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MATHEMATICS

Paper 0580/11
Paper 11 (Core)

General comments

Overall there was a fairly positive response by candidates to the questions. There seemed to be better consideration of sensible answers this year with apparently less evidence of impossible answers. The checking of answers as to their suitability still however needs to be strongly encouraged when preparing candidates for the examination. The number of 'no responses' or no evidence of any understanding in the responses is a cause of concern. Candidates are at a considerable disadvantage if all topics in the syllabus are not covered in teaching and quite a number of straightforward questions were missed out by some candidates, possibly in some measure due to them having no knowledge of the topic.

Although, as usual, there were many low-scoring candidates, the vast majority showed understanding of most questions, giving reasonable, if not always correct, responses. There was a substantial proportion of very good scripts well in the grade C area.

Working within the space provided and with clarity is improving and the importance of doing this should be stressed. Some did write with very small letters and figures; constructions, particularly arcs, were at times very difficult to see. A reminder to candidates prior to the examination to use pen or pencil appropriately and to show all working clearly, together with firm pencil work is essential advice. There was evidence that a significant number of candidates did not have the necessary basic geometrical instruments. There was not much evidence of rough paper being issued this year and Centres should be aware that this is neither necessary nor to the candidates' advantage, as it discourages showing working in the allocated areas.

Comments on specific questions

Question 1

Putting surplus brackets around 2×8 was not penalised, resulting in a good response to the question. A few candidates re-wrote the question, sometimes arriving at $16 - 1 = 15$ which did not answer the question. A particular error was to include the first minus sign inside the bracket.

Answer: $2 \times 8 - (5 - 4) = 15$

Question 2

Although this question was answered very well, some candidates did not go back to the original values but gave decimal equivalents. The mark was generally gained in this case, providing it was made clear which item the decimal referred to. Some candidates put the numbers starting with the largest – either through carelessness or misreading – in which case the mark was not awarded.

Answer: $28\% < 0.283 < \frac{2}{7}$

Question 3

Generally candidates who knew how to cube a number gained the mark for this question. No specific rounding was asked for but a few who cubed correctly failed to give one of the three acceptable answers (i.e. rounded to 1, 2, or 3 decimal places). Many did not understand the mathematical operation and a considerable variety of incorrect responses were seen.

Answer: 12.2 or 12.17 or 12.167 cm^3

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Question 4

This question on bearings was very poorly done, with few candidates understanding how a bearing is measured. Common incorrect methods seen included 360 – 72 and 180 – 72. Making use of the diagram by writing 72° and/or 108° not only resulted in 1 mark but led some to the correct answer. Although 'NOT TO SCALE' means the answer cannot be found from measuring, the diagrams are intended to be close to the correct value. Then if candidates understand the rule for bearings they should have seen this was between 180° and 270°.

Answer: 252°

Question 5

Although responses to upper and lower bounds are improving, this question is still one of the least well done. Some confusion still exists with the upper bound value being incorrectly given as 16 499, the main reason for some candidates obtaining only 1 of the two marks. Many did not add and subtract 500 (half of one thousand) causing errors of 15 000, 15 050, 15 950 and 15 999.5 to be seen for the lower bound, with equivalent values for the upper bound.

Answer: $15\,500 \le N < 16\,500$

Question 6

Most candidates knew that mixed numbers needed to be changed to improper fractions, so gaining the method mark. Many of these did go on to a correct final answer (form and cancelling were not essential for the second mark) but errors in the process for multiplication of fractions were common. Finding a common denominator and adding, inverting a fraction as if attempting division, and various other incorrect attempts at resolving the calculation were seen.

Answer: $4\frac{8}{28}$ or $\frac{120}{28}$ or any equivalent fraction or mixed number

Question 7

This question on construction was not attempted by a substantial number of candidates. Possibly, as referred to above, some may not have had the correct instruments. However, relating the locus of points equidistant from two lines to bisecting the angle between them was not appreciated by many. Some had an idea about the line required but did not know the construction, while others produced line bisectors or made-up arcs for an otherwise correct line.

Answer: A correct angle bisector (±2°) with two pairs of correct arcs.

Question 8

There was clearly some guesswork for the choices offered, but 4 was the most common wrong answer for the prime number while 0.3333 and $\frac{5}{2}$ were favoured for the irrational number. The term prime was known by most candidates but the term irrational was apparently not in the vocabulary of most candidates. Another common response was to give more than one answer, which automatically meant the mark could not be awarded. Candidates need to read the question carefully and realise that 'a' or 'an' means just one from the list.

Answers: **(a)** $\sqrt{25}$ or 5 **(b)** $\sqrt{8}$

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Question 9

(a) Most candidates gave the correct response and in the 24-hour system. A time of 2:23 was common and without the pm it was not correct. Although a time was asked for, quite a number indicated a time period by using hours (or h) and/or minutes in their answer which was not awarded marks. The problem of number of minutes in an hour taken as 100 instead of 60 producing an answer of 13 83 is still evident with some candidates.

(b) Many candidates ignored the 2 hours 30 minutes in the stem of the question and used their answer to part **(a)** as a period of time. Again the 100 minutes in an hour error caused division by 230 to be common. Only a few did not know the correct formula but only a minority gained both marks in this part.

Answers: **(a)** 14 23 or 2 23 pm **(b)** 94 km/h

Question 10

Generally there was a good response to this question on simultaneous equations, with most following the elimination method, while some carefully done substitutions were successful. However, many candidates gained only 1 mark as they did not multiply correctly or missed multiplying the constant term. A number missed the method mark as they added, or did mixed addition and subtraction, instead of subtracting after multiplication. Manipulation of directed numbers caused many to lose marks. Candidates should also realise that examination questions on simultaneous equations always result in integer or simple fraction or mixed number answers enabling them to clearly see when they have made an error.

Answer: $x = 4$ and $y = 5$

Question 11

(a) Most candidates gave a ruled line but this quite often went to the wrong point due to poor reading of the grid scale. Some thoughtlessly felt the line had to go to the top right hand corner. Lines with negative gradients also featured significantly.

(b) Many gained the mark from follow-through in this part. Some calculated the kilometre equivalent to 12 miles, rather than reading it from the graph.

Answers: **(a)** ruled line from (0, 0) to (24, 15) **(b)** 18.8 to 19.6 km

Question 12

Many candidates did not attempt drawing a net or appeared to have little idea how to approach the task. Attempts at solids were often seen. The triangles presented the greatest problem and very few used compasses to form the equilateral triangles (not essential but good technique). More often than not the triangles had a height of 4 centimetres, but rectangles, when drawn, were usually correct.

Answer: Correct net layout with two 7-by-4 rectangles and two equilateral triangles correctly positioned.

Question 13

(a) Apart from some reversing coordinates, this part was done correctly by candidates of all abilities.

(b) Some candidates did not understand vectors and a 2-by-2 matrix was often seen in this part. Inversion of the entries was also quite common.

(c) This part did present problems for many, and a great variety of answers resulted. Some attempted to extend the grid for their solution, which can never produce a correct answer.

Answers: **(a)** (–2, 1) **(b)** $\begin{pmatrix} 6 \\ 4 \end{pmatrix}$ **(c)** H at (2, –2)

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Question 14

(a) This part was generally well done but the wrong answer of 3 was often seen. The other significant error was to quote the whole calculation, namely $(-3)^3 = -27$ in the answer space. Candidates must observe what the question is asking, in this case the value of *p*.

(b) Negative powers were not really understood by many candidates and answers of $\frac{1}{6}$, -6, $-\frac{1}{6}$ and $(\frac{1}{6})^{-1}$ were the most common wrong answers in this part.

