Location Entry Codes

As part of CIE's continual commitment to maintaining best practice in assessment, CIE has begun to use different variants of some question papers for our most popular assessments with extremely large and widespread candidature, The question papers are closely related and the relationships between them have been thoroughly established using our assessment expertise. All versions of the paper give assessment of equal standard.

The content assessed by the examination papers and the type of questions are unchanged.

This change means that for this component there are now two variant Question Papers, Mark Schemes and Principal Examiner's Reports where previously there was only one. For any individual country, it is intended that only one variant is used. This document contains both variants which will give all Centres access to even more past examination material than is usually the case.

The diagram shows the relationship between the Question Papers, Mark Schemes and Principal Examiner's Reports.

Question Paper	**Mark Scheme**	**Principal Examiner's Report**
Introduction	Introduction	Introduction
First variant Question Paper	First variant Mark Scheme	First variant Principal Examiner's Report
Second variant Question Paper	Second variant Mark Scheme	Second variant Principal Examiner's Report

Who can I contact for further information on these changes?
Please direct any questions about this to CIE's Customer Services team at: international@cie.org.uk

MATHEMATICS

Paper 0580/11
Paper 1 (Core)

General comments

The responses to the questions on the paper indicated that the standard of the examination was appropriate to the level of the candidates. While there were candidates who were clearly not familiar with many topics, most tackled all questions. There were fewer very high marks this year. However, there were enough straightforward questions, enabling those well prepared for the examination to show their abilities and gain the higher grades.

The working space was often not well used and hardly at all by some candidates. While nothing or very little is expected if there is only 1 mark for a question or part, as soon as 2 or more marks are available, then at least 1 mark will be for method even if the answer is incorrect. In these cases working should be clearly indicated in the working space and not minutely and/or faintly in pencil as was often observed. All working should be done clearly and in pen. Drawings may be done in pencil, but even then candidates should ensure that it is not so faint that it is difficult to see.

There is usually adequate space on the question paper for working; in the rare cases that candidates run out of space they are permitted to use extra paper, but they should put a note on the original answer space indicating where there working continues.

A number of questions relate to actual everyday situations where candidates should consider if their response is possible. It was far from uncommon to see an answer of the length of the road in **Question 6** as 115 000 kilometres!

Questions on number were generally answered quite well, while angles, area and volume caused more problems for the less able candidates. Basic algebra in **Questions 5** and **9** caused more errors than expected and equations of lines and gradients continue to be misunderstood by the many candidates.

Apart from for very weak candidates the time allowance for the paper was evidently appropriate.

Comments on specific questions

Section A

Question 1

While many understood multiples, the main error was to give a factor for the answer instead. It was sensible to list the multiples of the two numbers, but these lists were often left in the answer space with the common multiple not isolated.

Answer: 28 or other multiple of 28

Question 2

There were many correct answers but the most common error was to state 180°. Also incorrect responses of 2/2, 2/4 and 2/8 were seen as well as worded answers and reference to lines of symmetry.

Answer: 2

Question 3

The vast majority of answers were correct but –17 and 13 and even –30 (from doubling?) were the most common incorrect answers.

Answer: – 13

Question 4

Dividing by 4 or 2 as well as squaring were often seen. It seemed that some confused perimeter and area, and many had problems with working from area to length. However, the more able candidates generally found the square root correctly.

Answer: 6.5

Question 5

This question caused considerable difficulty for many candidates. Some took it as a two-bracket question while others thought it was an equation. A mark was gained for either 12 or $-13x$ regardless of what was done subsequently to the expression. For those who understood the question, the sign or signs of the terms were often incorrect.

Answer: $12 - 13x$

Question 6

The conversion of units caused the majority of the problems for candidates, resulting in many completely unrealistic distances for the length of the road. Some read the scale as 1 250 000, not understanding the ratio notation.

Answer: 11.5

Question 7

This was not as well answered. Quite a number of candidates confused > and <. Many did not indicate working, and **part (b)** in particular was poorly attempted.

