CONTENTS

MATHEMATICS

Papers 0580/01 and 0581/01
Paper 1 (Core)

General comments

The vast majority of candidates performed positively and to a reasonable standard on this paper, although there was only a small number achieving over 80%.

The presentation of work on the scripts was in general clear, but too often there was a lack of working where candidates may well have gained marks for method even though their answers were incorrect. Again, marks were lost by not observing the 3-figure accuracy stated in the rubric. Answers are expected to the nearest cent in money questions.

There was no significant evidence of shortage of time, but all questions required some degree of thought before responding. It is essential that all topics in the syllabus should be covered by candidates. It was evident that many candidates had very little understanding of certain areas.

Comments on specific questions

Question 1

The question was well done in general, although –25 was often seen. Since the question used the term 'risen' rather than 'change in temperature' the common response of –17 was incorrect.

Answer: 17.

Question 2

Although most achieved the correct solution, some showed lack of understanding by not attempting the question while others thought only one set of brackets was required. Bracketing just 9 + 3 or 5 × 9 was often seen.

Answer: (10 – 5) × (9 + 3).

Question 3

It was pleasing that only a very few candidates changed the question to 9 ÷ 5, but a mark was very often lost by leaving an answer consisting only of 5s. Some even gave an answer of 0.5 without working which did not gain a mark.

Answer: 0.56.

Question 4

This question was very well done by the vast majority of candidates with only a few confusing the two expressions.

Answers: **(a)** 100; **(b)** 400.

Question 5

Being a standard type of question on ratio, it was done generally well. Some candidates were confused over which fruit was required for the answer, though more concern was felt over the significant minority who displayed various incorrect ways of multiplying and dividing the numbers 5, 12 and 3.6.

Answer: 1.5.

Question 6

This question was very poorly done with many candidates showing complete ignorance of bearings. The lack of the zero in part **(b)** was not penalised.

Answers: **(a)** 270; **(b)** 045.

Question 7

Unexpectedly this question was poorly done. Common errors were to choose the correct two terms but to put them in the wrong order and to put **(a)** as acute and **(b)** as obtuse. Many others appeared to have simply guessed at the answers. These basic terms are probably introduced well before the final examination year and the response shows how vital it is to revise basic terminology.

Answers: **(a)** Obtuse; **(b)** Reflex.

Question 8

The question produced a mixed response dependent on candidates' understanding of basic ideas of vector manipulation. The combination of rules of vectors and negative numbers meant that many candidates did not gain full marks. A considerable number gained 1 mark by correctly finding 2**b** or –2**b** followed by a wrong answer.

Answer: $\begin{pmatrix} 5 \\ 0 \end{pmatrix}$.

Question 9

It was pleasing to see that this question on fractions was well done with most candidates correctly applying the rule for division of fractions. Only a few attempted a decimal solution, which did not score. Using arrows and terms such as cross-multiplying did not in general lead to convincing solutions.

Answer: $\frac{3}{5} \times \frac{10}{7}$ and then $\frac{30}{35} = \frac{6}{7}$ or cancelling to give $\frac{6}{7}$.

Question 10

Most candidates were successful in applying the rules of indices with only a small number multiplying and dividing indices. Strangely a number of candidates left the indices as 2 + 5 and 4 – 3.

Answers: **(a)** a^7; **(b)** b or b^1.

Question 11

While most candidates correctly did this question, there were a significant number who confused the inequality signs.

Answers: **(a)** $<$; **(b)** =.

Question 12

For those who understood rotational symmetry this was well done, although the answer of 4 for part **(b)** was common. It seemed that many gained the mark in **(a)** more from observing 3 sides or 3 lines of symmetry, rather than from rotational symmetry.

Answers: **(a)** 3; **(b)** 2.

Question 13

The idea of a net of a solid was by no means universally understood and attempted 3 dimensional drawings were seen at times. Otherwise the main error was to draw a rhombus rather than a square, which tended to distort the triangles. Reasonable accuracy by eye was accepted although some very well constructed nets were seen.

Answer: A sketch showing a square surrounded by 4 equal isosceles triangles.

Question 14

Careful reading of the question was particularly important and quite a number of candidates only found the discount. A common error was to simply subtract $0.15 from $19.60. Rounding to 3 significant figures lost the final mark rather than giving the exact amount Bernard had to pay.

Answer: 16.66.

Question 15

Most candidates could attempt a correct multiplication although addition and confusion with surface area were quite often evident; $350 \times 200 = 7000$ was common. Most candidates could not successfully change to litres, (i.e. division by 1000) and answers of 24.5 and 245000 were common. Candidates showing working usually gained at least 1 mark but many only wrote an incorrect answer and so got zero.

Answer: 24500.