(c) Many candidates achieved one of the two marks available here, usually the integer 4. A power of 1 was common, again showing weakness on directed number manipulation.

Answers: **(a)** –3 **(b)** 6 **(c)** $4s^3$ or $\frac{4}{s^{-3}}$

Question 15

(a) Many gained full marks on this part but a significant proportion substituted correctly but could then not resolve the calculation. Addition and subtraction rather than multiplication and division were applied by many candidates.

(b) This part was by no means so well done, and certainly not by those who had failed to resolve part **(a)** correctly. Many seemed to think that a numerical substitution was needed and so did not produce an algebraic expression. A denominator of 3 and $J - 3$ were very common errors.

Answers: **(a)** 15 **(b)** $(d =)\ \dfrac{3J}{m}$

Question 16

The whole of this question was very poorly done, in particular part **(b)**.

(a) Some candidates produced the 3 significant figures, 167, and others gave an answer in correct standard form but few achieved both aspects correctly. Some thought that two answers were required as two skills were referred to.

(b) This was the worst done question on the paper. It seemed that the method of multiplying by 1000 and dividing by 3600 was beyond all but the most able core candidates. Dividing by 60 and multiplying by other powers of 10 were common. A very large proportion of candidates clearly had no idea how to tackle this conversion.

Answers: **(a)** 1.67×10^3 **(b)** 464 or 463.8(3…..) m/s

Question 17

(a) Most candidates coped with this single common factor factorisation in this part. However, some carelessly missed off the *y* from the bracket and others tried to take out two factors. A small proportion of candidates combined the parts to give an answer of $9x^3y$ or similar. Algebraic questions are marked at final answer stage so this extra would not be ignored.

(b) Most candidates correctly expanded the first bracket but did not cope with the directed number multiplication required for the second bracket. Thus 1 mark was very common. Of those who did correct expansions it was very common to see signs changing when like terms were combined. Also seen at times was an attempt to multiply out two brackets.

Answers: **(a)** $x(5x + 4y)$ **(b)** $5x + 13y$

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Question 18

Writing down clear geometric reasons for the size of angles is a skill which was not very evident from most candidates. Once again in this question the diagram should have helped to at least deduce the approximate size of the angles and it was surprising to see angles totally impossible for the situation.

(a) Many gained the mark for the angle but could not write down a phrase containing the key words of the reason.

(b) The mark here was often gained as a follow-through, but many felt the angle was 90°. The geometric properties should be the key when diagrams are not to scale. It was not sufficient to state that "a triangle adds to 180°" since that does not indicate what it is about the triangle that adds to 180°.

(c) Although this part was the most straightforward mark, it was omitted by many more than the other parts. Of those who did attempt it the reason requiring one word, 'opposite' was often gained even when candidates had not given the same response as part **(b)**. Some simply said it was the same as part **(b)** which was not a geometric reason.

In geometric questions many candidates are having difficulty coping with angles given by 3 letters. It is essential that they become familiar with this notation as it will almost always be used rather than specifying an angle with one letter.

The lack of a degree symbol was not penalised. Key (required) words are the words not in brackets below.

Answers: **(a)** 75°, reason - angle(s) (on a straight) line (=) 180 or straight line 180.
(b) 67°, reason - angle(s) (in a) triangle (sum to) 180 or exterior angle (of a triangle is the) sum of interior (opposite) angles.
(c) 67°, reason - (vertically) opposite.

Question 19

(a) Most candidates managed to divide 240 by 4 to obtain the correct answer.

(b) In this part, regardless of the instructions in bold, quite a number gave a measured angle. Without correct working, a mark was not awarded. Another error was to start with 54 (presumably measured) and calculate 36 yellow cars, which again was not credited.

(c) This part was not well done at all.

(i) This part simply required basic use of a protractor and realising it was an angle greater than 90°. There was also confusion as to whether an angle or number of cars was required even though the question stated 'angle'.

(ii) In this part, many divided their last answer by 240 instead of 360, following the confusion in part **(i)**. Those who understood percentages usually achieved these marks even though it was often due to a follow-through from an incorrect part **(i)**. Incorrect rounding or truncating of answers at times caused the loss of an accuracy mark in this part.

Answers: **(a)** 60 **(b)** 54 from correct working **(c)(i)** 116 or 117 or 118 **(ii)** 32.2 or 32.5 or 32.8 %

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MATHEMATICS

Paper 0580/12
Paper 12 (Core)

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Working within the space provided and with clarity is improving and the importance of doing this should be stressed. Some did write with very small letters and figures; constructions, particularly arcs, were at times very difficult to see. A reminder to candidates prior to the examination to use pen or pencil appropriately and to show all working clearly, together with firm pencil work is essential advice. There was evidence that a significant number of candidates did not have the necessary basic geometrical instruments. There was not much evidence of rough paper being issued this year and Centres should be aware that this is neither necessary nor to the candidates' advantage, as it discourages showing working in the allocated areas.

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Answer: $2 \times 8 - (5 - 4) = 15$

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Although this question was answered very well, some candidates did not go back to the original values but gave decimal equivalents. The mark was generally gained in this case, providing it was made clear which item the decimal referred to. Some candidates put the numbers starting with the largest – either through carelessness or misreading – in which case the mark was not awarded.

Answer: $28\% < 0.283 < \frac{2}{7}$

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Generally candidates who knew how to cube a number gained the mark for this question. No specific rounding was asked for but a few who cubed correctly failed to give one of the three acceptable answers (i.e. rounded to 1, 2, or 3 decimal places). Many did not understand the mathematical operation and a considerable variety of incorrect responses were seen.

Answer: 54.9 or 54.87 or 54.872 cm^3

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Question 4

This question on bearings was very poorly done, with few candidates understanding how a bearing is measured. Common incorrect methods seen included 360 – 72 and 180 – 72. Making use of the diagram by writing 72° and/or 108° not only resulted in 1 mark but led some to the correct answer. Although 'NOT TO SCALE' means the answer cannot be found from measuring, the diagrams are intended to be close to the correct value. Then if candidates understand the rule for bearings they should have seen this was between 180° and 270°.

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Most candidates knew that mixed numbers needed to be changed to improper fractions, so gaining the method mark. Many of these did go on to a correct final answer (form and cancelling were not essential for the second mark) but errors in the process for multiplication of fractions were common. Finding a common denominator and adding, inverting a fraction as if attempting division, and various other incorrect attempts at resolving the calculation were seen.

Answer: $2\frac{30}{33}$ or $\frac{96}{33}$ or any equivalent fraction or mixed number

Question 7

This question on construction was not attempted by a substantial number of candidates. Possibly, as referred to above, some may not have had the correct instruments. However, relating the locus of points equidistant from two lines to bisecting the angle between them was not appreciated by many. Some had an idea about the line required but did not know the construction, while others produced line bisectors or made-up arcs for an otherwise correct line.

Answer: A correct angle bisector (±2°) with two pairs of correct arcs.

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(a) Many candidates gave the correct response and in the 24-hour system. A time of 3:18 was common and without the pm it was not correct. Although a time was asked for, quite a number indicated a time period by using hours (or h) and/or minutes in their answer, which was not awarded marks. The problem of number of minutes in an hour taken as 100 instead of 60 producing an answer of 14 78 is still evident with some candidates.

(b) Many candidates ignored the 4 hours 30 minutes in the stem of the question and used their answer to part **(a)** as a period of time. Again the 100 minutes in an hour error caused division by 430 to be common. Only a few did not know the correct formula but only a minority gained both marks in this part.