Answers: **(a)** > **(b)** =

Question 8

The most common error response was to multiply instead of divide. It seems very difficult for some candidates to work out whether they should have numerically more or less in the new currency. Estimating before applying the calculator would perhaps have been a guide to the correct operation. Of those who did do it correctly all too often the two decimal place instruction was applied incorrectly or not at all.

Answer: 15.77

Question 9

Two quite straightforward inverse operations in the right order were needed but many seemed put off by the most basic algebra. Most realised the +2 had to be dealt with first but this was often added to the 53. Division by 5 was usually attempted (though some subtracted it), but it was quite common to see the answer left as an improper fraction, which was not acceptable.

Answer: (x =) 10.2 or $10\frac{1}{5}$

Question 10

This regularly tested skill of limits of numbers to a given approximation is becoming more successful, with many this time getting both limits correct. However, there are still many who do not understand what is required and 6600 and 6800 were often seen. There were a few correct but reversed answers, and 6749 was sometimes seen at the upper limit.

Answer: $6650 \le L < 6750$

Question 11

More careful reading of the question was needed by many candidates who ignored the 2 minutes early. There also seemed to be a lot of confusion between length of time and time of day, even though the units of minutes were stated in the answer space. The very common response in **part (b)** was to subtract 1256 from 1320 giving 64. Reading of tables is a very important life skill, and should be mastered by all taking the examination at core level. Many clearly needed more practice at this and clock work so that they will realise that there are 60 minutes in one hour and not 100.

Answers: **(a)** 12 **(b)** 24

Question 12

Many candidates did not seem able to substitute into an equation and there was evidence of much-confused working. Those who made progress to $0 = 2 \times 4 - k$ still often ended with $k = -8$. This was another case of a basic algebraic skill far too often not understood.

Answer: (k =) 8

Question 13

Most candidates had an understanding of the structure of standard form but there was much confusion over the power of 10, often –5 or 3. Rounding to 2 figures was often seen even though no accuracy was specified. Carelessness by omitting the decimal point was common, though some might have felt the first part should have been 578.

Part (b) was poorly done with many confused about the difference between significant figures and decimal places. Many answers of 0.01 were seen in this part and **part (c)**. Truncating, rather than rounding was common, even if the position of the digits was correct.

Part (c) was more successful but answers such as 0.0 or 0.00 were seen quite often

Answers: **(a)** 5.78×10^{-3} **(b)** 0.0058 **(c)** 0.01

Question 14

Many candidates had been well taught in this area and could clearly show the required working or a convincing non-calculator method. However, there were still a disturbing number who were clearly uncertain and having found the improper fraction to divide by they did not invert and multiply, or they inverted both fractions. No marks were awarded unless the improper fraction was shown, and to gain the second mark a clearly correct method was required.

Answer: $\frac{1}{6}$ after a full, clear and correct method.

Question 15

Apart from in a few cases, **parts (a)** and **(b)** were done correctly. Confusion between the x and y coordinates was the main error. Otherwise, some did not realise only a point was required and drew line segments in **part (a)**.

Part (c) was not done well, with a minority of candidates achieving the correct gradient. A required negative value seemed to cause concern and many just had no idea what was required.

Answers: **(a)** Point marked at (3, 2) **(b)** (–2, 1) **(c)** –0.5 or $-\frac{1}{2}$

Question 16

Part (a) was known by most candidates, but there were some answers containing the letter p or just 0.

Most knew the rule to add the indices, but a significant minority made errors, mainly multiplying them.

Part (c) was also done quite well but subtraction of indices was often seen.

Answers: **(a)** 1 **(b)** q^{11} **(c)** r^{-6} or $\frac{1}{r^6}$

Question 17

Candidates found this question difficult. It was not sufficient just to show the angle of 12° at B and then say 12 + 78 = 90. The response of 168 – 78 = 90 was not sufficient for the solution since this was just a statement of the relationship without a geometrical justification. However, many of the high scoring candidates gave very good, clear and correct explanations.

Part (b) was only correct for a small percentage of candidates. Many did not use the given fact of the isosceles triangle to find the angle of 45°. Even if they did, more often than not the correct answer was not found.