Question 16

There was a very poor response to this question with relatively few correct answers to the lower boundary of the lengths. Many answers seemed to bear little connection with the given values. A considerable number achieved a follow through mark in part **(b)** by correctly using the area formula but many did not divide by 2.

Answers: **(a)(i)** 7.5, **(ii)** 5.5; **(b)** 20.6.

Question 17

Although most candidates subtracted in part **(a)**, a significant number added the readings. The 3 months caused some confusion in **(b)** resulting in the number 3 being used in calculations. Although some candidates divided by 8.78, most correctly multiplied by the cost per unit but again the last mark was often lost by rounding to 3 significant figures. It was common to see an answer left in cents, again emphasising the need for careful reading of the question.

Answers: **(a)** 1018; **(b)** 89.38.

Question 18

Most candidates gained 1 mark on the list of factors but all 8 factors were not seen very often; leaving out 1 and/or 30 was the most common error. Only a very few included numbers which were not factors.

There were a great variety of responses for prime factors with some candidates including numbers not in their part **(a)**. The main errors were to omit the prime factor 2 and to include the number 15.

Answers: **(a)** 1, 2, 3, 5, 6, 10, 15, 30; **(b)** 2, 3, 5.

Question 19

(a) There was a great variety of answers to this part with many trying to do a subtraction with the times and not considering 60 minutes in 1 hour. Those who simply worked out the time period without a calculator were generally more successful.

(b) The changing of minutes to a decimal or fraction of an hour appears to be extremely difficult for candidates at Core Level, although the vast majority gained a mark for dividing 355 by their time. Even with a correct part **(a)**, the most common response was to calculate $355 \div 6.45$.

Answers: **(a)** 6 hours 45 minutes; **(b)** 52.6.

Question 20

(a) Probability was clearly not understood by many, but this part was done well by the higher scoring candidates. Again lack of careful reading of the question caused some candidates to respond with a fraction.

(b) Although it was intended that this part should be done by adding the fractions and subtracting from 1, nearly all found the number of yellow beads and subtracted the total of blue and yellow from 35. Unfortunately, most left the answer as 4 and since the question asked for the probability, no mark was awarded at this stage. Just a few candidates regarded a bead as having been removed in part **(a)** giving only 34 as the denominator.

Answers: **(a)** 10; **(b)** $\frac{4}{35}$.

Question 21

Most candidates could achieve a mark in each part of this question, but few gained full marks. Rounding exact answers to 2 significant figures was common, as was answers with correct figures but not in standard form. In part **(a)** it was common to see 9.9 from adding 1.5 and 8.4.

Answers: **(a)** 2.34×10^3; **(b)** 1.26×10^6.

Question 22

(a) Many candidates did not know the term 'diameter', even though the question clearly referred to half of a circle rather than semi-circle.

(b) Part **(i)** was not done well with many answers of 37.7 from 12π and a mark lost by not adding on the diameter. While part **(ii)** was more often correct a significant number confused area and perimeter as well as losing a mark for not dividing by 2.

Answers: **(a)** Diameter; **(b)(i)** 30.8, **(ii)** 56.5.

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. Fewer candidates than last year scored very few marks. The paper was slightly less challenging this year. There was no evidence that candidates were short of time. The general level of performance was slightly higher than last year.

Comments on specific questions

Question 1

This was generally well answered but 14 was a common error.

Answer: 15.

Question 2

This was reasonably well answered but a substantial number of candidates got the order of operations wrong. A surprising number of candidates took the 3 in front of the √ sign to be a cube root. The accuracy to 1 decimal place was not well answered.

Answer: 550.6.

Question 3

The response to this question was very varied. Some candidates did not know what an integer or an irrational number was and many gave 22/7 as the answer in **(b)**. The difference between $\sqrt{14}$ and $\sqrt{16}$ was not clear to some candidates and many others gave multiple answers, which was not acceptable.

Answers: **(a)** $\sqrt{16}$ or $\frac{65}{13}$; **(b)** π or $\sqrt{14}$.

Question 4

Most candidates knew what was required but were unable to complete the question correctly. The mistakes were either to ignore the inequality and use = throughout, ignoring the negative sign and ending up with +4, or failing to reverse the inequality when dividing by a negative sign.

Answer: $x > -4$.

Question 5

Most candidates were able to answer this correctly.

Answer: 14.

Question 6

Most candidates were unable to answer this question correctly. Many candidates assumed this was a speed-time graph. Large numbers of candidates read the distance at 8.30 as a speed. Others were dividing the distance at 8.30 by either the clock time of 8.30 or by 0.5.

Answers: **(a)** 96; **(b)** 0.

Question 7

This question was badly answered even by some of the more able candidates. Most answers seemed to have been obtained from $R = kv$ instead of $R = kv^2$.

Answer: 3200.