Answers: **(a)** 15 18 or 3 18 pm **(b)** 98 km/h

Question 10

Generally there was a good response to this question on simultaneous equations with most following the elimination method, while some carefully done substitutions were successful. However, many candidates gained only 1 mark as they did not multiply correctly or missed multiplying the constant term. A number missed the method mark as they added, or did mixed addition and subtraction, instead of subtracting after multiplication. Manipulation of directed numbers caused many to lose marks. Candidates should also realise that examination questions on simultaneous equations always result in integer or simple fraction or mixed number answers enabling them to clearly see when they have made an error.

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Answers: **(a)** ruled line from (0, 0) to (24, 15) **(b)** 11 to 11.5 km

Question 12

Many candidates did not attempt drawing a net or appeared to have little idea how to approach the task. Attempts at solids were often seen. The triangles presented the greatest problem and very few used compasses to form the equilateral triangles (not essential but good technique). More often than not the triangles had a height of 4 centimetres, but rectangles, when drawn, were usually correct.

Answer. Correct net layout with two 7-by-4 rectangles and two equilateral triangles correctly positioned.

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(a) Apart from some reversing coordinates, this part was done correctly by candidates of all abilities.

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(c) This part did present problems for many, and a great variety of answers resulted. Some attempted to extend the grid for their solution, which can never produce a correct answer.

Answers: **(a)** (–2, 1) **(b)** $\begin{pmatrix} 6 \\ 4 \end{pmatrix}$ **(c)** H at (–1, 2)

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Question 14

(a) This part was generally well done but the wrong answer of 3 was often seen. The other significant error was to quote the whole calculation, namely $(-3)^3 = -27$ in the answer space. Candidates must observe what the question is asking, in this case the value of *p*.

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Answers: **(a)** 12 **(b)** $(d =) \dfrac{3J}{m}$

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The whole of this question was very poorly done, in particular part **(b)**.

(a) Some candidates produced the 3 significant figures, 167, and others gave an answer in correct standard form but few achieved both aspects correctly. Some thought that two answers were required as two skills were referred to.

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Answers: **(a)** 1.67×10^3 **(b)** 464 or 463.8(3…..)

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(a) Most candidates coped with this single common factor factorisation in this part. However, some carelessly missed off the *m* from the bracket and others tried to take out two factors. A small proportion of candidates combined the parts to give an answer of $10\,mp^3$ or similar. Algebraic questions are marked at final answer stage so this extra would not be ignored.

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Answers: **(a)** $p(3m + 7p)$ **(b)** $14m + 23p$

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Question 18

Writing down clear geometric reasons for the size of angles is a skill which was not very evident from most candidates. Once again in this question the diagram should have helped to at least deduce the approximate size of the angles and it was surprising to see angles totally impossible for the situation.

(a) Many gained the mark for the angle but could not write down a phrase containing the key words of the reason.

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(b) 67°, reason - angle(s) (in a) triangle (sum to) 180 or exterior angle (of a triangle is the) sum of interior (opposite) angles.
(c) 67°, reason - (vertically) opposite.

Question 19

(a) Most candidates managed to divide 240 by 4 to obtain the correct answer.

(b) In this part, regardless of the instructions in bold, quite a number gave a measured angle. Without correct working, a mark was not awarded. Another error was to start with 54 (presumably measured) and calculate 36 yellow cars, which again was not credited.

(c) This part was not well done at all.

(i) This part simply required basic use of a protractor and realising it was an angle greater than 90°. There was also confusion as to whether an angle or number of cars was required even though the question stated 'angle'.

(ii) In this part, many divided their last answer by 240 instead of 360, following the confusion in part **(i)**. Those who understood percentages usually achieved these marks even though it was often due to a follow-through from an incorrect part **(i)**. Incorrect rounding or truncating of answers at times caused the loss of an accuracy mark in this part.

Answers: **(a)** 60 **(b)** 54 from correct working **(c)(i)** 116 or 117 or 118 **(ii)** 32.2 or 32.5 or 32.8%

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MATHEMATICS

Paper 0580/21
Paper 21 (Extended)

General comments

The level of the paper was such that all candidates were able to demonstrate their knowledge and ability and the full range of marks was scored. The paper was again challenging for the most able this year and very few candidates scored full marks. There was no evidence at all that candidates were short of time as almost all attempted the last few questions. A few Examiners reported a number of candidates who should have been entered for the Core paper but this was less than last year. Failure to give answers to the correct degree of accuracy continued to be a concern this year. Candidates need to read the general rubric carefully at the start. They also need to make sure that they have noted the accuracy requirements of particular questions in their checks at the end of the paper. Examiners also reported an increase in premature approximation during a calculation which almost always leads to an incorrect answer.

Comments on specific questions

Question 1

This question on symmetry was reasonably well answered by over half the candidates but some of the less able suggested 0 or 3 as the answer for part **(a)** and 3 or 6 for part **(b)**. Candidates should be aware that tracing paper and a ruler are useful aids to answering this question. There was a welcome absence of any reference to turns or angles.

Answers: **(a)** 6 **(b)** 0

Question 2

This question on prime numbers was very well done. The one error that many candidates made was to choose 51 as the second prime number.

Answer: 47 53

Question 3

This was intended as an order of operations question using a calculator. Many candidates chose not to show any working and failed to work to sufficient accuracy (which should be at least 4 significant figures) to obtain the correct answer. Only about half the candidates answered this question correctly.

Answer: -0.577(350…)

Question 4

Less than half the candidates were able to deal with this indices question. Most could arrive at 1¼ but x^4 proved to be much more difficult. This question proved to be a very good indicator of the candidate's general ability on this paper.

Answer: 1¼ x^4

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Question 5

This number question also reflected the general ability of the candidate, with the weaker candidates often finding the percentage increase or using the wrong base year in the denominator.

Answer: 161%

Question 6

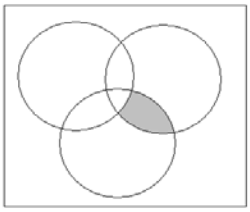
Most candidates were unable to answer this question. Many calculated the matrix 5**A** + **B** whilst others attempted $5\mathbf{A}^{-1} + \mathbf{B}^{-1}$. Those that did start out correctly were unable to handle either the negative signs or else could not multiply correctly by zero. Some very able candidates made errors on this question.

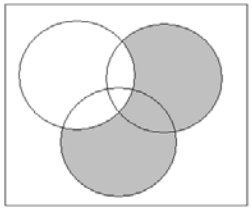
Answer: 5

Question 7

This was generally well done by all but the weaker candidates. The most common error was to include the intersection of all 3 sets.

Answer:





Question 8

Quite a large number of candidates found the gradient of *AB*, others the mid-point of *AB* and even a few found the equation of *AB*. Those that used a small sketch quickly realised that this was a simple question on Pythagoras.

Answer: 5

Question 9

This question on simultaneous equations was probably the best answered question on the paper. The topic is well understood by all candidates whatever method is taught to deal with it. Even low-scoring candidates gained 3 marks here.

Answer: $x = ½$ $y = 3$

Question 10

This remains a poorly understood topic on the syllabus. A large number of candidates ignored the square of the speed and used direct or inverse proportion.

Answer: 245

Question 11

This question on bounds was much better answered this year. There seems to be a much clearer idea of what the bounds are and there was a welcome absence of numbers ending in 4 or of recurring decimals. However quite a large number of candidates found the perimeter first and then attached bounds to that.

Answer: 258 cm

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Question 12

This question on simplifying an expression was not well done and whilst most candidates scored 1 or 2 marks for algebraic manipulation, both the squaring and the multiplication by -4 were handled with a lack of care. The very common errors were to fail to reverse the signs when multiplying by -4 or to leave out an x term when squaring. A few candidates attempted calculating 16 – 4 first. Very careless mistakes in the working were often seen and some candidates divided the final expression by a common factor or invented an equation to solve.