Answers: **(a)** 12 seen at A and B or 180 – 168 = 12 and 12 + 78 (= 90) seen. **(b)** 123

Question 18

There was considerable uncertainty over the formula for volume of a cylinder, but the majority who knew it made progress on **part (a)**. However the correct answer did not necessarily follow. Some tried to change the units in **part (a)**.

Part (b) defeated all but a few, with most dividing by 100 or 1000.

Answers: **(a)** 1083300 to 1084000 or 1080000 or 1083000 **(b)** 1.08 (3sf) or their answer ÷ 10^6

Question 19

It was very rare to see a response to **part (a)** which simply added length to width and doubled. Many added an extra length or missed out one of the lengths not shown. Others looked at the diagram and, regardless of the label ‘not to scale’, they assumed that the two missing lengths were equal. Some candidates also mixed up area and perimeter.

Part (b) was done better but again many had little idea of how to split up the shape. Unrealistically large answers were evident here from multiplying all the lengths together. A common wrong answer was from multiplying 22 by 10 and ignoring the section cut out.

Answers: **(a)** 64 **(b)** 172

Question 20

This question was well done with many candidates gaining all the marks. In **part (a)** the main error was not reading the question properly, resulting in not subtracting the percentage from 100. Also, an answer of 15 without the percentage sign is not a probability, showing carelessness in most cases rather than lack of understanding. Some candidates need to appreciate that probability should be expressed as a fraction, decimal or percentage and no other way.

Apart from those who just put numbers in **part (b)** instead of fractions, the marks were gained by the vast majority of candidates. Some did try to make the question more difficult by assuming that the denominator was 14 or reduced each time a part was done.

Answers: **(a)** 15% or 0.15 or $\frac{15}{100}$ or equivalent fraction **(b) (i)** $\frac{4}{15}$ **(ii)** $\frac{10}{15}$ **(iii)** 0 or $\frac{0}{15}$

Question 21

Very few candidates knew the term *similar.*

In **part (b)** again few appreciated the relationship between similar triangles. Most attempted to add 2 to the 12 or apply Pythagoras to the triangles, again assuming that a right angle was present when not stated or indicated.

Surprisingly few seemed to know the term reflex, even though most realised the angle at *D* was equal to 68°. Doubling or subtracting from 180 were the common errors.

Answers: **(a)** Similar **(b)** 15 **(c)** 292

Question 22

Almost all candidates clearly had enough time to attempt this question, the best done on the paper. The table was well done although a number of candidates did not have angles totalling 360°. Another error often seen was to give 60° for both missing angles.

Provided candidates could use protractors correctly, they generally scored marks for the pie chart. Nearly all labelled the sectors correctly, at least for their angles.

Answers: **(a)** (Australia) 45 (New Zealand) 5 75 **(b)** All sectors correct ±2°. Correct labelling

MATHEMATICS

Paper 0580/12
Paper 1 (Core)

General comments

The responses to the questions on the paper indicated that the standard of the examination was appropriate to the level of the candidates. While there were candidates who were clearly not familiar with many topics, most tackled all questions. There were fewer very high marks this year. However, there were enough straightforward questions, enabling those well prepared for the examination to show their abilities and gain the higher grades.

The working space was often not well used and hardly at all by some candidates. While nothing or very little is expected if there is only 1 mark for a question or part, as soon as 2 or more marks are available, then at least 1 mark will be for method even if the answer is incorrect. In these cases working should be clearly indicated in the working space and not minutely and/or faintly in pencil as was often observed. All working should be done clearly and in pen. Drawings may be done in pencil, but even then candidates should ensure that it is not so faint that it is difficult to see.

There is usually adequate space on the question paper for working; in the rare cases that candidates run out of space they are permitted to use extra paper, but they should put a note on the original answer space indicating where there working continues.

A number of questions relate to actual everyday situations where candidates should consider if their response is possible. It was far from uncommon to see an answer of the length of the road in **Question 6** as 95 000 kilometres!