Question 8

This topic proved to be a source of difficulty for many candidates. Under a half of the candidates were able to complete this question correctly. The most common error was to divide by the 2002 figure instead of the 1997 figure. Other mistakes involved rounding errors or failing to find the difference in the populations.

Answer: 3.23.

Question 9

Parts **(a)** and **(c)** were generally well answered. In part **(b)** many candidates were unable to find the *n*th term where a common error was $n + 7$. Quite a few candidates were counting along the sequence and ending up one term out of place. A large number did not use part **(b)** to find part **(c)**.

Answers: **(a)** 71; **(b)** $7n + 1$; **(c)** 37.

Question 10

Most candidates used the correct trigonometry but failed to deal with the height above sea level and so 180 was a common incorrect answer.

Answer: 766.

Question 11

Part **(a)** of this question was reasonably well answered with almost all candidates identifying the even numbers. A few candidates missed out or added in a prime number in set *A*. Less than 20% of the candidates understood the notation in part **(b)** with 45, 49 being a very common wrong answer.

Answers: **(a)** 41, 43 and 47 inside set *A*, 45 and 49 between sets *A* and *B*; **(b)** 2.

Question 12

More than half of the candidates were able to answer this question correctly. Those that did not, usually failed to square both sides as the first operation. Many candidates were poor at setting out their answers in a form that was easy to mark and so it became difficult to allocate marks to their working.

Answer: $c = \dfrac{b^2 + 5}{3}$.

Question 13

This question has been well answered in the past but it was not the case this year and only about half of the responses to part **(a)** were correct. There was some confusion with perimeter in the second part whilst other responses seemed to start again and ignore part **(a)**.

Answers: **(a)** 115 125; **(b)** 2400.

Question 14

Most candidates were able to identify (–1, 0) but very few found the other point. A very common error was (2, 0). Almost no candidates were able to answer part **(b)**.

Answers: **(a)** (–1, 0) and (1, –4); **(b)** $-1 < x < 1$.

Question 15

Almost all of the candidates knew what to do but very few were able to answer it completely accurately. Part of the arc and/or the bisector were often omitted.

Answers: **(a)** arc of a circle radius 5 cm inside the quadrilateral in two places; **(b)** perpendicular bisector of the side *DC* across the quadrilateral.

Question 16

Most candidates had the general idea of what was required and could attempt all the parts of the question.

A significant number of candidates halved the 126 and so 63, 42, 96 was a very common wrong answer.

Answers: $p = 54°$ $q = 51°$ $r = 78°$.

Question 17

Generally well answered with very few candidates failing to score some marks. Common errors were premature division by 2 and failing to round the answers correctly. Those completing the square often only gave one answer.

Answers: –7.10 or 3.10.

Question 18

Generally well done with most candidates scoring at least two marks.

Answers: **(a)** $\begin{pmatrix} -7 & -8 \\ 4 & -11 \end{pmatrix}$; **(b)** $\begin{pmatrix} 22 & 0 \\ 0 & 22 \end{pmatrix}$; **(c)** $\dfrac{1}{22}\begin{pmatrix} 4 & 2 \\ -1 & 5 \end{pmatrix}$.

Question 19

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 do the question at all. Others reported confusion between area and circumference. No clear pattern can be reported overall with the exception of premature approximation occurring during calculations in part **(b)** leading to loss of marks.

Answers: **(a)** 180; **(b)** 37.7.

Question 20

This question was very well done and a large number of candidates scored full marks. The most common error was in part **(a)** where the probabilities were often written with the last two reversed. A few candidates had incorrect denominators of either 25 or 23.

Answers: **(a)** $\frac{11}{24}$ $\frac{14}{24}$ $\frac{10}{24}$; **(b)(i)** $\frac{91}{3000}$, **(ii)** $\frac{77}{150}$.

Question 21

This question was very well done and a large number of candidates scored full marks. Those that failed to score full marks either failed to draw the vectors in the correct place, reversed the coordinates or did not understand the meaning of the notation as requiring a length to be found.

Answers: **(a) AB** drawn to (4, 6) and **BC** to (8, 6); **(b)** (5, 1); **(c)** 5.83.

Papers 0580/03 and 0581/03
Paper 3 (Core)

General comments

Most candidates were able to attempt all of the questions on this paper, although there was a variation between Centres, with Centres differing in their strengths and weaknesses. There was a considerable improvement in algebra from some Centres, and a noticeable weakness in transformations and trigonometry from others.

Time did not appear to be a problem for the candidates.

The answers given in this report are for guidance only. The mark scheme shows more detail of acceptable ranges of values, for example on questions involving measurements.

Comments on specific questions

Question 1

(a) This part of the question was not generally well done. There were many wrong answers for the speed, which should have been a simple starter for the paper. Candidates who recognise speed as the distance gone in one hour were able to read the answer straight from the graph. There was a mixed response to the completion of the graph, with some candidates unable to interpret the time axis correctly. Many candidates gave the inevitable wrong answer of 16 km as the total length of the journey.