Answer: $-36x^2 + 48x$

Question 13

This question on solving an inequality was generally very well done. The most common error was to fail to reverse the inequality symbol or else to treat it as an equals sign and find a solution.

Answer: $x \geq 0.8$

Question 14

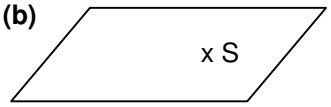
This question on compound interest was understood only by the most able candidates. The use of months confused many candidates and also quite a number of answers assumed that the question was on simple interest. There seemed to be much evidence that the question had not been properly read, particularly as the word 'interest' in bold and the accuracy requirement were often ignored.

Answer: \$11.50

Question 15

There were considerably fewer non-vector answers this year and an almost complete absence of column vectors as well. However, many candidates ignored the instruction to give a single vector whilst others had the direction of the vector reversed, particularly in part **(a)(ii)**. Some candidates failed to indicate the answer in part **(b)** with a cross, which made it almost impossible to mark. This topic remains one of great difficulty for the majority of candidates.

Answers: **(a)(i)** $\overrightarrow{OQ}$ or $2\overrightarrow{OM}$ **(ii)** $\overrightarrow{RM}$ or $\overrightarrow{MP}$ or $\frac{1}{2}\overrightarrow{RP}$ **(b)**



Question 16

Part **(a)** on calculating times was generally very well answered. In part **(b)** the weaker candidates incorrectly found the speed for each part of the journey and then the average of those two speeds. The other common error in this part was to divide by 1.3 instead of 1.5 hours. In part **(c)** many candidates simply subtracted 85 from 360 or else found the anticlockwise angle, so that 275 and 95 were very common incorrect answers.

Answers: **(a)** 08 10 **(b)** 4 km/h **(c)** 265°

Question 17

It was clear that candidates knew what was required by this question on exchange rates and generally gained marks on it. However, Examiners reported problems of premature approximation, failing to take notice of the accuracy requirement and lack of clear working so that marks were difficult to award when answers were wrong. In part **(b)**, which was less well done, the common error was to use the wrong year data in the denominator.

Answers: **(a)** £261.48 **(b)** 3.86%

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Question 18

This question on the equation of a straight line was very badly done except by the most able. Most candidates scored 1 mark for the parallel gradient but were unable to obtain any of the intercepts with the axes in order to find the value of *c*. Some assumed that *OA* = *OB*.

Answer: $m = 2$ $c = -8$

Question 19

Most candidates were able to use their knowledge of geometry in this question but it was very common to see incorrect assumptions being made about the diagram, for example, that angle *BOC* = angle *BCO* or that the triangle *OBC* was equilateral.

Answers: **(a)** 44° **(b)** 158°

Question 20

This question on cumulative frequency was probably the second best answered question on the paper. There was some misreading of the scales but most candidates clearly understood this topic.

Answer: **(a)** 38 h **(b)** 45 to 46 h **(c)** 15 to 16 h **(d)** 10 or 11

Question 21

This speed-time question was probably the second worst answered on the paper and was a very good discriminator for the most able candidates. Part **(a)** usually allowed candidates to gain at least one mark for the gradient of the line but almost no correct answers were seen for part **(b)**. The very common incorrect answer of 480 betrayed a lack of understanding that the distance travelled is the area under the *v-t* graph *down to the time axis.* Most candidates only found the area of the triangle under the graph down to the truck line.

The other major error was to use distance = speed x time which, of course, only applies to constant speed.

Answer: **(a)** 0.8 m/s^2 **(b)** 960 m

Question 22

This whole question on functions was well done except by the least able quarter of the candidates, who were generally unable to score any marks. The few errors there were, were caused in part **(a)** by using fg(0), in part **(b)** by finding f(x) × g(x) and in part **(c)** by incorrect algebra.

Answers: **(a)** 2 **(b)** $4x^3 + 5$ **(c)** $\frac{3x-1}{2}$

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MATHEMATICS

Paper 0580/22
Paper 22 (Extended)

General comments

The level of the paper was such that all candidates were able to demonstrate their knowledge and ability and the full range of marks was scored. The paper was again challenging for the most able this year and very few candidates scored full marks. There was no evidence at all that candidates were short of time as almost all attempted the last few questions. A few Examiners reported a number of candidates who should have been entered for the Core paper but this was less than last year. Failure to give answers to the correct degree of accuracy continued to be a concern this year. Candidates need to read the general rubric carefully at the start. They also need to make sure that they have noted the accuracy requirements of particular questions in their checks at the end of the paper. Examiners also reported an increase in premature approximation during a calculation which almost always leads to an incorrect answer.

Comments on specific questions

Question 1

This question on symmetry was reasonably well answered by over half the candidates but some of the less able suggested 0 or 3 as the answer for part **(a)** and 3 or 6 for part **(b)**. Candidates should be aware that tracing paper and a ruler are useful aids to answering this question. There was a welcome absence of any reference to turns or angles.

Answers: **(a)** 6 **(b)** 0

Question 2

This question on prime numbers was very well done. The one error that was made was to miss out 41 and give 43 as the second prime number.

Answer: 37 41

Question 3

This was intended as an order of operations question using a calculator. Many candidates chose not to show any working and failed to work to sufficient accuracy (which should be at least 4 significant figures) to obtain the correct answer. Only about half the candidates answered this question correctly.

Answer: -0.577(350…)

Question 4

Less than half the candidates were able to deal with this indices question. Most could arrive at 1¼ but x^4 proved to be much more difficult. This question proved to be a very good indicator of the candidate's general ability on this paper.

Answer: 1¼ x^4

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Question 5

This number question also reflected the general ability of the candidate, with the weaker candidates often finding the percentage increase or using the wrong base year in the denominator.

Answer: 139%

Question 6

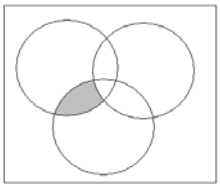
Most candidates were unable to answer this question. Many calculated the matrix 5**A** + **B** whilst others attempted $5\mathbf{A}^{-1} + \mathbf{B}^{-1}$. Those that did start out correctly were unable to handle either the negative signs or else could not multiply correctly by zero. Some very able candidates made errors on this question.

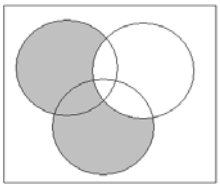
Answer: 8

Question 7

This was generally well done by all but the weaker candidates. The most common error was to include the intersection of all 3 sets.

Answer:





Question 8

Quite a large number of candidates found the gradient of *AB*, others the mid-point of *AB* and even a few found the equation of *AB*. Those that used a small sketch quickly realised that this was a simple question on Pythagoras.

Answer: 10

Question 9

This question on simultaneous equations was probably the best answered question on the paper. The topic is well understood by all candidates whatever method is taught to deal with it. Even low-scoring candidates gained 3 marks here.

Answer: $x = ½$ $y = 3$

Question 10

Proportionality remains a poorly understood topic on the syllabus. A large number of candidates ignored the square of the speed and used direct or inverse proportion.

Answer: 128

Question 11

This question on bounds was much better answered this year. There seems to be a much clearer idea of what the bounds are and there was a welcome absence of numbers ending in 4 or of recurring decimals. However quite a large number of candidates found the perimeter first and then attached bounds to that.

Answer: 198 cm

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Question 12

This question on simplifying an expression was not well done and whilst most candidates scored 1 or 2 marks for algebraic manipulation, both the squaring and the multiplication by -4 were handled with a lack of care. The very common errors were to fail to reverse the signs when multiplying by -4 or to leave out an x term when squaring. A few candidates attempted calculating 16 – 4 first. Very careless mistakes in the working were often seen and some candidates divided the final expression by a common factor or invented an equation to solve.

