MATHEMATICS

Paper 0581/01

Paper 1 (Core)

General comments

Overall the vast majority of candidates tackled the paper with confidence and, while some questions proved to be difficult, there were no questions that proved to be of a too high standard for core level. There are however, still too many candidates being entered who clearly have not fully covered the syllabus. This is evidenced by some very good responses together with straightforward questions being missed out or tackled in such a way to indicate complete lack of understanding. In particular, responses to the probability question, indicated complete lack of understanding of the topic.

The general impression this year is that few candidates scored exceptionally high or low marks, which is pleasing in that candidates were in general correctly entered for this level. On the other hand there were substantial numbers presenting well-answered scripts and fully justifying the maximum grade available at this level.

There was evidence of poor use of calculators, or even no calculator used, by some candidates. The 3 significant figures instruction in the rubric was often not applied. Also some candidates were allowed to use rough working paper. This is unnecessary and should not be permitted, since the answer spaces are sufficient for the workings, and working not seen on the question paper cannot gain credit. Most candidates are showing working where appropriate, but this must continually be stressed.

Comments on specific questions

Section A

Question 1

Although well answered in general, poor use of the calculator often resulted in an answer of 5.9. Other common errors resulted in answers of –5.9 or 13.1 There was a very small minority who made a numerical rather than a sign error, answering with –13.2.

Answer. –13.1

Question 2

$(2 \times 3) - (4 + 5) = 6 - 9 = 3$ was a common error although the question was done correctly by a substantial majority of candidates. Some put in extra brackets, but if the mathematical sense was not affected this was not penalised.

Answer. $2 \times (3 - 4) + 5 = 3$

Question 3

This is the first year that correlation was examined and it is clear that the topic was not known well by candidates at many cCentres. While perhaps just about the majority were correct, there were substantial incorrect choices of both positive and zero. Some answered with words that did not appear on the list.

Answer. Negative

Question 4

Leaving the answer as $4^2 + 2$ or 10 from $4 \times 2 + 2$ were the common incorrect responses to the question. A few candidates interpreted the question as an equation, namely $n^2 + 2 = 4$, leading to $n = 1$. However, the majority were correct.

Answer. 18

Question 5

Dividing rather than multiplying by 0.78 was the only common error and, apart from omission, this question was well answered. Candidates should consider whether their answer on conversions is expected to be a greater or smaller quantity than that given.

Answer. 12.09 (12.1 was allowed)

Question 6

This question was better done than expected with a substantial majority of fully correct answers. There were not many gaining 1 mark (from a partial factorisation) and the main error was putting 3*a* inside the bracket with the rest correct. Also seen were $2a(b - 3)$ and $2a(2ab - 3)$ and in the scheme none of these were able to score.

Answer. $2a(ab - 3)$

Question 7

There was a lot of confusion over whether to multiply or divide. Part **(a)** was worse than part **(b)** and even when done correctly an answer of 0.056 was often seen. The use of 100 rather than 1000 as a conversion factor was often evident.

Answers: **(a)** 0.0561; **(b)** 15300

Question 8

With a mark awarded for either x^6 or y^3 seen the majority of candidates scored 1 mark. However, relatively few gained full marks due to incomplete solutions or an addition sign added. The terms 'simplifying' and 'factorising' were confused and rules of indices were by no means universally understood.

Answer. $3x^6y^3$

Question 9

Part **(a)** was very well done showing clear understanding of indices. However, part **(b)** rounding to the nearest 1000 presented considerable problems. 80007 and 79500 were common wrong answers. Also a careless answer of 8000 was often seen.

Answers: **(a)** 79507; **(b)** 80000

Question 10

In general this was well done, but rather incomplete working often led to the wrong order. For example $\frac{33}{50}$ and $\frac{2}{3}$ both written as 0.66 was often seen. Many gained 1 mark due to reverse order or clearly indicating two correctly converted to decimals. This question was a very clear case of when showing working it is likely to lead to a consolation method mark

Answer. $\frac{6}{10} < \frac{33}{50} < \frac{6}{10}$

Question 11

Although this question was quite well done, the method of 'change the sign when you change the side' was not applied in many cases. $15x$ and/or -10 were often seen. Even those achieving $5x = 6$ or $-5x = -6$ found the answer to be $\frac{5}{6}$ quite often.

Answer. $\frac{6}{5}$ or equivalent

Question 12

Most candidates gained at least one correct from the list. The most common incorrect answers were A and E. Very few gave more than two responses and some wrote the symbols, which were credited.

Answer. B and D

Question 13

Many candidates could not do this question and a great variety of incorrect answers were given. Of those who found the figures 351 many did not change the answer to standard form. Also 3.5×10^{-3} was given without 3.51 being seen, many believing the answer, like the numbers in the question, needed just 2 figures.

Answer. 3.51×10^{-3}

Question 14

This was probably the most badly answered question on the paper. The topic is one that core candidates find difficult but this time there was also confusion with centimetres and millimetres. 15.1 and 16.1 (15.6 ± 0.5) were common wrong answers. Many other candidates clearly did not understand the question, some of whom regarded it as a change of units question. There were very few reversed correct answers although there were quite a number who managed to get one correct.

Answer. $15.55 \text{ cm} \leq \text{length} < 15.65 \text{ cm}$

Question 15

Part **(a)** was quite well done although 3.5 was a common wrong answer. Of those getting **(a)** wrong, many achieved part **(b)** with a follow through. Others appear to have started part **(b)** from the beginning and gained the correct answer and consequently this resulted in part **(b)** being better answered than part **(a)**.