(b) The candidates were more successful on this part of the question, with many gaining full marks. In this instance marks were given for correct answers obtained by calculation even though the question said “Use your graph”.

Answers: **(a)(i)** 10, **(iv)(a)** 15, **(b)** Hatab, **(v)** 32; **(b)(i)** 450, **(iii)(a)** 302 to 310, **(b)** 10.60 to 10.80.

Question 2

This question was not well done. This is disappointing because the style of the questions on transformations has hardly changed for some time now so there are plenty of past examples for practice. Candidates have four words to learn: translation, rotation, reflection and enlargement. There is a strong hint in the number of marks available for each description as to how much other information needs to be given. The transformations are always single transformations and candidates gain no marks for one transformation followed by another. The use of tracing paper is strongly advised so that, for example, the centre of rotation may be accurately found. As has been mentioned before, "describe fully" does not mean write sentences, but rather give all the necessary information in a concise form, as in the answers given below.

Candidates often did not use the correct scales in part **(b)** but counted squares instead.

In part **(d)** many candidates were unable to draw a 180° rotation about the given point.

Answers: **(a)** translation $\begin{pmatrix} -6 \\ -7 \end{pmatrix}$; **(b)** rotation 90° clockwise about (0, 0); **(c)** (0, 0) 1.5.

Question 3

This was not well done. Most candidates found the length of *AD* successfully, and many were able to use Pythagoras to find the length of *DE*, but a large number added $10^2 + 8^2$.

Using the sine ratio to find angle *AED*, and the tangent ratio to find the length of *CD*, both standard trigonometry questions, seemed beyond many of the candidates. Most of those who did recognise that tan40 and 6 were required for part **(c)** then incorrectly proceeded to find 6 x tan40.

There was a follow through mark available for those who added their answers to parts **(b)** and **(d)** to obtain an answer to part **(e)**.

Answers: **(a)** 8; **(b)** 6; **(c)** 53.1; **(d)** 7.15; **(e)** 13.2.

Question 4

(a) This was often done well. Many candidates left out or deleted the arcs necessary for the accurate construction of the triangle, and were in danger of losing a mark, although on this occasion full marks were awarded for an accurate triangle. Those who tried to draw the triangle without using arcs almost inevitably lost accuracy.

A common misconception was to draw the triangle given exactly, (including in some cases the words "NOT TO SCALE"!).

The angle was often correct within the tolerance allowed, but too many candidates assumed the triangle to have a right angle, and attempted to calculate the required angle. This, in spite of clear wording to use their triangle to measure the angle. Examiners also noted a surprising number of candidates who were unable to measure the required angle in their triangle correctly.

(b) This was sometimes well done, gaining full marks, but there were many variations of the required diagram, some bearing no resemblance to the expected answer. Some candidates drew freehand diagrams. A common mistake, when drawing the perpendicular bisector of the line *PQ*, was either to use no arcs, or to use arcs that were too small to give an accurate line. The shading was usually carefully done, but often using the wrong boundaries, for example using the arcs that had been used in part **(ii)**.

Answer: **(a)** 54 to 58.

Question 5

(a) Many candidates failed to see that the quadrilateral was a kite, and gave various wrong answers such as parallelogram or rhombus. The line of symmetry was usually correct, but Examiners had to decide whether extra lines (notably *AC*) were intended to be lines of symmetry or aids to the calculation of *y*.

(b) This was a simple question if candidates remembered that the angle in a semi-circle is a right angle. For those who did not a follow through mark was available for seeing that *q* and *r* had the same value.

(c) There are many ways to calculate the interior angles of a regular polygon, and candidates would benefit from trying out several different ways. Practical work with a ruler and some polygons would help candidates to find their preferred methods. Unfortunately, many rely on imperfectly remembered formulae, and consequently lose the marks.

Answers: **(a)(i)** kite, **(iii)** 70; **(b)** $p = 90$, $q = 50$, $r = 50$; **(c)** 128.6.

Question 6

Most candidates were able to complete the tables and plot the graphs. The main problem came with evaluating $(-1)^2 - 2\times(-1)$, which was often given as 1 or –1. Candidates could be encouraged to go back and look at their values again if one point appears to be out of place.

The candidates were not so good when it came to reading the values of *x* to solve the problems in parts **(c)** and **(f)**. Many left out the required negative signs or misread the scales, and many gave *y*-values as well although on this occasion they were not penalised for this. The answer spaces clearly stated "*x* = …".

Answers: **(a)** 3 0 0; **(c)** –0.8 to –0.7, 2.7 to 2.8; **(d)** 4 0; **(f)** –1.7 to –1.4, 2.4 to 2.7.