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Answer: \$12.92

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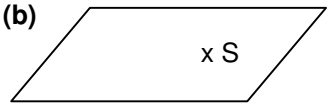

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MATHEMATICS

Paper 0580/03
Paper 3 (Core)

General comments

The paper set this year was felt to compare well with previous years and once again gave the opportunity for candidates to demonstrate their knowledge and application of Mathematics. The majority were able to use the allotted time to good effect and complete the paper but it was noted that a significant number omitted whole or part questions. The standard of presentation and amount of working shown was generally good although the practice of showing clear working, the formulae used, substitution and calculations performed, should continue to be encouraged by Centres. Working was considered essential in **Questions 1(b)(iii), 2(c), 3(b)(i), 3(b)(iv), 7(c), 7(e)**, and useful in **Questions 2(a)(i)(ii)(iii) (b), 3(a)(i), 4(b)(i)(ii) (c) (d), 5(d)(iii), 6(c)(i) (e), 7(d),** and **9(d)**.

Comments on specific questions

Question 1

(a) The majority of candidates used fractions to state their probabilities although decimals and percentages were also seen. The erroneous use of ratios was rare. A significant number gave integer values, often 1, 2 and 0, and use of a denominator of 15 was another common error. In part iii) a significant number seemed to recognise the impossible situation but were unable to give 0 as the correct probability answer.

(b) (i) Generally correct although 3 and 1 were common errors.

(ii) Generally correct although 8 was a common error.

(iii) The calculation of the mean from the grouped data proved more difficult. Whilst the majority recognised the basic method to be used, common errors included 65/5, 25/5, 15/5 and 40/5.

(iv) This part was generally well answered and with a follow through credited, full marks were often scored. A small number of frequency polygons were seen.

Answers: **(a)(i)** 1/5 **(ii)** 2/5 **(iii)** 0 **(b)(i)** 6 **(ii)** 1 **(iii)** 2.6 **(iv)** correct bar chart

Question 2

Generally there was evidence of a good understanding of circles and associated formulae although a significant and surprising number of responses did not contain any reference to pi.

(a) (i) This first part was the least successful with a significant number not recognising that the circumference was to be found or not applying the correct formula.

(ii) This part was more successful although again a variety of incorrect formulae were seen.

(iii) Many candidates found it difficult to appreciate the two steps required here and simply used 0.8 incorrectly as the radius.

(b) Many candidates did not see the connection between this part and the previous part **(a)(ii)** in that volume = area of cross section x depth was expected to be used. Those who did, generally calculated the volume and changed to litres correctly. A small number were able to effectively start again to calculate the volume. A variety of incorrect formulae were used with the simple 0.4 x 1000 being common.

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(c) This part was generally more successful particularly with a follow through being applied. When giving their answer to the nearest minute a number of candidates involved 60 in a calculation rather than simply rounding.

Answers: **(a)(i)** 15.7m **(ii)** 19.6 m^2 **(iii)** 14.6 m^2 **(b)** 7840 to 7860 litres **(c)** 31 min

Question 3

(a) (i) Generally answered well although a surprising number gave 10.5 (blue paint) as the answer.

(ii) Generally answered well although a common error was to multiply by 2 rather than divide by 2. A significant number did not appreciate the practical need to buy a whole number of tins.

(b) (i) Generally well answered although a number simply found 12%.

(ii)(iii) Generally answered well although a significant and disappointing number of candidates attempted to round their answers. Exact answers, particularly in terms of money, should not be rounded.

(iv) This was less successful with many candidates erroneously dividing by 2 not the correct value of 9.

Answers: **(a)(i)** 4.5 litres **(ii)** 3 **(b)(i)** $ 8.14 **(ii)** $ 32.56 **(iii)** $ 46.25 **(iv)** $ 8.76

Question 4

(a) Generally well answered. However part **(i)** saw a wide variety of spellings and other mathematical names for the isosceles triangle. Common errors in part **(iii)** were 35° and 90°.

(b) (i) The rest of this question involving the application of trignometrical methods proved as usual to be difficult for all but the better candidates. Weaker candidates simply added or multiplied sides or angles. Another common error was to use the ratio 6/7 instead of 7/6 within the inverse tangent method.

(ii) This part on the use and application of Pythagoras was more successful although a significant number lost the accuracy mark by incorrect rounding or truncating. Few long methods were seen.

(c) Again this part proved to be difficult. It was also significant that whilst a number were able to write down the implicit statement of sin 35 = 7/BC few were able to then correctly transpose and calculate BC.

(d) This part was generally better answered especially with a follow through being applied. However a common error was to include the lengths of 6 and 7, from the interior of the kite, in the calculation.

Answers: **a)(i)** Isosceles **(ii)** DNC **(iii)** 70° **(b)(i)** 49.4° **(ii)** 9.22cm **(c)** 12.2cm **(d)** 42.8cm

Question 5

(a) Generally well answered with the majority of candidates able to score full marks.

(b) The plotting of the points was generally good and the drawing of the quadratic curve proved to be better than in previous years. Fewer straight line segments were seen this time.

(c) (i) Generally well answered with the majority able to identify and describe the correct point.

(ii) This was less successfully answered with a significant number unable to offer any solution. Those candidates using the correct intersection method were more successful. A number tried to solve the given equation but often made algebraic errors. A significant number attempted to use the quadratic formula but again few were successful.

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(d) (i) Generally well answered although a common error was to plot the point at (–2, –1).

(ii) Generally well answered although the common error was to draw the vertical line x = –2.

(iii) The concept of gradient did not seem to be understood by many candidates. Extra problems were caused by the scale of the axes and the use of a negative gradient, often resulting in those candidates applying a correct method making a numerical error and losing the accuracy mark.

(iv) Again generally poorly answered although a small number were able to pick up marks with a follow through basis being applied. The majority of candidates appeared unfamiliar with the use of "y = mx + c".

Answers: **(a)** 2, –6, 2 **(b)** graph drawn **(c)(i)** (–2,–7) **(ii)** –4.6 to –4.75 and 0.6 to 0.75 **(d)(i)** point plotted **(ii)** line drawn **(iii)** –2 **(iv)** $y = -2x - 3$

Question 6

This question involving algebraic techniques proved difficult for many candidates particularly in writing down the algebraic expressions in parts **(a) (b)** and **(c)**.

(a) 4x, 4, x = 4, x = x + 4, were the common errors.

(b) x + 3, x^3, 12, x = 3, x/3, x = 3x, were the common errors.

(c) (i) As a consequence full marks were only achieved by the better candidates. Those who attempted the addition often omitted the x for Ravinder. The attempt to multiply together the answers from parts **(a)** and **(b)** was also a common error.

(ii) Few candidates appreciated what was required in this part with many not attempting it. A very common error was to solve the given equation and not to show that it was true. The expected justification was 5x + 4 = 28 x 3 or (5x + 4) ÷ 3 = 28 leading to 5x + 4 = 84.

(iii) This part, which did ask candidates to solve the equation, was met with much greater success and the correct answer of 16 was generally given with correct working seen here or in part **(c)(ii)**. One common error however was to start with the incorrect line of working of 9x = 84.

(d) Generally well answered although common errors of 3, 4, 12, 16 and 84 were seen. Again a number of candidates failed to appreciate the information given in part **(b)** and that the required calculation was simply to multiply their x from part **(c)(iii)** by 3.

(e) Generally well answered by the majority of candidates irrespective of previous answers. However common errors of 75 – 63 and 63/100 x 75 were seen.

Answers: **(a)** x + 4 **(b)** 3x **(c)(i)** 5x + 4 **(ii)** justification **(iii)** 16 **d)** 48 **(e)** 84%

Question 7

(a) Generally well answered although common errors of 1, 2 and 5 were seen.