Answers: **(a)** 3.2; **(b)** 384

Question 16

Part **(a)** was well answered with most getting the mark. Some gave 2^3 as an answer, which was incorrect, although 1 mark was given if 3^{-4} was also written for part **(b)**. The second part was very poorly answered showing a lack of understanding of negative indices. The most common wrong answer was 4 but also 27 ($81 \div 3$) and $\frac{1}{4}$ were seen.

Answers: **(a)** 3; **(b)** -4

Question 17

Part **(a)** was correct for the vast majority but part **(b)** caused a lot of problems for most candidates. $\frac{A}{4\pi}$ was often found but then many did not know the final step, often the result was $\frac{A}{4\pi r}$. Common errors were to square root the area, A, or subtract rather than divide as a first step. Also, strangely, there were quite a few numerical answers.

Answers: **(a)** Answer rounds to 314; **(b)** $\sqrt{\frac{A}{4\pi}}$

Question 18

The graph question did cause many problems although most managed to gain some marks. Part **(a)** was well done but answers of 60, 0.5 and 33 were seen a number of times. In part **(b)(i)** well over half the candidates failed to get the correct line, mostly by arriving at B in 1 hour rather than 45 minutes. Possibly there was some confusion over a speed of 80 km/h and the distance 80 km of the supermarket from town A. Most candidates gained the mark for the stop, usually as a follow through, and also a straight line to 1430 enabled another mark to be gained. It is of concern that quite a number produced impossible graphs, going back in time or even vertical lines.

Answers: **(a)(i)** 30; **(ii)** Straight line from (1100, 20) to (1145, 80); **(b)** Horizontal line at 80, 4 units long; Straight line to (1430, 0)

Question 19

Part **(a)**, and to a lesser extent, part **(b)** were answered well. Occasional addition rather than multiplication in part **(a)** and answers of 60 in part **(b)** were the main errors. A correct answer to part **(c)** was only found occasionally with many who had a clear idea of percentages stopping at the point of 63.6%. With only 2 marks for the part a full method for percentage loss was required for the method mark. The majority of candidates however, had little or no idea how to proceed with this part.

Answers: **(a)** 52.2(0), 83.7(2); **(b)** 7.8(0); **(c)** Answer rounds to 36.4

Question 20

Many missed the vertical line on H and often extra lines were added to W, but in general the lines of symmetry were correct. However, many candidates did not understand order of rotational symmetry with meaningless answers often seen. Angles were often given and 4 was very common for the second shape. Although various misleading or incorrect lines were drawn on the shapes, some candidates still managed to find the correct orders.

Answers: **(a)** 2 correct lines on H and 1 correct line on W; **(b)** 1 and 2

Question 21

Quite a number missed out the question, presumably not having studied vectors. Otherwise it was very well done with most gaining all 4 marks. The only significant error in part **(a)** was 2 instead of 4 while in part **(b)** the omission of the negative was quite common.

Answers: **(a)** $\begin{pmatrix} 0 \\ 4 \end{pmatrix}$; **(b)** $\begin{pmatrix} 30 \\ -24 \end{pmatrix}$

Question 22

This was very poorly done again showing lack of understanding of significant figures. In part **(a)** 5.0 and 10.0 were often seen as well as 13.5 and 16 both being rounded to 10. In part **(b)** many candidates worked out the calculation and then tried to give the answer to the required accuracy, usually unsuccessfully. The splitting of the estimation into parts **(a)** and **(b)** was intended to help but many showed a complete lack of understanding of rounding. Part **(c)** was better but the weaknesses in use of calculator were very evident by incorrect answers. 15.1 was common as was 9.5 from premature approximation. It was rather disturbing to see many totally inconsistent answers to parts **(b)** and **(c)**.

Answers: **(a)** $\frac{10+20}{5-(20\div 10)}$; **(b)** 10; **(c)** 9.49

Question 23

In cCentres where the work had been well-covered very good marks (often all five) were gained. However, many did not appreciate that probability is between 0 and 1 or that these were the values for impossible and certain respectively. Although decimal and percentage forms were accepted, provided to 3 significant figures where appropriate, candidates should be taught to use fractions when that is the form of the question. Most errors occurred in parts **(a)(i)** and **(c)**, the latter it is felt was very often just a guess.

Answers: **(a)(i)** $\frac{31}{36}$; **(ii)** 0; **(iii)** 1; **(b)** $\frac{17}{99}$; **(c)** Piero's

MATHEMATICS

Paper 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 particularly in the first half of the paper. There was no evidence at all that candidates were short of time.

Particular comments

Question 1

This was generally well answered but (–)230 was a common error for many candidates who ignored or misused the negative sign in front of the 100.

Answer: –170

Question 2

This was not very well answered again this year, a large number of candidates probably using their calculator to add the fractions in part **(a)**. There were some candidates who tried to use decimals. This question required candidates to use two of the four rules of fractions and was not suitable for calculator use.

Answer: **(a)** 3 **(b)** 8

Question 3

This was generally well done but a substantial number of candidates did not get the order of operations correct in both parts and so 13 × 3 and (2 – tan 30°) × tan 60° were the common errors.

Answer: **(a)** 5 **(b)** 1

Question 4

Most candidates knew what was required but most were subtracting 10 minutes instead of 5 minutes from the 8 hours. A large number of candidates were using 100 minutes in an hour instead of 60 when they tried to multiply by 30.