Questions on number were generally answered quite well, while angles, area and volume caused more problems for the less able candidates. Basic algebra in **Questions 5** and **9** caused more errors than expected and equations of lines and gradients continue to be misunderstood by the majority of candidates.

Apart from very weak candidates the time allowance for the paper was evidently appropriate.

Comments on specific questions

Section A

Question 1

While many understood multiples, the main error was to give a factor for the answer instead. It was sensible working to list the multiples of the two numbers, these lists were often left in the answer space with the common multiple not isolated.

Answer: 36 or other multiple of 36

Question 2

There were many correct answers but the most common error was to state 180°. Also incorrect responses of 2/2, 2/4 and 2/8 were seen as well as worded answers and reference to lines of symmetry.

Answer: 2

Question 3

The vast majority of answers were correct but –17 and 13 and even –30 (from doubling?) were the most common incorrect answers.

Answer: – 13

Question 4

Dividing by 4 or 2 as well as squaring were often seen. It seemed that some confused perimeter and area, and many had problems with working from area to length. However, the more able candidates generally found the square root correctly.

Answer: 7.4

Question 5

This question caused considerable difficulty for many candidates. Some took it as a two-bracket question while others thought it was an equation. A mark was gained for either 10 or $-17x$ regardless of what was done then to the expression. For those who understood the question the sign or signs of the terms were often incorrect.

Answer: $10 - 17x$

Question 6

The conversion of units caused the majority of the problems for candidates, resulting in many completely unrealistic distances for the length of the road. Some read the scale as 1 250 000,not understanding the ratio notation.

Answer: 9.5

Question 7

This was not as well answered. Quite a number of candidates confused > and <. Many did not indicate working, and **part (b)** in particular was poorly attempted.

Answers: **(a)** > **(b)** =

Question 8

The most common error response was to multiply instead of divide. It seems very difficult for some candidates to work out whether they should have numerically more or less in the new currency. Estimating before applying the calculator would perhaps have been a guide to the correct operation. Of those who did do it correctly all too often the two decimal place instruction was applied incorrectly or not at all.

Answer: 23.65

Question 9

Two quite straightforward inverse operations in the right order were needed but many seemed put off by the most basic algebra. Most realised the +2 had to be dealt with first but this was often added to the 53. Division by 5 was usually attempted (though some subtracted it) but it was quite common to see the answer left as an improper fraction, which was not acceptable.

Answer: (x =) 10.6 or $10\frac{3}{5}$

Question 10

This regularly tested skill of limits of numbers to a given approximation is becoming more successful with many this time getting both limits correct. However, there are still many who do not understand what is required and 6600 and 6800 were often seen. There were a few correct but reversed answers, and 6749 was sometimes seen at the upper limit.

Answer: $6650 \le L < 6750$

Question 11

More careful reading of the question was needed by many candidates who ignored the 2 minutes early. There also seemed to be a lot of confusion between length of time and time of day, even though the units of minutes were stated in the answer space. The very common response in **part (b)** was to subtract 1256 from 1320 giving 64. Reading of tables is a very important life skill, and should be mastered by all taking the examination at core level. Many clearly needed more practice at this and clock work so that they will realise that there are 60 minutes in one hour and not 100.

Answers: **(a)** 12 **(b)** 24

Question 12

Many candidates did not seem able to substitute into an equation and there was evidence of much-confused working. Those who made progress to $0 = 2 \times 4 - k$ still often ended with $k = -8$. This was another case of a basic algebraic skill far too often not understood.

Answer: (k =) 8

Question 13

Most candidates had an understanding of the structure of standard form but there was much confusion over the power of 10, often –5 or 3. Rounding to 2 figures was often seen even though no accuracy was specified. Carelessness by omitting the decimal point was common, though some might have felt the first part should have been 656.

Part (b) was poorly done with many confused about the difference between significant figures and decimal places. Many answers of 0.01 were seen in this part and **part (c)**. Truncating, rather than rounding was common even if the position of the digits was correct.