(b) Generally well answered although the common error was to omit the 2 diagonal lines of symmetry. A small number attempted to describe the situation by using words such as square or triangle.

(c) A generally well answered question showing good knowledge of a money situation. Common errors were 2800 / 1.75 or simply 2800 – 2300.

(d) Again generally well answered in that the correct method was applied enabling the majority of candidates to at least gain the method mark. However the instruction to give the answer correct to 2 decimal places was often ignored leading to answers of 3100.4 and 3100 or incorrectly applied leading to answers of 310.04 or 3100.04. The other common error was to calculate 2300 / 1.348.

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(e) This part did show that candidates are generally more familiar and confident with compound interest with many using the formula, though its use was not always evident nor its application correct. However a significant number still seem confused between simple and compound interest. Confusion between interest and amount also often resulted in a loss of accuracy marks.

Answers: **(a)** 4 **(b)** 4 correct lines drawn **(c)** € 2600 **(d)** $ 3100.40 **(e)** $ 5962.32

Question 8

This question showed a generally good understanding and appreciation of transformations with the majority of candidates able to attempt all the transformations to be drawn. A number of errors could have been avoided by careful reading of the question.

(a) (i) A generally good understanding of translations was shown although the vector directions were not always correct.

(ii) Again a rotation was normally seen but often with an incorrect centre of rotation or incorrectly rotated clockwise or through 180 degrees.

(b) (i) Again a reflection was normally seen but often in the y-axis or other incorrect line.

(ii) This part was less successful with a translation often drawn. Reflections, when drawn, were often in an incorrect line.

(iii) The correct single transformation was generally stated but often the description was incomplete or incorrect.

Answers: **(a)(i)(ii) (b)(i)(ii)** correct diagrams drawn **(iii)** translation $\begin{pmatrix} 8 \\ 4 \end{pmatrix}$ or rotation through 180° about (4, 0)

Question 9

(a) Generally well answered with the majority able to score full marks.

(b) Although most candidates applied the correct method and recognised the patterns, a number of numerical errors were made resulting in the loss of accuracy marks.

(c) (i) Generally well answered although a significant number did not appreciate how to use the given formula, with the common error to use the value of 15.

(ii) Those candidates who used the given formula with the value of 20 were generally correct. A significant number appeared to continue the pattern up to the value of 20 but generally met with less success.

(d) This part proved difficult for all but the better candidates. Those few who correctly used the given formula to obtain $3^2 + 3k + 1 = 7$ were generally successful in then solving to obtain the correct value of k. Common errors were $3^2 + 3k + 1 = 0$, $7^2 + 7k + 1 = 0$ or 3, and $3k = -10$. A significant number omitted this part.

Answers: **(a)** 13, 21, 10, 15 **(b)** 43, 28 **(c)(i)** ½ x 5 x 6 = 15 **(ii)** 210 **(d)** –1

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MATHEMATICS

Paper 0580/04
Paper 4 (Extended)

General comments

Overall this paper proved to be accessible to the majority of candidates. Most candidates were able to attempt all questions. The questions/parts of questions on arithmetic (percentages, ratio etc.), simple transformations, lengths of arcs and areas of sectors, use of sine rule, estimated mean and algebra not in context were generally well-attempted. The questions on probability, matrix transformations and shears, similarity area and volume, drawing and interpreting histograms, generalising sequences and simple proof gave the most difficulties.

There were, as usual, many excellent scripts and most candidates were appropriately entered at extended tier and achieved success. There were, however, still some candidates who found this paper too challenging and the core examination would have been more suitable, as they often scored their only marks in the arithmetic and algebra skills questions.

Candidates appeared to have sufficient time to complete the paper and omissions appeared to be due to difficulty with the questions rather than lack of time. The use of at least three significant figure accuracy unless specified was noted by most candidates but some marks were lost by approximating before completing the calculation, leading to an inaccurate final answer.

Most candidates followed all the rubric instructions. Quite a number of candidates still crossed out working when they thought it was incorrect and did not go on and replace it; the best advice is to leave any work alone that is not going to be replaced for Examiners to mark. Writing in the question booklet appeared to suit the candidates and standards of presentation were higher than ever.

A final point to make is the use of the number of marks allocated for a question is a good guide as to how much work is required for that question.

Comments on specific questions

Question 1

This question on ratio was well answered on the whole by the majority.

(a)(i) Many candidates worked out the required total cost correctly. Some misunderstood and used \$2.40 as the total amount and then divided this by 7 before giving each of the three parts of the ratio as their answer. Others incorrectly regarded \$2.40 as one part of the ratio and gave an answer of \$16.80.

(ii) This part was very well answered and the only common error was to misread the requirement and give the percentage of the amount not spent instead of the amount spent.

(b) This part was also very well answered, although there were a few who recognised that the vegetables took up $\frac{8}{12}$ of the cost but were then unable to complete the calculation.

(c) This part proved more challenging and although many were successful, some were unable to combine the aspects of cost and mass from the two previous ratios, but they were often able to gain credit for showing the total cost of the fruit (\$3.60) or the weight of the fruit (2.25 kg). Some obtained both values but were then unable to combine them correctly.

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(d) In the final part, many recognised the reverse percentage aspect and were successful in obtaining \$1.92. However a considerable number reduced \$2.40 by 25% to give \$1.80, which is the predictable error on this type of percentage question.

Answers: **(a)(i)** \$8.40 **(ii)** 42% **(b)** 6 kg **(c)** \$1.60 **(d)** \$1.92.

Question 2

Many candidates were able to tackle the first three parts of the question well and picked up marks. The final three parts proved challenging.

(a)(i) Most candidates were able to give the correct transformation and give the equation of the mirror line, although some mistakenly gave the line as $y = 1$.

(ii) Two marks were commonly earned in this part, as many gave the term 'rotation' and gave the angle as 180°. Fewer, however, gave the coordinates of the centre of rotation for the third mark.

(iii) Similarly for the enlargement, two marks were commonly earned, with many candidates not giving the correct centre of enlargement; (6, 3) or (6, 1) were common errors.

In all three of the above parts, weaker candidates often went on to give more than one transformation and where this was the case no marks were scored as a **single** transformation was asked for.

(iv) This part was less well answered; the shear was often confused with a stretch. It was pleasing to see this year that many candidates attempted to describe an invariant line. This was often incorrect, but there was progress in this use of language.

(b) The first matrix was answered correctly more often than the second. Many chose to use the method of simultaneous equations to find the unknown matrices and often without success as this is a lengthier method and errors often appear in the algebra. The unit vector method was a more suitable method.

Some candidates appeared to quote the matrices from memory and often had values in incorrect positions, e.g. $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ for part **(i)**. For the most able who had correctly identified the shear in part **(a)(iv)**, a common error was to include the scale factor as 1 and not –1 within the matrix.

Many candidates did choose to omit this part, indicating a lack of knowledge in this area.

Answers: **(a) (i)** Reflection in $x = 1$ **(ii)** Rotation, 180°, centre (1, 0) **(iii)** Enlargement, scale factor 3, centre (6, 4) **(iv)** Shear, factor –1, y–axis invariant **(b)(i)** $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ **(ii)** $\begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix}$.

Question 3

This question caused widespread difficulties. Parts **(a)** and **(d)** were the parts that gained most marks. Candidates appeared to read the instruction about giving their answer as a fraction, but some either missed or did not understand "without replacement".

(a) This part was very well answered by most candidates.