Answer: $237.5 \leq T < 242.5$

Question 5

This question seemed to be very challenging. Many candidates were not able to measure the two lengths to any reasonable accuracy and others seemed to think that the question could be answered visually. A few tried, incorrectly, to use Pythagoras or trigonometry. However, a substantial number of candidates did score both marks and many others gained 1 mark for a reasonable attempt.

Answer: 330 m

Question 6

This was very well done, although there are still a surprising number of candidates who write the answers in the reverse order. It is absolutely essential that working is shown in this question, as in many others, if the answer is incorrect.

Answer: $1/125000 < 8 \times 10^{-5} < 0.0008 < 0.8\%$

Question 7

This question was poorly done, only the more able candidates getting all 3 parts correct. Part **(a)** was often known but the common errors in the other two parts were to solve the equations $32n = 2$ and $32n = 8$.

Answer: **(a)** 0 **(b)** 1/5 **(c)** 3/5

Question 8

Whilst there were a large number of correct answers to part (a), it was not unusual to see 3 h 55 m.

As in **Question 4**, candidates have difficulty working with 60 minutes in an hour and this was clear in part **(b)** with a very large number using 2.55 hours instead of 2.917 hours for their calculations. Rounding errors often prevented some candidates scoring full marks.

Answer: **(a)** 2 h 55 m **(b)** 52.8 km/h

Question 9

This was generally well done this year. Part **(a)** was the worst answered of the three parts with 19 and 20 very common errors. Candidates seem to assume that all sequences can be dealt with by differences and this is not the case in **(a**) which is extended by adding consecutive terms and in the other two parts by multiplication.

Answer: **(a)** 21 **(b)** $360\ x^2$ **(c)** 486

Question 10

This question was either very well or very badly answered. Many candidates started with $7x^2 + 24x^2 = 150^2$ and failed to gain any marks even if they intended $(7x)^2 + (24x)^2 = 150^2$ because subsequent working usually had $31x^2$ in it. Those that tried the $x = 6$ option and gave a correct Pythagoras calculation did not always set their work out very well and could not be awarded full marks.

Answer: **(b)** 336

Question 11

Part **(a)** was well done. Some candidates could not deal with the complement and this was even more obvious in part **(c)**.

Answer: **(a)** overlap of A and B shaded **(b)** no shading inside either A or B **(c)** B not shaded

Question 12

Given the time that is often spent teaching this topic, it was very poorly answered. Most candidates did not state that the tangents were equal in length and in the last part the opposite angles of a cyclic quadrilateral adding up to 180° was also rarely seen.

Answer: **(a)** isosceles triangle because the tangents are equal in length **(b)** 71° **(c)** 109°

Question 13

There were very few correct solutions to this question. Candidates did not seem to be aware that they needed to cube the length scale factor to work with volumes. There were some attempts to convert cm^3 to m^3 but usually the power of 10 was incorrect.

Answer: **(a)** 40 **(b)** 0.00004

Question 14

This question was generally well answered albeit with some misreading of the scales. A significant number of candidates did not seem to associate the question in part **(c)** with the graph and gave answers of 0 or 32.

Answer: **(a)** 68 **(b)** 80 **(c)** –40

Question 15

Part **(a)** was generally correct and most candidates knew what was required in part **(b)** but were unable to produce a correct final answer. Most candidates could not answer part **(c)** correctly, not understanding the relationship between f and f^{-1} in the context of $ff^{-1}(x)$.

Answer: **(a)** 8 **(b)** $\frac{5-x}{3}$ **(c)** 8

Question 16

Most candidates knew what was required in both parts of this question but were unable to deal with the algebra correctly. This question was a good discriminator between the more able candidates.

Answer: **(a)** $105x^2$ **(b)** 22.6°

Question 17

This was generally badly answered with very few candidates scoring full marks. In part **(a)** many candidates lost a negative sign and 10 was a frequent wrong answer. In part **(b)** a large number of candidates chose to ignore the method of factorisation and made numerous errors using the formula. Candidates should be aware that an accuracy is specified when the formula is the best method to be used.

Answer: **(a)** –10 **(b)** 4 or 1.5

Question 18

Whilst most candidates knew what was required and were able to score marks on this question, a large number failed to understand that **two** sets of arcs are required in part **(a)(i)** and arcs on FG and FH are essential for part **(a)(ii)**. Accuracy of construction was checked by **(b)** and less than half the candidates scored this mark.

Answer: **(a)** perpendicular bisector of EG **(b)** angle bisector of GFH **(c)** 67°

Question 19

In part **(a)** few candidates had a clear idea of the order of the answer and (15 8) in various forms was not uncommon. Part **(b)** was better answered particularly the *x* value. In part **(c)** most candidates had a vague idea that it was to do with the determinant but were unable to explain that terms of the adjoint matrix would be divided by a zero determinant.

Answer: **(a)** (23) **(b)** $x = 4$ $y = 6$ **(c)** the determinant is zero

Question 20

Most candidates scored marks on this question and both parts of part **(a)** were well done with some algebraic slips in expanding brackets. In part **(b)** many failed to start with $5x^2 + 30x - 40 = 0$. Almost all possible methods for solving this equation were seen but since most candidates failed to divide through by 5, a vast range of arithmetic errors were seen even in the expected use of the formula thus leading to loss of marks. Finally, many candidates failed to find a positive answer to the required degree of accuracy.

Answer: **(a)(i)** $4x(x + 4)$ **(b)** $x = 1.1$

Question 21

This question was a good test for the more able candidates. An unusually large number of candidates failed to recognise and solve these simultaneous equations. In part **(b)** many candidates found the gradient correctly but were unable to find c correctly because of the arithmetic.