Question 7

There was a noticeable improvement in many of the candidates' ability to manipulate algebra. However, candidates often do not understand the use of the word "expression" and feel compelled to include an equals sign in their answer. Unfortunately they often write "= 0" and then go on to solve the resulting equation. Thus many candidates lost at least one mark in **(a)(ii)**.

Many could not deal with the negative signs in part **(b)**, but a pleasing number were able to factorise the expression in part **(c)**. Changing the subject of the formula was not so well done, a common mistake being to write $u - v$ for the first part of the working.

There were many correct answers to the simultaneous equations, and many others gained method marks even though they were unable to finish accurately.

Answers: **(a)(i)** 16, **(ii)** 3 x +8; **(b)** $-9a + 5b$; **(c)** $3a(2 - 3a)$; **(d)** $(v - u)/a$; **(e)** 2.5, –3.5.

Question 8

Most candidates were able to attempt the first part of this question, finding the mean, median and mode.

Many, however, seemed unable to measure the angles in the pie chart accurately, many apparently guessing the values. Most saw 15 as the multiplier for calculating the rainfall and were able to gain the follow through marks for this.

The answer expected for part **(b)(iii)** was a simple observation that the trend was an increase in the rainfall in successive years. Many candidates tried to evaluate the increase in some way, or merely compared the rainfall for 2000 with that of 1996.

Answers: **(a)(i)** 22, **(ii)** 77, **(iii)** 89; **(b)(i)** 72 ± 1, 80 ± 1, 94 ± 1, **(ii)** 1080 ± 5, 1200 ± 5, 1410 ± 5.

Question 9

This question gave the candidates a chance to show some knowledge of sequences by answering the numerical parts of the question even if they failed to understand the algebraic parts. Candidates again showed a lack of understanding of expressions and the use of letters. Typical errors were "nth row^2", or "nth = n^2" in part **(a)(ii)(c)**.

In part **(a)(iii)(b)** candidates were often unable to simply write the expression with the substitution of 30. If they did succeed in writing "300 – 30 + 1" they often then introduced a bracket to get 900 – 31 = 869.

Answers: **(a)(i)** 27 28 29 30 31 32 33 34 35 36, **(ii)(a)** square, **(b)** 100, **(c)** n^2, **(iii)(a)** 43, **(b)** 871; **(b)(i)** 100, **(ii)** 10*n*, **(iii)** 91, **(iv)** 10*n* – 9.

Papers 0580/04 and 0581/04

Paper 4 (Extended)

General comments

Overall this paper proved more difficult to candidates than in previous years. The following questions proved very challenging to most, **Questions 3 (b)** and **(c)**, **7**, **9** and **10**. 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 however, substantial numbers entered for the wrong tier. They found this paper too challenging and would have had a better experience and more success with the Core exam. 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 and there were fewer losing accuracy marks by premature approximation.

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.

Comments on specific questions

Question 1

Most candidates scored well on this question.

In the first part, the best answers reduced the ratio to the correct integer values although answers of *n* : 1 and 1 : *n* were also acceptable provided *n* was given to three significant figures or better. Fractions alone were sometimes seen and candidates were not given any credit for this because a ratio was asked for. Parts **(b)** and **(c)** were well answered, 41% was a common answer in **(c)** and was accepted without the third significant figure being shown. A few candidates did not read the information carefully and confused the populations of Newtown and Villeneuve, using the wrong town in the calculations.

Most candidates found the reverse percentage in part **(d)** challenging. There was the predictable incorrect answer of 56250 for those who did not consider the reverse percentage method, but many candidates attempted a correct reversal method but with 125% instead of 225% as required and arrived at an answer of 36000 instead of 20000. Some credit was given to candidates who did this.

The final part was generally well answered, only a few candidates did not consider the overall population of the two towns in their calculation.

Answers: **(a)** 15 :13 or 13 :15; **(b)** 12600; **(c)** 41.0; **(d)** 20000; **(e)** 14000.

Question 2

The majority of candidates answered very well the parts of the question asking for points to be calculated, plotted and joined with a curve. The reciprocal curve required in part **(a)** was almost always drawn well. This year, very few candidates used straight lines to join the points and there were very few errors in scaling. The straight-line graph in part **(b)** was also drawn very well, although some candidates did not follow the instructions in drawing the graph on the same grid and then had problems in answering the final part of the question requiring solutions to be read from the intersection of the curve and the line. Some candidates attempted a freehand line for $y = 8 - x$, and it should be noted that lines should be ruled for linear graphs. A few did not recognise the linear function and spent time calculating the full range of points which was unnecessary.

The estimate of the gradient produced a wide range of approaches. Examiners were expecting a tangent to be drawn at the point (3, 3) and then the gradient of the tangent to be calculated. The majority of candidates did draw a tangent and it should be noted that chords were not accepted as a suitable line. Some candidates drew no line at all and tried to use co-ordinates to calculate an answer. Those that drew good tangents and attempted a correct gradient calculation often left their answer as a positive value.