(b)(i) This part was answered correctly by a minority of candidates. Answers of $\frac{1}{30}\left(\text{from } \frac{1}{6} \times \frac{1}{5}\right)$ and $\frac{1}{36}\left(\text{from } \frac{1}{6} \times \frac{1}{6}\right)$ were very common. Some candidates added instead of multiplying the fractions.

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(ii) Fewer candidates were successful in this part. Those few who drew a two-by-two grid for all of the required outcomes were the most likely to succeed. Many earned a method mark for identifying one correct combination and for showing $\frac{1}{6}\times\frac{1}{5}$.

(iii) This part was answered slightly better than the other parts of **(b)**. Some worked out $\frac{4}{6}\times\frac{1}{5}$ rather than $\frac{4}{6}\times\frac{2}{5}$. Some added the probabilities.

(c) This part was, again, poorly answered. Few saw that you could add $\frac{2}{6}$ to the previous answer. A few tried to find the probability that 1 was not chosen and then subtract from 1, but many of these worked out the probability of 1 not being chosen with 3 attempts rather than with 2 attempts and showed the product of three probabilities.

(d) This part was well answered, though the working was sometimes confused and often appeared to be unrelated to the correct answer. Many found the answer correctly. Some correctly wrote down the sum of six cards with letter *x* for the seventh card divided by 7, and then wrote down 38*x* rather than 38 + *x*.

Answers: **(a)(i)** 1 **(ii)** $\frac{3}{6}$ **(b)(i)** $\frac{2}{30}$ **(ii)** $\frac{4}{30}$ **(iii)** $\frac{8}{30}$ **(c)** $\frac{18}{30}$ **(d)** 4.

Question 4

This was answered quite well with many candidates demonstrating good techniques in trigonometry as in previous years. Many candidates scored full marks for the question.

(a) Many candidates constructed the triangle, drew the bisectors and shaded the area correctly. Some missed the arcs in the construction of the triangle. Other candidates lost further marks by not showing the construction arcs for the angle bisector and perpendicular bisector and some failed to shade the correct area. There were a few who drew the wrong bisectors or failed to draw any at all.

(b)(i) The majority of candidates chose to use the cosine rule in this part, with either the correct lengths or the scaled lengths. A number chose to write the cosine rule in the side form rather than the angle form and then rearrange. This caused errors for many and it would be better for candidates to learn the angle version of the cosine rule to avoid these problems. Most candidates scored two method marks but many did not show the final decimal stage of –0.11111… or show a more accurate angle 96.37º to 96.38º to justify the angle as 96.4º.

(ii) This part was often correct. Amongst the more able candidates the only error was to use 7 cm and 9 cm rather than 140 m and 180 m and thus give an answer of 31.3 cm^2.

Some weaker candidates assumed a right-angled triangle. The other error was to use the wrong combination of sides within the ½ *ab* sin *C* formula.

(iii) This part was very well answered; candidates were very confident in using the sine rule. The only common errors were in rearranging the equation to make sin *B* explicit or more commonly to make a premature approximation for the sine of 96.4º.

Answers: **(a)** construction **(b)(i)** use cosine rule to obtain angle 96.37 to 96.38 **(ii)** 12521 to 12523 or 12500 or 12520 m^2 **(iii)** 35.4°.

Question 5

This was one of the more challenging questions on the paper, particularly the two parts involving the derivation of an equation. However there were candidates who clearly had a very good background in algebra and performed well in this question as well as in **Question 9**, without necessarily scoring highly elsewhere in the paper.

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(a)(i) There were some excellent, well-presented solutions in this part, containing a correct algebraic statement connecting the two areas with the difference of 59 cm^2 followed by a correct full equation with brackets expanded and a completion to the required form.
On the other hand many candidates struggled with this part or left it out. There were also expressions for separate areas often seen but never put together in an equation. A fairly common error was to give the area of the larger rectangle as 59 and completely overlook the area of the smaller rectangle.

(ii) This part was generally well done, although the common error of incorrect signs was seen, but perhaps less often than in previous years. A more surprising error was to give the factorisation as $x(x+7)-44$ or more commonly as $x(x-4)+11(x-4)$.

(iii) In this part, the solutions immediately followed from part **(ii)**. Even with a pair of factors in part **(ii)**, many chose to use the formula, even though this part carried only one mark.

(iv) This part was quite well done, considering the need to recognise the method required and to use the positive root from part **(iii)**. Most candidates realised that this was a question involving the use of the tangent ratio, whilst others used Pythagoras to calculate the hypotenuse and then used sine or cosine. Others used the sine rule and it must be pointed out that a question with only two marks would require a short single-step solution. A disappointing answer was that of 45°, on the false assumption that the sides of the rectangle were equal.

(b)(i) The responses to this part were very similar to part **(a)(i)**, although this question involved an immediate equation from the ratio of sides of similar triangles. If a correct equation was stated, the expansions and the final equation were usually comfortably obtained. The most common error was to start with the ratios of non-corresponding sides.

(ii) This part was quite often the only successfully answered part for some candidates in the whole of **Question 5**. Although the formula for quadratic equations is not given, candidates seem to be well prepared to expect this to come up in one of the papers and can do this regardless of the parts of the question before and after. The common errors were failure to cope with $-(-2)$, $(-2)^2$, the formula seen as $-b \pm \frac{\sqrt{b^2-4ac}}{2a}$ and answers given to 1 decimal place, although in the mentioned incorrect formula case, candidates were allowed to recover later in their working. Candidates should be aware that required accuracy is always specified in this type of problem.

(iii) The final part was usually well done, candidates following their positive answer from part **(ii)** into $4x+8$. A few candidates misunderstood perimeter for area, a few others calculated the perimeter of the larger rectangle or the semi-perimeter of the correct rectangle and a few left an answer in terms of *x*.

Answers: **(a)(i)** correct verification **(ii)** $(x+11)(x-4)$ **(iii)** -11, 4 **(iv)** 28.3
(b)(i) correct verification **(ii)** -2.61, 4.61 **(iii)** 26.4.

Question 6

This question was well done in parts by some candidates although many struggled with the function aspect of this graph question. As the graph was provided, the usual easier marks for plotting and drawing were not available. This proved to be a good discriminator and a full range of scores was seen.

(a) If the questions had been presented as 'find *y* for a given value of *x*', then it is likely candidates would have been more successful. If the functions had been given in algebraic form, then again there would have been more success. A frequent error in part **(i)** was 16, that is, to omit the minus sign.

(b) The same comments also apply to all of part **(b)**.

(i) This part could have been written to ask for a value of *x* for a given value of *y*.

(ii) This part could have asked for *x*-co-ordinates of points of intersection. However, phrasing the questions as 'solve f(*x*) = *k* and f(*x*) = g(*x*)' proved to be more problematic.

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(iii) The inequality in this part was a good discriminator of able and less able candidates.

Answers just out of range were also occasionally seen.

(c) There was considerable success here as this was a more conventional question asking for the gradient. A common error was to use other points than *A* and *B* as stated in the question. Another was the misreading of the scale with 3 instead of 30 in the working or the answer.

(d) This part was also an effective discriminator and the most common error was to draw a graph parallel to the graph of $y = g(x)$ but through (0, – 10), instead of 10 below the graph of $y = g(x)$. Many candidates did not attempt this part.

(e)(i) Most candidates attempted to draw a tangent at the vertex of the curve but many did not realise that it was parallel to the *x*-axis and an inclined line was common.

(ii) Candidates who were successful in part **(i)** succeeded here. Looking at the marks available for the question should have suggested a simple answer: a full linear equation involving gradient and *y* – intercept was not necessary.

(f) This part saw mixed success, involving the shading of a region between four straight lines, three of which were parallel to the axes. Candidates with a good experience in linear programming found this question straightforward. A common error was to draw the line $x = -2.5$, instead of $x = -3$ and $x = -2$. A number of candidates gained the mark for the lines drawn correctly but were not clear about the region.