Answer: **(a)** (2½, 4) **(b)** $y = \frac{5x}{3} - \frac{11}{3}$

MATHEMATICS

Paper 0581/03

Paper 3 (Core)

General comments

The paper seemed accessible to the majority of candidates if a little challenging in places. The vast majority of candidates managed their time well and were able to complete the paper and thus demonstrate their knowledge and understanding of Mathematics. A number of questions this year needed careful reading to identify the methods required. The use of estimates and a common sense check of the answers given may have avoided a number of errors. Once again the amount of working shown proved detrimental to a number of candidates. Working was expected, and method marks were available, in **Questions (3)(a)(i)**, **(b)(iii)**, **(5)** all, **(6)(a)**, **(b)(i)**, **(8)(a)(ii)(v)(vi)(vii)** and **(9)** all. The breakdown of individual questions follows.

Question 1

Part **(a)** was generally well answered although in **(i)** the answer of 3.14 was often seen, the terms multiple and factor were confused leading to common errors of **(iii)** 3 and **(v)** 88, and a small number gave the sum of 10 in error to **(vi)** rather than the product of 24.

Part **(b)** was started well by the majority of candidates. Some wrong answers to **(i)** were seen in that some of the lines were omitted. The table in **(ii)** was generally answered well with most candidates able to continue the sequence or to draw further diagrams to obtain the required values. Part **(iii)** saw the common errors of 100 and 200. Part **(iv)** was less successful with a significant number of candidates unable to give the generalised algebraic expression for the nth term of the sequence and giving a numeric value in error. Part **(v)** was poorly answered with the majority of candidates unable to correctly identify the square numbers sequence. Common errors included triangular numbers, evens, sequence, frequency, y values and square roots.

Answer: **(a)(i)** $\sqrt{35}$ **(ii)** 3 **(iii)** 45 **(iv)** 2 or 3 or 37 **(v)** 2 **(vi)** 24
(b)(i) correct drawing **(ii)** 16 25 36 **(iii)** 10000 **(iv)** n^2 **(v)** square numbers

Question 2

The table in part **(a)** was generally completed correctly although a small significant number could not deal with the negative values. The vast majority of candidates were able to correctly plot the required points though a significant number were then unable to draw a smooth curve. A “flat top” was commonly seen with a small number drawing a series of straight lines. Those who plotted a reasonable curve were usually able to draw the line of symmetry correctly for part **(c)**. A number of candidates did not appear to use the graph to answer part **(d)** and simply used 2, or –10, from the table. Part **(e)** was generally answered well although a small number drew x = 1 or simply plotted a single point usually (0,1). Those candidates who then used this line to answer part **(f)** were generally correct although a common error was 0.6. A very common error was in using the intersections with the x-axis and giving answers of –1 and 2. A small number attempted to calculate the required values instead of using the graph but were rarely correct.

Answer: **(a)** –4 –4 –10 **(b)** correct graph **(c)** x = 0.5 drawn **(d)** 2.2 to 2.4 **(e)** y = 1 drawn
(f) –0.6 1.6

Question 3

Part **(a)(i)** was poorly answered with candidates using a variety of incorrect formulae or finding the exterior angle by using 360/7. Part **(a)(ii)** was generally well answered with a follow through allowed. In part **(b)** a significant number were unable to apply algebraic skills to this geometric setting. Those who were confident in the use of algebra generally answered part **(i)** correctly although common errors of 3y = x and 3y+x = 180 were seen. The simplification in **(ii)** was again well answered although the use of 3xy was a common error. Those candidates who used their equation to answer part **(iii)** were generally correct. A significant number returned to the original diagram and were generally correct although a common error here was in giving the answer of y = 120. Part **(c)(i)** was generally well answered by mention of the angle sum of a triangle, although common errors involving the use of isosceles or right angled triangles were seen. Part **(ii)** was less well answered with many candidates not realising that they had to state why this triangle was right angled. Few correct reasons were seen. Those candidates who recognised the simultaneous equations method in part **(iii)** were generally correct in their solution, with the majority using the elimination method. Many candidates, having solved the equations, were then unable to use their result in the correct diagram and so failed to earn the mark in part **(iv)**. Very few correct answers were seen even allowing for follow through.

Answer: **(a)(i)** 128.571 **(ii)** 128.6 **(b)(i)** x + 3y + 80 +95 = 360 **(ii)** x + 3y = 185 (**iii)** 40
(c)(i) angle sum of triangle used **(ii)** angle in a semi circle used **(iii)** a = 70 b = 20 **(iv)** 40

Question 4

The transformation of enlargement was usually correctly identified although the scale factor of 3 was not always given. The centre of enlargement was often omitted or incorrect. Those few candidates who drew in the lines of enlargement to find the required centre were generally correct. Common errors seen were (0,0) or an apparent attempt to use vectors. The transformation of reflection was also generally correctly identified although the equation of the line of reflection was often omitted or incorrect. In part **(b)(i)** many translated the shape by counting squares instead of the units given on the axes resulting in the loss of an accuracy mark. In part **(ii)** the use of the centre of rotation at (-1,-2) caused a number of problems, again resulting in the loss of the accuracy mark. A small number drew a rotation of 90 degrees in error.

