well answered and most candidates were more familiar with the required formula here, some however did ignore the instructions on the front of the question paper concerning π and used the approximation $\frac{22}{7}$ that led to an inaccurate answer.

The final part was challenging and was done well by only a few more able candidates and the majority did not make any link between the work done in part **(a)** on the volume of the pool and the rate of flow. A number of candidates did however get some credit for showing how to convert a time in seconds to days and hours.

Answers: **(a)(i)** 63, **(ii)** 1512, **(iii)** 1512000; **(b)(i)** 1891.62, **(ii)** 1900; **(c)(i)** 6868 to 6873.2, **(ii)** 2 days 13 hours.

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Question 8

There were very mixed answers to this question and full marks were seldom awarded. There were a variety of responses to part **(a)(i)** including $\frac{x}{40}$ as a common error. Those that did provide the correct response often spoiled their answer by introducing a further undefined variable such as *y*, or wrote $x = \frac{40}{x}$ which is ambiguous. Part **(ii)** proved difficult to all but the most able and some candidates attempted a spurious proof, working backwards from the required equation for which no credit was awarded.

Part **(iii)** was done well generally, although many did not use factorisation as the most efficient method preferring to use the quadratic formula instead. Some made sign errors with factors and those that used the quadratic formula were usually able to recall the correct formula but often made slips in the substitution and evaluation. Part **(iv)** was often overlooked and of those that selected the correct positive root of 8, a significant number went on to spoil their answer by taking away 2 or dividing 40 by 8.

In part **(b)**, the majority were able to obtain the equation $2m = 5n$, but had more difficulty with the other equation $m = n + 2.55$. The misread of 2.25 for 2.55 was also fairly common. The most common method was then to equate coefficients and subtract even though a substitution method would have been more efficient. Candidates did generally show however a correct method to solving simultaneous equations from their two equations in part **(b)(i)**.

Answers: **(a)(i)** $\frac{40}{x}$, **(ii)** correct proof, **(iii)** –10 and 8, **(iv)** 8; **(b)(i)** $m = n + 2.55$, $2m = 5n$, **(ii)** $m = 4.25$, $n = 1.7$.

Question 9

Part **(a)** was tackled well and was almost always correctly done.

In part **(b)**, the best responses clearly showed the mid values being multiplied by the frequencies before adding and the total then divided by the sum of the frequencies. Some made numeric errors in an otherwise correct method. There are still some candidates omitting working and in those cases, no correct method can be implied from incorrect answers. Common errors also included multiplying the width of each class by the frequencies and dividing by the number of classes rather than the sum of the frequencies. There were many good reasons given for **(b)(ii)** that referred to the exact data not being given or mid values having to be used as an estimate or that the original data was given in classes. A number however did overlook this part.

Part **(c)** was done well and many candidates drew accurate graphs in part **(d)**. The vertical scale did cause some problems in plotting the points with cumulative frequencies of 15, 75 and 213 to within the correct small square, the accuracy required for the plots. Some plotted points incorrectly horizontally at the mid value rather than the upper bound of the class, and a few of the weaker candidates drew bar charts. Most candidates then drew good curves, but a few omitted the first section from (120, 0) to (130, 15).

The first three parts of **(e)** were tackled reasonably well but most appeared unfamiliar with the term percentile in the fourth part. Some answers were out of range however, indicating that a number of candidates worked on a total frequency of 280 rather than 270 in this part and the next. The best responses to **(e)** all showed clear annotation on the graphs.

Part **(f)** was often omitted, a method mark for the use of 240 or 241 was available for candidates here but was seldom awarded and those that demonstrated use of this value usually always scored both marks.

Answers: **(a)(i)** $160 < h < 170$; **(b)(i)** 162, **(ii)** mid values were used; **(c)** 15, 39, 75; **(e)(i)** 162 to 164, **(ii)** 176 to 178, **(iii)** 28 to 30, **(iv)** 167.5 to 169; **(f)** 186.5 to 188.

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