In the final parts, those that were able to make a correct initial statement involving the two functions earned a method mark, but to arrive at $x^2 - 7x + 4 = 0$, the fraction had to be correctly dealt with and the resulting brackets expanded correctly and this proved to be difficult for many.

In solving the equation, the best answers given were to read the intersecting points from the graph to one decimal place. Some candidates however attempted to use the quadratic formula to find the roots of the equation. This was a very inefficient method and also did not follow the instructions of the question that were to 'use your graph'. Candidates should also note that only the solution to the equation should be written, not co-ordinates of intersections. This leaves an ambiguity as to the solution, a few candidates did write co-ordinates and were penalised for this.

Answers: **(a)(i)** p = 12, q = 1.5, r = 1.2, **(iii)** –0.6 to –1.0; **(c)(ii)** x = 0.5, 0.6, 0.7 or 0.8 and 6.2, 6.3, 6.4 or 6.5.

Question 3

This question was generally badly answered.

The first part of the question on finding a standard volume of a cylinder was tackled reasonably well, however, some candidates having obtained the correct answer attempted to convert to cubic metres often unsuccessfully. Some of the more common errors in finding the volume were to halve the volume of the cylinder or in some cases to find the total surface area of the cylinder.

There were some good answers to the next part, where candidates correctly divided their volume by the volume of water coming out of the pipe per second and then converted to hours successfully, but these were a small minority. There were a wide range of incorrect attempts seen, but some credit was given to those that calculated the volume of water coming out of the pipe in 1 second and to those that were able to demonstrate in their working an understanding of how to convert seconds into hours. Some attempted calculations involving speed, distance and time and never made the link between the volume found in part **(a)** and the problem here.

Very few correct answers were seen to the final part and it was not attempted in many cases. The best answers correctly converted the area to cubic centimetres or and then divided the volume in part **(a)** by this area to give an answer in centimetres which was then converted to millimetres. Some successful candidates completely restarted and calculated the volume in cubic metres and then used the 70 square metres given in the question for the area. The majority who were not successful either could not convert the area and volumes to 'like' units or did not make the link between the volume in part **(a)** and the problem posed here.

Answers: **(a)** 552600 to 553000; **(b)** 6 hours and 51 minutes; **(c)** 8.

Question 4

The majority of candidates demonstrated some understanding of transformations on this question but very few were able to answer entirely correctly, usually slipping in the final part.

Candidates generally scaled the graph correctly and drew a correct triangle *ABC*. For the translation, it was clear that the word 'translation' was understood but in many cases the vector required was not and translations other than 9 to the left and 3 up were seen. The reflection was answered well generally although some used an incorrect mirror line of the line $y = 1$ or $x = –1$ on occasions.

Many successful attempts were seen at the enlargement and the 'ray' method was evident on many scripts. Some candidates did not use the correct centre however or used a scale factor other than 2. For some candidates, the ray method was used but was slightly inaccurate and counting the squares from the centre of enlargement would have been a useful check on the accuracy for this method.

The next part was usually either correct or a rotation of 180° was drawn.

The method for calculating the points from the matrix varied, the best methods pre-multiplied by the matrix with the object co-ordinates in column form. Some candidates showed no working and had tried to recognise the matrix and the transformation that it represented, this was only successful for some. For those candidates who drew the correct transformation, the transformation was usually accurately described with the correct terminology of rotation and the equation of the mirror line.

In the final part, the stretch was often omitted. For those that attempted this part, errors included a stretch of 1.5 in the *y* direction rather than the *x* direction, or moving points *B* and *C* to the correct image points but not moving point *A*. In both of these cases, the candidates scored partial credit. The stretch however was the weakest transformation for candidates. The correct matrix was very rarely seen and was usually given with no working by those who recognised how a scale factor of 1.5 in the *x* direction and 1 in the *y* direction could be represented within a matrix multiplication. Those candidates that attempted complex algebraic methods involving trying to match object and image points with an unknown matrix usually led to incomplete or incorrect answers.

Answers: **(e)(ii)** reflection in line $y = -x$; **(f)(ii)** $\begin{pmatrix} 1.5 & 0 \\ 0 & 1 \end{pmatrix}$.

Question 5

Candidates generally showed a good grasp of trigonometric techniques particularly in using the sine rule for the final part of this question. Very few candidates had their calculators in the wrong mode this year and calculations where RADS or GRADS were used were rare.

The first part was well attempted and the cosine rule was usually used appropriately to show that the angle *A* was 37° to the nearest degree. Those that stated the cosine rule explicitly in the angle form were more successful than those that chose to rearrange the implicit form of the rule. Some candidates assumed the 37° within their method and were unable to score full marks as a result. Where candidates are asked to verify a particular result, it is best practice not to use the result itself in the verification.