Answer: **(a)(i)** enlargement, scale factor 3, centre (2,4) **(ii)** reflection, in line x = 4
(b) correct diagrams drawn

Question 5

In part **(a)** a surprising number of candidates used an incorrect formula to find the area of the stated triangle with the common error being 180. A significant number attempted to use the diagonal BD. Those who correctly recognised the use of trigonometry in part **(b)** were usually able to identify and correctly use the tangent ratio, although the misuses of sine and cosine ratios were seen. Weaker candidates tended to use the values of 10, 18 and 55 in an incorrect purely numeric way. Few candidates in part **(c)** used the method of area of triangle ABD minus the area of triangle AXD although those who did were usually successful. Most candidates chose to use the equally valid method of finding the area of the shaded triangle BDX direct by finding the length of BX first. Unfortunately few candidates then used the correct perpendicular height of 10 in the formula and instead chose to use either length BD or DX calculated by Pythagoras or trigonometrical methods. In part **(d)** those candidates who recognised the use of Pythagoras were generally successful. However a significant number of candidates attempted to use the incorrect angle of 35 degrees with a trigonometrical method. It was also noticeable in this question that a number of candidates did not give their answers correct to 3 significant figures as stated on the front on the paper. This can lead to the loss of accuracy marks.

Answer: **(a)** 90 **(b)** 14.3 **(c)** 18.5 **(d)** 20.6

Question 6

Although the method for part **(a)** was given in the question not all candidates were able to correctly use this to find the number of bricks. However the particular problem encountered in this question was the incorrect conversion, or lack of conversion, of the units used. In some cases this led to an unrealistic answer. Part **(b)(i)** was generally well answered although a significant number simply gave the answer of 36 (correct 5% but not added) or incorrectly subtracted this 36 from the total of 720. Part **(ii)** was well answered particularly with a follow through accepted although a small number erroneously rounded down. Part **(c)(i)** tended to be either correct or 70, 28 obtained by incorrectly multiplying both ratio values by 14. Part **(ii)** was more successful particularly with a follow through being applied, although common errors of multiplying by 3.5, 14/3.5 and 14 × 3.5 were seen.

Answer: **(a)** 750 **(b)(i)** 756 **(ii)** 8 **(c)(i)** 10 , 4 **(ii)** 2

Question 7

This proved to be a difficult question for many candidates. Methods to find both gradient and intercept values, and the application and use of y = mx+c were rarely seen. The absence of working made it difficult to identify errors. In part **(c)(i)** a significant number drew lines that only satisfied one of the two given conditions.

Answer: **(a)** –1 **(b)** m = 2 , c = 3 **(c)(i)** correct line drawn **(ii)** y = 2x – 3

Question 8

This question on Statistics was generally well done although there was a certain amount of confusion between the definitions of mean, mode and median. In part **(a)(i)** the frequency table was completed correctly by the vast majority of candidates with just a few leaving their answers as tally marks. In part **(ii)** many candidates did not show evidence that size x frequency had been calculated. Indeed the common error was simply to use the sum of the shoe sizes leading to 52/8, or to use the sum of the frequencies leading to 34/8. In part **(iii)** knowledge of the term range seemed surprisingly weak, with often no attempt made or the answer left as 10 – 3. In part **(iv)** the mode was generally stated correctly. Part **(v)** saw a very mixed response from candidates with many showing an incorrect application of the method used to find the median value. Common errors were simply using the 8 shoe sizes values leading to 6.5, or the 8 frequency values leading to 4.5. Other errors included the use of just the 17^{th} value or the answer of 17. Those candidates who wrote down a rank order list of the full 34 values tended to then state the correct value. Part **(vi)** was generally well answered although the lack of working was a problem for a number of candidates. Common errors were finding 6% of 34, 6 × 34, or using the 7 (from size) rather than the frequency of 6. Part **(vii)** was generally well answered with a follow through allowed, although a number lost the accuracy mark by not rounding to a integer value. Part **(b)(i)** was generally well done in that most candidates could read the bar chart, however a significant number only obtained one mark for the special case where they did not add together the two frequencies. Part **(ii)** was generally answered well although the common errors of stating the frequency or just one shoe sizes were seen.

Answer: **(a)(i)** 3, 6, 8, 7, 6, 1, 1, 2 **(ii)** 5.71 **(iii)** 7 **(iv)** 5 **(v)** 5.5 **(vi)** 17.6% **(vii)** 54
(b)(i) 12, 25, 19, 2 **(ii)** 5 and 6

Question 9

A small number of candidates were unable to attempt this question. The construction in (a) was generally done well although a disappointing number lost an accuracy mark due to inaccurate lengths or right angle. A few appeared to only use integer values for the two lengths. Part **(b)(i)** was less successful with many candidates seeming to measure the wrong angle in order to work out the required bearing, whilst those who did measure the correct angle in their constructed triangle failed to convert to a bearing. Part **(ii)** was more successful particularly with a follow through applied. Part **(iii)** saw a poor response with many candidates failing to show clear and complete working. Those who did usually gained method marks either for converting the speed or for using the correct formula to calculate the time. Even those candidates who arrived at the correct 2.7 hours found it difficult to convert to hours and minutes. Part **(iv)** was poorly answered in that many candidates did not appreciate that a conversion was required as different units of time were used. The common error was an answer of 0.4 (from 18/45). Part **(v)** was generally well answered although a number only drew part of the circle. Other errors included the drawing of line and angle bisectors. Part **(vi)** was generally well answered although a small number did not appreciate the use of the loci previously drawn.