Part (c) was more successful but answers such as 0.0 or 0.00 were seen quite often

Answers: **(a)** 6.56×10^{-3} **(b)** 0.0066 **(c)** 0.01

Question 14

Many candidates had been well taught in this area and could clearly show the required working or a convincing non-calculator method. However, there were still a disturbing number who were clearly uncertain and having found the improper fraction to divide by they did not invert and multiply, or they inverted both fractions. No marks were awarded unless the improper fraction was shown, and to gain the second mark a clearly correct method was required.

Answer: $\frac{1}{15}$ after a full, clear and correct method.

Question 15

Apart from in a few cases, **parts (a)** and **(b)** were done correctly. Confusion between the *x* and *y* coordinates was the main error. Otherwise some did not realise only a point was required and drew line segments in **part (a)**.

Part (c) was not done well with a minority of candidates achieving the correct gradient. A required negative value seemed to cause concern and many just had no idea what was required.

Answers: **(a)** Point marked at (3, 2) **(b)** (–2, 1) **(c)** –0.5 or $-\frac{1}{2}$

Question 16

Part (a) was known by most candidates, but there were some answers containing the letter *p* or just 0.

Most knew the rule to add the indices, but a significant minority made errors, mainly multiplying them.

Part (c) was also done quite well but subtraction of indices was often seen.

Answers: **(a)** 1 **(b)** q^8 **(c)** r^{-8} or $\frac{1}{r^8}$

Question 17

Candidates found this question difficult. It was not sufficient just to show the angle of 12° at *B* and then say 12 + 78 = 90. The response of 168 – 78 = 90 was not sufficient for the solution since this was just a statement of the relationship without a geometrical justification. However, many of the high scoring candidates gave very good, clear and correct explanations.

Part (b) was only correct from a small percentage of candidates. Many did not use the given fact of the isosceles triangle to find the angle of 45°. Even if they did, more often than not the correct answer was not found.

Answers: **(a)** 12 seen at *A* and *B* or 180 – 168 = 12 and 12 + 78 (= 90) seen. **(b)** 123

Question 18

There was considerable uncertainty over the formula for volume of a cylinder, but the majority who knew it made progress on **part (a)**. However the correct answer did not necessarily follow. Some tried to change the units in **part (a)**.

Part (b) defeated all but a few, with most dividing by 100 or 1000.

Answers: **(a)** 1458216 to 1459145 or 1460000 or 1459000 **(b)** 1.46 (3sf) or their answer ÷ 10^6

Question 19

It was very rare to see a response to **part (a)** which simply added length to width and doubled. Many added an extra length or missed out one of the lengths not shown. Others looked at the diagram and regardless of the label 'not to scale', they assumed that the two missing lengths were equal. Some candidates also mixed up area and perimeter.

Part (b) was done better but again many had little idea of how to split up the shape. Unrealistically large answers were evident here from multiplying all the lengths together. A common wrong answer was from multiplying 22 by 10 and ignoring the section cut out.

Answers: **(a)** 64 **(b)** 172

Question 20

This question was well done with many candidates gaining all the marks. In **part (a)** the main error was not reading the question properly, resulting in not subtracting the percentage from 100. Also an answer of 15 without the percentage sign is not a probability, showing carelessness in most cases rather than lack of understanding. Some candidates need to appreciate that probability should be expressed as a fraction, decimal or percentage and no other way.

Apart from those who just put numbers in **part (b)** instead of fractions, the marks were gained by the vast majority of candidates. Some did try to make the question more difficult by assuming that the denominator was 14 or reduced each time a part was done.

Answers: **(a)** 15% or 0.15 or $\frac{15}{100}$ or equivalent fraction **(b) (i)** $\frac{4}{15}$ **(ii)** $\frac{10}{15}$ **(iii)** 0 or $\frac{0}{15}$

Question 21

Very few candidates knew the term *similar*.

In **part (b)** again few appreciated the relationship between similar triangles. Most attempted to add 2 to the 12 or apply Pythagoras to the triangles, again assuming that a right angle was present when not stated or indicated.

Surprisingly few seemed to know the term reflex, even though most realised the angle at *D* was equal to 68°. Doubling or subtracting from 180 were the common errors.