It is worth pointing out the apparent lack of familiarity in dealing with function notation in a graphical situation amongst a large number of candidates.

Answers: **(a)(i)** -16 **(ii)** 18 to 19 **(b)(i)** -4.3 to –4.2, 1.5 to 1.6 **(ii)** -4.5 to –4.4, 1.3 to 1.4 **(iii)** -4.5 to –4.4 < x < 1.3 to 1.4 **(c)** $-\frac{30}{7}$ **(d)** ruled line from (-5, 30) to (2, 0) **(e)(i)** horizontal line through (-3, -27) **(ii)** $y = -27$ **(f)** ruled lines and correct region indicated.

Question 7

The first part of this question was found to be very straightforward but part **(b)** was more challenging and part **(c)** turned out to discriminate the grade A's or possibly even the A*'s.

(a) Most candidates were able to find the length of the arc of the sector with the area of the sector proving to be equally accessible. A few candidates mixed up arc length and sector area in parts **(i)** and **(ii)**.

(b)(i) The making of a cone from the sector in part **(a)** was much more of a challenge and a large number of candidates either omitted this part or did not see how to use the fact that the arc of the sector became the circumference of the base of the cone. Trigonometry was occasionally seen with the angle of 60° being used incorrectly. Another error was to think that the radius of the base of the cone was a half of the radius of the sector.

(ii) Most candidates who had an answer to part **(i)** used Pythagoras correctly.

(iii) Candidates who substituted their radius and their height into the given formula for the volume of a cone were awarded the method mark, even if an accuracy mark was lost. This proved the merits of showing the method being used in a question.

(c) This part was set as a discriminating part and was at the end of the question and only carried two marks. If candidates were successful in one part they were invariably successful in the other part.

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(i) This part tested the concept of similar volumes and the candidates had to realise that the volume W was to be multiplied by 3^3. The majority of candidates who attempted this part either used numbers from earlier solids or used letters for radius and height but did not pick out the expression for W.

(ii) This part intended to test the concept that doubling the radius will quadruple the area of the circular base. The candidate then had to recognise that this was also the volume factor since the height was not changed. The problems described in part **(i)** were repeated in this part.

Answers: **(a)(i)** 25.1 cm **(ii)** 301 or 302 or 301.4 to 301.7 cm^2 **(b)(i)** 3.99 to 4.01 cm **(ii)** 23.7 cm **(iii)** 394 to 398 cm^3 **(c)(i)** $27W$, **(ii)** $4W$.

Question 8

This statistics question was well done by many candidates in parts **(a)**, **(b)** and **(c)(i)**. Parts **(c)(ii)** and **(iii)** proved more difficult.

(a) Most candidates recognised the modal class but some were unable to use appropriate notation to indicate the group and a common error was to give an answer of 5.75, that is, the midpoint of the required interval.

(b) The estimated mean was routine work for many who showed a very clear method with full working in obtaining the correct solution. A few used the upper or lower class boundaries instead of the mid-value for the calculation. Others found $\sum fx$ correctly but then divided by 6 instead of the total frequency. The majority of candidates were successful here however.

(c)(i) This part was very well answered.

(ii) Some correctly converted the frequencies of 17 and 15 to the correct heights for the histogram, but the majority did not deal with the frequency of 17 correctly (i.e., dividing by the interval width) and simply drew a bar of height 17.

(iii) The final part was not well answered and the most common error was to give an answer of 5.

Answers: **(a)** $5.5 < x \leq 6$ **(b)** 5.67 min **(c)(i)** 17, 15
(ii) histogram with heights of bars 11.3 and 15 **(iii)** 2.5.

Question 9

Most candidates were prepared for this question and demonstrated some knowledge of the algebraic techniques required. Errors with signs and brackets were frequent, however, and resulted in wrong final answers and expressions. Some of the weaker candidates made excellent attempts at this question having struggled elsewhere on the paper.

(a) The majority knew how to tackle the equation in this part and tried to collect the fractions with a common denominator, but many made errors in removing the brackets or even omitting them and some were reluctant to multiply both sides of the equation by 12. A common error for the more able candidates was to deal with the fractions successfully and rearrange the equation to $7m + 7 = -84$ but then make an error in $-84 - 7$, so that $7m = -77$ was often seen. Many candidates were successful however.

(b)(i) This part was generally well answered although a few sign errors were noted after the substitution stage.

(ii) The majority were successful in setting up the correct form for the single fraction but there were often errors in converting the numerator of the fraction correctly, usually from lack of brackets or incorrect expansion of the second bracket, and a numerator of $3x + 9 - 2x - 2$ was very common.

(iii) The more able candidates who were successful in part **(ii)** and then made the link to part **(iii)**, were able to remove the fractions correctly in this equation and obtain the correct solution. Of the remaining candidates relatively few spotted the link to part **(ii)** and restarted the question with

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subtracting the fractions, often giving them a different answer from that in part **(ii)**. Removing the fractions then often led to errors in expanding the brackets.

(c) Many candidates made a good attempt in this part and there were a large number of correct answers. Two common errors included making a correct first step of $p(q - 1) = t$ but then omitting the brackets and therefore giving $pq = 1 + t$ as the second step, or, after $p(q - 1) = t$, concluding that $q = \frac{t}{p} - 1$.

Weaker candidates with poorer solutions were very confused and showed no understanding of inverse operations. Some made a straight interchange of p and q in the original equation. For these candidates it was also difficult to follow the thought process as one operation was not completed before the next was begun in many cases.

Answers: **(a)** -13 **(b)(i)** 0.5 **(ii)** $\frac{x+11}{(x-1)(x+3)}$ **(iii)** $x = -\frac{1}{3}$ **(c)** $q = \frac{t+p}{p}$.

Question 10

Most candidates found this question difficult in places and omissions in parts were common.

(a) This part proved to be the most accessible and was reasonably well done. Those candidates who wrote down the correct lists of odd numbers generally went on to give the correct answers. The common errors were to start at incorrect odd numbers e.g. 23 and 33, to omit addition signs, or to work out the total incorrectly.

(b) Not many candidates were able to give the correct term as 'cubes' and a variety of incorrect answers were noted. These included 'squares', 'sequences', 'factors', 'multiples', 'cube roots', 'odd numbers', 'totals', 'primes' and 'integers'.

(c) Many candidates found this part difficult, with a number attempting a numerical response rather than an algebraic one.

(d) This part was reasonably well answered with most candidates realising that $n = 4$ has to be substituted into the expression. A common error was to substitute $n = 13$, i.e. the value given by the formula.

(e) Many who had been successful in part **(a)**, correctly wrote the relevant calculation for this part. Errors included beginning with multiplying 7 by the incorrect odd number and then adapting the numbers to be added to make 343. Others omitted one or more of the values to be added.

The final two parts of the question were only successfully attempted by the most able.

(f) The notion of replacing n in the given expression with $n - 1$ escaped most candidates.

(g) This part was often omitted or a token numerical attempt made. There were a number of excellent candidates however who successfully brought together n, $n^2 - n + 1$ and $n(n - 1)$ to verify that the total was n^3.

Answers: **(a)** 21 + 23 + 25 + 27 + 29 = 125 and 31 + 33 + 35 + 37 + 39 + 41 = 216 **(b)** cubes
(c)(i) n **(ii)** n^3 **(d)** $4^2 - 4 + 1 = 13$ **(e)** $(7 \times 43) + 2 + 4 + 6 + 8 + 10 + 12$
(f) $n(n-1)$ **(g)** $n(n^2 - n + 1) + n(n-1) = n^3$.

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