Answer: **(a)** ??correct??diagram **(b)(i)** 234 **(ii)** 186 **(iii)** 2 hr 42 min **(iv)** 24 **(v)** correct circle **(vi)** 92

MATHEMATICS

Paper 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, 4, 5b,c, 6, 7a,c, 8b. There were also a number of questions, however, that were well received by candidates and were very well answered, **Questions 1**, **2** and **3** for example.

There were as usual some excellent scripts, scoring high marks and the majority of candidates were appropriately entered at extended tier and achieved success at grades C and above. There were still however substantial numbers entered for the wrong tier in spite of comments made in previous examiners reports. Those candidates 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 but there were some losing accuracy marks by premature approximation particularly on **Question 3**. Candidates were also using the correct conventions for writing probabilities (fractions, decimals or %) on **Question 5** and no issues were reported on the incorrect use of ratio or use of words.

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. It should also be emphasised that those candidates who are not showing clear working and in some cases crossing working out or doing it on separate paper are jeopardising marks that may be awarded for method in some questions. Method marks are available for correct working and working should be shown along with the solution in the main body of the 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

Section A

Question 1

Most candidates scored reasonably well on this question.

In the first part, almost all obtained the three required values, usually by the standard method, a very small number mistakenly divided \$800 by each of the ratio parts which was the only common error made. Part **(b)** was answered reasonably well, although there is confusion between the concept of simple interest and compound interest and this was evident in many scripts. Some candidates used 100 $\left(\frac{2}{7}\right)$ rather than 250 $\left(\frac{5}{7}\right)$ within the calculation for 10%, and some gave an answer of just the interest rather than the total amount that Maria had at the end of the two years.

Part **(c)** was generally well answered apart from those that made the predictable error of working out 20% rather than 80% and giving an answer of \$50 instead of \$200.

The ratio in part **(d)** required values found in the previous parts to be used and many were able to do this successfully for the method mark. Fewer however were able to earn the second mark for simplifying the ratio to its lowest form.

In the final part, those that recognised that a compound interest calculation was required were generally successful. It was pleasing to see a good number of candidates using a multiplier of 1.05 to the power 2 as the most efficient method rather than a two-stage calculation. Many however did a simple interest calculation and scored no marks.

Answer: **(a)** 350, 250, 200 ; **(b)** 275 ; **(c)** 200 ; **(d)** 11 : 8 : 4 ; **(e)** 110.25.

Question 2

In part **(a)**, those candidates that recognised the use of the cosine rule to find LH, and were able to recall it from memory were generally successful in dealing with the arithmetic to obtain the correct answer. The incorrect combination leading to an answer of 197 was rarely seen this year. A small number were unable to state the cosine rule correctly even though they recognised that it should be used. A few regarded triangle WLH as right- angled and attempted Pythagoras'.

In part **(b)**, the sine rule was used well and many candidates were successful in finding angle H first and then using the sine rule to find WJ. A number of candidates used angle W, 36°, in the sine rule and as a result found the side HJ.

In part **(c)**, those that recognised the method of area of triangle = ½ absinC were nearly always successful in obtaining full marks. Some tried to use ½ base × height and made errors in calculating the perpendicular heights while a few others incorrectly regarded the shape WLHJ as a trapezium and used the formula for the area of trapezium.

In part **(d)**, the first bearing was answered very well, the second bearing was rarely answered correctly and was often omitted.

The final part proved challenging for all but the most able who were able to recognise the relationship between cm and km. The majority gave an answer of 1: 200.

Answer: **(a)** 393 to 393.5 ; **(b)** 1212 ; **(c)** 820900 to 822000 ; **(d)(i)** 73, **(ii)** 289 ; **(e)** 20 000 000.

Question 3

The question was generally well answered.

In part **(a)**, most candidates attempted to use the formula for the area of a trapezium and the vast majority were successful in substituting correctly into the formula and evaluating. Some tried to split the trapezium usually into a rectangle and triangle and do a two-stage calculation. This method often led to errors in the area of the triangle. Some candidates did not give three significant accuracy in their final answer and were penalised for answers of 0.88 or even 0.9.

Part **(b)** was well answered with the majority multiplying their answer to part **(a)** by 500.

Fewer were successful with parts **(c)** and **(d)** and although the majority understood that their answer to part **(b)** had to be multiplied by 4.8, many did not convert their answer to standard form. Those that realised that standard form was required were nearly always successful in making the conversion. In part **(d)**, multiplying by 1000 or 100 000 was a common misconception. A few of the candidates did not see the progression from parts **(a)** to **(d)** surprisingly.

In part **(e)**, those that recalled the formula for volume of a cylinder were nearly always able to then calculate the volume of the pipe correctly. Common errors included using $2\pi rh$ or $\frac{1}{3}\pi r^2 h$ to find the volume of the cylindrical pipe.

In part **(f)**, there were many excellent answers showing clear methodology in creating the required fraction to then correctly convert to a percentage. Even those that had previously made errors in the question were often able to demonstrate a correct method for finding the required percentage with their figures. Some obtained the percentage of soil replaced by the pipe instead of the percentage removed without the pipe.

Answer: **(a)** 0.875 ; **(b)** 437.5 ; **(c)** 2.1×10^3 ; **(d)** 2.1×10^9 ; **(e)** 62.8 to 62.84 ; **(f)** 85.6 to 85.7.

Question 4

This graph question proved more challenging to answer than in previous years.

There were as usual some outstanding graphs drawn with perfect solutions to the parts **(d)** to **(f)**, but there were also many examples of work abandoned before the graph had been drawn.