The bearing was often given correctly and less than 3 figures in the answer was not penalised on this occasion. For a few, the term 'bearing' did not appear to be fully understood however.

Those who were successful in part **(a)(i)** were almost always then calculating the correct area in part **(iii)**. Some candidates attempted a two-step method of finding the perpendicular height first before using the $\frac{1}{2}$ base x height formula for a triangle, rather than using the $\frac{1}{2}ab\sin C$ method directly. The problem with the two-step method is that it led to premature approximation of the height and pushed the final answer outside the acceptable range, and this was seen quite frequently. Occasionally the wrong combination of sides was used in the area formula. Other successful methods seen for this area included using Hero's method.

In part **(b)**, candidates often did not go far enough with their verification of $p = 54.4$. A correct implicit trigonometric statement was usually seen involving a fraction but the answer of 54.4 was often given without showing explicitly how the fraction was to be resolved. Part **(ii)** of **(b)** was much better answered than part **(i)**. Some candidates favoured a circular argument and used 54.4 to find the answer to part **(ii)** and then used the answer to part **(ii)** to verify 54.4. This type of method is not considered a verification.

The final part of the question was very well answered. Candidates who correctly calculated angle $D = 94°$, invariably went on to the use the sine rule correctly.

Answers: **(a)(i)** 37, **(ii)** 14 to 14.1, **(iii)** 841.3 to 843; **(b)(i)** 70sin51 or equivalent, **(ii)** 44.1; **(c)** 36.5.

Question 6

This statistics question was slightly different in its demands to previous questions that have been asked on this topic and answers were varied as many candidates found the demands difficult.

The first part required candidates to calculate an unknown frequency that gave a mean value of 2.125 for the distribution. Many candidates attempted an algebraic method and some excellent work was seen in resolving the algebraic fraction and solving the equation. Some candidates attempted an algebraic method but made the common error of stating that $\frac{34+x}{5} = 2.125$.

Other candidates were very successful with a trial and improvement technique, making the assumption that the missing frequency was a small integer value, and this was a perfectly valid method provided the correct answer was found. It should be noted that trial and improvement methods score either full marks if the answer is found or no marks at all.

Many candidates appeared unfamiliar with finding a quartile from a frequency distribution in none graphical form and part **(ii)** was done poorly.

Some very good answers were given in part **(b)**, where many successfully interpreted the area of the relevant bars of the histogram as the frequencies required. Other candidates still thought that the heights of the bars were the frequencies and gave an answer of 15 for the interval in the second part of **(i)**. In part **(ii)**, 7 was a very common incorrect response for those candidates that divided 42 by the number of 1 cm squares between 30 and 60 on the graph.

The final part of the question proved very challenging and few candidates were completely successful. The most common error was to divide the total frequency (128) by 5, misunderstanding the grouped frequency distribution data and the way that it was represented. The data was not presented to the candidates in the usual tabulated way and this created the difficulties. In previous exams, finding an estimated mean has been a relative strong area for candidates.

Answers: **(a)(i)** 6, **(ii)** 1; **(b)(i)(a)** 21, **(b)** 30, **(ii)** 1.4, **(iii)** 27.57 to 27.6.

Question 7

This question proved very challenging for candidates, many of whom had the appropriate algebraic skills but could not apply them to this graphical context.

Most could find that $f(4)$ was 5 but for the co-ordinates of K, L and M, there was much confusion. A common error was to take the roots as –3 and 3 and not to consider a quadratic equation at all, making the assumption that the line of symmetry was the y-axis. Those that did consider the correct equation often tried to use the formula when simple factorisation was the most appropriate method. The question also asked for the coordinates of K, L and M and even the most able candidates often left answers as $x = -1$ or 3.

In part **(b)**, the majority of candidates tried to describe the changes to the graph in words and often fell short of the key points needed. The best answers were those that sketched the graphs. Generally **(i)** was described more successfully than **(ii)**. A large number of candidates thought that part **(ii)** would become a straight line.

In the final part, many were able to give the value of c as zero, but a number gave a co-ordinate answer and did not score.

The values of a and b were seldom correct. Many candidates attempted to calculate the gradient of the line joining the two points and misunderstood the requirements. Even those candidates that made a numeric substitution into the equation $y = ax^2 + bx + c$ to obtain to equations in a and b often had problems in solving these equations simultaneously, however very few made the correct substitution to even consider this method.

Answers: **(a)(i)** 5, **(ii)** (–1, 0) and (3, 0), **(iii)** (1, –4); **(b)(i)** has a maximum or equivalent, **(ii)** (0, 0) is minimum; **(c)(i)** 0, **(ii)** $a = 2$ and $b = -6$.