There were mixed responses for part **(a)**, where the difficulty of the function caused some to make calculator errors and rounding errors after a correct substitution. Common errors included – 5.9 for p and 11.8 for r. A few candidates did not state the values of p,q and r, but later in the question, they were correctly plotted on the graph. In these cases, no credit was given for the values in part **(a)** unless they were stated.

The scale caused some difficulty for candidates in plotting the values both horizontally and vertically the most common error was with the point at (0.5, 0.5) which was plotted at (0.5, -0.5) by a large number of candidates. Most candidates realise that a set of points making a curve should be joined by freehand and not straight lines. Many candidates understood the nature of the function and did not join both sections of curves together but equally many did not and incorrectly joined the sections of the graph from x = - 0.3 to 0.3.

In part **(d)**, there were very few correct solutions seen, part **(i)** was better answered then part **(ii)**, but in part **(ii)** even those that recognised the solution could be obtained by solving f(x) = - 4 did not usually consider the **three** intersections of y = - 4 and f(x) and very few drew the line y = - 4 to help.

In part **(e)**, there were numerous correct functions drawn, as well as candidates that did not recognise the linear nature of the function and tried to join the points freehand instead of ruled. Other errors included not extending the function over the required range. Some candidates also created a table of values which spanned all of the x values given in part **(a)** and did not realise that a minimum of 3 points would suffice to draw the line.

Part **(f)** was often omitted and those that responded often talked about the functions joining together or crossing rather than approaching each other. In the second part, many calculations were seen often leading to an answer of 3.03 thus not appreciating the nature of the gradients of the asymptote g(x) to the function f(x) where the gradient will tend to 3 for large values of x.

Answer: **(a)** - 6.1, 5, 11.9; **(b)** Correct scales; **(c)** Correct plots and curve; **(d)(i)** 0.45 to 0.5, **(ii)** - 2.4 to –2.1, - 0.5 to – 0.4, 0.3 to 0.4; **(e)** correct $g(x)$ drawn; **(f)(i)** Gets closer , **(ii)** 3.

Question 5

Part **(a)(i)** was answered very well as was part **(ii)** apart from the candidates who added the fractions for rain on both days instead of multiplying. Part **(iii)** required a little more strategy and fewer candidates were successful here, with a common error being to multiply $\frac{5}{6}$ by $\frac{1}{4}$, the probabilities of no rain on Monday and no rain on Tuesday.

Part **(b)** caused more problems, in the first part, a correct method was often seen, but arithmetic errors in evaluating the $\frac{1}{3}$ cubed were frequent with $\frac{1}{9}$ a common error. Very few correct responses to the second part were seen, most candidates tried to list combinations, and a common error was to only consider the three combinations of hitting the target once only. Those that did try to consider the other combinations usually omitted at least one of them. The most successful method seen was to calculate the probability of not hitting the target at all in the three throws and then subtracting this answer from 1.

In part **(c)**, both parts proved difficult for most candidates although the first part was better answered. Some wrote down a correct method for but then made an arithmetic error in giving 64 as the denominator rather than 256. The final part was often omitted.

Answer: **(a)(i)** $\frac{1}{3}, \frac{1}{4}, \frac{5}{6}$, **(ii)** $\frac{1}{2}$, **(iii)** $\frac{4}{9}$; **(b)(i)** $\frac{1}{27}$, **(ii)** $\frac{19}{27}$; **(c)(i)** $\frac{27}{256}$, **(ii)** $\left(\frac{3}{4}\right)^{n-1} \times \frac{1}{4}$.

Question 6

The question addressed two main topics, vectors and transformations and the parts of the question involving vectors were answered poorly in general, although transformations was not answered as well as in previous sessions.

In part **(a)**, the majority of candidates made an attempt at part **(i)** and were sometimes correct provided that care was taken with the direction of the vectors. The remaining three parts of **(a)** were not understood by the majority particularly the term 'position vector'. Those that did make some attempt at parts **(iii)** and **(iv)** often earned a method mark for describing the path in terms of **p** and **q** but were then not able to simplify the vectors.

In part **(b)**, answers again were very mixed and some candidates sensibly used a sketch to help. For IGCSE it is expected that vectors are written in columns vertically $\begin{pmatrix} x \\ y \end{pmatrix}$ and that co-ordinates are written horizontally (x, y). In some regions this would appear not to be the convention. Candidates were not penalised on this occasion for use of incorrect convention.

In part **(c)**, those that recognised the matrix as a rotation usually went on to describe it accurately and score all 3 marks, a significant number thought the matrix to be a reflection and part **(ii)** was often answered incorrectly as a result. Those that considered the recognised method of pre-multiplying the co- ordinate by the matrix were usually successful however in this part.

Part **(d)** again required some recognition of matrix transformations which proved difficult for the majority. The identity matrix was a common incorrect answer here.

Answer: **(a)(i)** $-\mathbf{p} + \mathbf{q}$, **(ii)** $\frac{2}{3}(-\mathbf{p} + \mathbf{q})$, **(iii)** $-\frac{2}{3}\mathbf{p} - \frac{1}{3}\mathbf{q}$, **(iv)** $\frac{1}{3}\mathbf{p} + \frac{2}{3}\mathbf{q}$; **(b)(i)** (4, -2), **(ii)** $\begin{pmatrix} -3 \\ 4 \end{pmatrix}$;

(c)(i) Rotation, 90° clockwise, centre (0, 0), **(ii)** (3, - 5) ; **(d)** $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$.

Question 7

In part **(a)**, various methods were used including an algebraic approach and trial and improvement. Candidates had mixed success with the algebraic approach, often struggling to process the denominator in the fraction, 17 + *a* often became 17*a* during the calculation. Trial and improvement was used successfully by many and this method either scored all 3 marks or zero. Methods involving trial and improvement are only given marks when they lead to a correct answer.

Parts **(ii)** and **(iii)**, depended on responses to part **(i)** and a follow through mark was allowed in part **(ii)** provided an integer answer was given in part **(i)**.

In part **(b)**, there were many very good answers scoring all 6 marks. Some gave the quartiles as 150 and 50 without taking the readings and some also made common errors giving 31 and 140 in (v) and (vi).

Part **(c)**, answers were very mixed and those that were able to calculate the correct frequencies of 150 and 125 from the histogram often went on to correctly obtain the estimated mean. Common errors for the first two parts included answers of 75 and 125 or 3 and 5 which were the heights of the bars of the histogram.

For the estimated mean, many used class widths instead of mid-values to multiply by the frequencies. The best solutions wrote clear mid-values, then added three products of mid-values and frequencies before division by 375.

Answer: **(a)(i)** 3, **(ii)** 20, **(iii)** 7 ; **(b)(i)** 14 to 14.2, **(ii)** 6, **(iii)** 28, **(iv)** 22, **(v)** 31.5 to 32, **(vi)** 60; **(c)(i)** 150, **(ii)** 125, **(iii)** 55.8.

Question 8

Parts **(a)(i)** to **(a)(iii)** were often well answered. Part **(a)(i)** was nearly always done correctly and the rearrangement of the formula in part **(ii)** was tackled confidently by the majority. Some, however, having successfully carried out the two steps required, then incorrectly cancelled down thus spoiling the final answer.

In part **(iii)**, some restarted using the original formula and substituted 377 in place of A and 6 in place of r, others used their answer to part **(ii)**. This was tackled reasonably well by the majority.

Part **(iv)** proved difficult and although many made a start and substituted 1200 into the original formula they were unable to make further progress because the subtle recognition, that in this case $h = r$, was not made and the algebra was often left unfinished. Those that made the connection were nearly always successful in obtaining the correct solution. Trial and improvement was another favoured method and provided the answer was given within the required range then full marks were given for this method. Accuracy was an issue for some with an answer of 9.8 commonly given when three significant figures or better are required.

In part **(b)** answers were very mixed and very few candidates were successful in obtaining full marks.

Part **(i)** was often correct, but for some, confusion with the units led to an answer of 1.34.

Part **(ii)** and **(iii)** were often correct but also other variations with $45x$, $48(x - 75)$ and use of 0.45 and 0.48 were seen regularly.

In the final part, some were able to set up a correct initial equation, but errors included a sign error with the 7 or one of the expressions perhaps multiplied by 7. Clearing the fractions also proved difficult for those that were able to set up the equation, with the single term of 7 often overlooked when multiplying through by 45 and/or 48.

It was pleasing, however, to see a number of candidates obtaining correct solutions to this challenging part of the question.

Answer: **(a)(i)** 439.8 to 440, **(ii** $\frac{A - 2\pi r^2}{2\pi r}$, **(iii)** 3.99 to 4.01, **(iv)** 9.77 to 9.78 ; **(b)(i)** 134 , **(ii)** $\frac{x}{45}$, **(iii)** $\frac{x - 75}{48}$, **(iv)** 3915.

Question 9

There were many excellent answers to this question scoring full marks. Equally many candidates were challenged by the content here and struggled to complete the question.

In part **(a)**, the majority were able to obtain one of the required inequalities with a common error to consider y and 4 rather than x and 4. The inequality signs were not commonly both correctly given and an extra mark was awarded where both were written correctly.

In part **(b)**, scaling was done accurately and in part **(c)**, at least one correct boundary line was often drawn depending on answers to part **(a)**. A follow through mark was allowed in the case of $y = 4$ instead of $x = 4$. The region was correctly given less frequently, usually owing to an incorrect boundary or an incorrect inequality sign in part **(a)**.

In part **(d)**, those that had correctly answered part **(c)** invariably obtained the correct solutions. Some had incorrect regions but were able to use a 'problem solving' approach to find at least one of the solutions. For many with incorrect regions, however, trial and error was used unsuccessfully.

Answer: **(a)** $x + y \leq 12$, $x > 4$; **(b)** correct scales **(c)** Three correct ruled lines and shading of region not required ; **(d)(i)** 18, **(ii)** 27.

MATHEMATICS WITH COURSEWORK

Paper 0581/05

Paper 5 Coursework (Core)

General comments

In contrast to the June examination session few Centres submitted coursework for this session.

The coursework seen was of a high standard, comparing favourably with work submitted in previous years. Generally, the tasks allowed candidates the freedom to investigate problems for themselves and were not over prescriptive. This benefited candidates entered at the Core level since many were able to demonstrate high levels of mathematical skill in manipulating algebraic expressions, even though this sometimes contained minor errors. The majority of written work shows that candidates have a clear understanding of the assessment criteria and are able to structure their write-up appropriately. For example in a mathematical investigation, outlining a strategy, breaking the problem down into smaller tasks, following through with calculations in a structured way, linking diagrams, tables and calculations with text and linking different aspects of the task together to form an overall conclusion.

It was pleasing to see that most Centres annotated candidates' work with helpful comments, making clear the reasons for the award of particular marks. Centres are to be commended for the quality of assessment, both in terms of accuracy and evidence provided.

MATHEMATICS WITH COURSEWORK

Paper 0581/06

Paper 6 Coursework (Extended)

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