Question 8

This was done reasonably well by the majority of candidates and was certainly the best attempted of the questions on the second half of the paper. Many candidates were completely successful in part **(a)** and scored 5 marks. A few misunderstood the table and failed to notice that the amounts of petrol referred to use per 100 km. Some candidates misunderstood part **(iii)** and did a separate calculation for the main roads and the other roads and never brought the two answers together. Most errors occurred in part **(iii)(b)** where instead of dividing 31.2 by 3.6 or equivalent, errors included the answer to **(a)** divided by 100, 360 divided by 31.2 or for some finding the mean of 8.0 and 9.2 the values that were given in the table and not taking into account the differing distances travelled on the two roads.

There were lots of correct solutions to part **(b)**, however parts **(ii)** and **(iii)** were less well answered. The effect of ratio on areas and volumes of similar shapes is less well understood than simple linear ratio. A few candidates also had problems with the unit conversions including centimetres to metres in the first part and others did not understand how to interpret a ratio given in the form 1 : 25. In some case 1 + 25 = 26 was seen and used throughout part **(b)**. The most common error however was predictably to use a scale factor of 25 in parts **(ii)** and **(iii)**.

Answers: **(a)(i)** 32.2, **(ii)** 550, **(iii)(a)** 31.2, **(b)** 8.7; **(b)(i)** 15.8, **(ii)** 80000, **(iii)** 16.

Question 9

There were very mixed answers to this question and full marks were seldom scored.

In the first part the greatest problem was in setting up the correct equation. Often $2-3(7-x)$ or $7-(2-3x)$ was written as the first step and then an attempt was made to 'solve'. For those that did set up the correct equation, a number were unable to deal with the negative sign correctly and made errors in collecting the unknowns and the numbers.

There were many good answers to the inverse and many understood this concept. A number were not able to deal again with the negative terms when rearranging the equation. A small number of candidates showed little working here and were not therefore able to score method marks where they had made only a slight error in the final answer, often giving $\frac{x-2}{3}$ as their answer. The composite function part was understood by many and correctly attempted. A number had problems with the arithmetic and could not process the negatives involved. Answers of 16 – 10 = 6 and –26 were common. Answers to part **(iv)** were again mixed as several candidates having obtained the correct expression then went on to spoil their answer by attempting a 'solution'. Other common errors included $(2-3x)^2$.

In part **(b)**, *h*(2) was usually correctly evaluated, but candidates had more difficulty with *h*(–3). Most recognised that the answer was a fraction but again processing the negative index created problems and answers of $\frac{1}{27}$ or $\frac{1}{9}$ were common. The standard form part was well answered, only the weaker candidates were unable to convert to standard form correctly. In the next part, very few candidates were able to explain that the square root of a negative number cannot be found. Many explanations did not interpret the power of 0.5 as a square root and this was crucial to the explanation.

In the final part, many correct answers were seen as well as the more common errors where the 3125 had been squared or the square root found.

Answers: **(a)(i)** –2.5, **(ii)** $\frac{2-x}{3}$ or equivalent, **(iii)** 26, **(iv)** $2-3x^2$; **(b)(i)** 4, **(ii)** $-\frac{1}{27}$, **(iii)** 3.65 to 3.66 x 10^6, **(iv)** square root of a negative number, **(v)** 5.

Question 10

This question proved extremely challenging and was very poorly answered. Geometric properties of shape remains a weak area for candidates. For many candidates, the question was rarely completed and only a token attempt was seen.

In part **(a)**, there were no common incorrect answers but a range of incorrect shapes such as squares, parallelograms, trapezia, rectangles and even triangles appeared. Very few candidates scored full marks for this part.

Similarly in the next part, candidates were unable to really visualise the angles required. Some attempted a diagram and tried to mark the angle x, in the correct position, they often went on to give $2x$ correctly as one of the required angles but then thought that all of the required angles would be $2x$ instead of using the right-angled triangles inside the rhombus to find an expression for the other angle. Some candidates misunderstood the wording of the question and instead of giving the four angles, gave the sum of the four angles for the rhombus.

A common wrong answer to the next part was 240 cm^2, although there were more good answers to this part than any other part of **Question 10**.

The final part was not easy and was often omitted. Very few candidates who attempted it considered Pythagorean triples where the two shorter sides had a product of 60 as was the intention.

Answers: **(a)(i)** Rhombus, **(ii)** Kite; **(b)** $2x$, 180 – 2x; **(c)** 120; **(d)** 13.

Papers 0581/05 and 0581/06

Coursework

General comments

In contrast to the June examination session, few Centres submitted coursework for this session. In general, the standard of coursework was good and the topics chosen for study allowed candidates to score well against the criteria. The work seen showed that most candidates had taken considerable pride in their work, and that they had become involved and interested in their research. For these candidates, it is clear that being actively engaged in a coursework task has enhanced their interest in the subject. This can only have a positive impact on their performance in the written papers.