Answers: **(a)** Similar **(b)** 19.95 to 20.04 **(c)** 297

Question 22

Almost all candidates clearly had enough time and so did this question, the best done on the paper. The table was well done although a number of candidates did not have angles totalling 360°. Another error often seen was to give 60° for both missing angles.

Provided candidates could use protractors correctly, they generally scored on the pie chart. Nearly all labelled the sectors correctly, at least for their angles..

Answers: **(a)** (Australia) 45 (New Zealand) 5 75 **(b)** All sectors correct ±2°. Correct labelling

MATHEMATICS

Paper 0580/21
Paper 2 (Extended)

General comments

The level of the paper was such that all candidates were able to demonstrate their knowledge and ability and the marks ranged from 0 to 70. The paper again provided challenge even for the most able this year but a significant number of candidates scored full marks. There was no evidence at all that candidates were short of time. The general level of performance was about the same as last year with most candidates finding some questions that they could do. A few Examiners reported a substantial number of candidates who should have been entered for the Core paper. Failure to give answers to the correct degree of accuracy was a concern this year; candidates need to read the general rubric carefully but also to make sure that they have noted the requirements of particular questions.

Particular Comments

Question 1

This was generally very well answered by all the weaker candidates but some of the more able seemed not to have revised this topic. Candidates should be aware that tracing paper and a ruler are useful aids to answering this type of question.

Answers: **(a)** 2 **(b)** 0

Question 2

This question was generally poorly done. A lot of candidates wrote the order of the given matrices correctly but were unable to state the order of the answer. Some candidates multiplied out the matrices but were still unable to give the correct answer, whilst other candidates had no idea how to do the question at all.

Answer: $a = 3$ $b = 4$

Question 3

This had been intended as an order of operations question using a calculator. Many candidates chose to treat it as a fraction question but failed to handle all the operations correctly. Those that went into decimals were usually rounding prematurely and not getting near to the correct decimal value to 3 sf, as required in the rubric. This question was a good discriminator at the top of the mark range.

Answer: 1.59 or $1\frac{22}{37}$

Question 4

Quite a large number of candidates did not seem to understand that standard form is a very specific format. Many divided instead of multiplying and others were also adding incorrect rounding into the question. This should have been an easy mark for converting 26700×10^{-6} into standard form. **Part (b)** on the other hand was generally well done so it is not easy to explain why **part (a)** caused so much confusion.

Answers: **(a)** 2.67×10^{-2} **(b)** 0.0267

Question 5

This was poorly done with over half the candidates failing to notice that a locus had been asked for and they simply identified the final position of *D* or the final position of the square.

Answer: Arc, centre *B*, radius *BD* from *D* to *D*', where *D*' is the final position of *D*

Question 6

Most candidates were able to find the first solution but only the more able could locate the second solution. The knowledge that the angles are supplementary was not very common.

Answer: 60° and 120°

Question 7

This topic continues to be one that candidates do not answer very well. The bounds for 6.1 correct to one decimal place are 6.05 and 6.15. Similarly for 8.1, they are 8.05 and 8.15. The upper bound for the area comes from multiplying the two largest together and not from calculating the area and then giving it bounds. No other rounding should take place; the answer must be to its full accuracy.

Answer: 50.1225

Question 8

About half of the candidates answered **part (a)** correctly. Almost no candidates saw any connection with **part (b)** and began this part from first principles. The common errors when dividing by $a + b$ was to leave $x^2 + x^2$ on the left hand side, this in turn became x^4 or, if taking the square root incorrectly, $x + x$.

Answer: $x = \sqrt{\dfrac{p^2 + d^2}{a + b}}$

Question 9

The question was understood but not well answered. Most appreciated that the gradient was 2 but assumed that *OA* and *OB* were equal or else tried to solve $2x + 3 = 7$. **Part (b)** was very well done although Examiners saw answers with the *x* co-ordinate as zero.

Answers: **(a)** $y = 2x - 4$ **(b)** (2, 0)

Question 10

This remains the best understood topic on the syllabus and large numbers of correct solutions were seen. Those that made arithmetic mistakes usually made them when multiplying the zeros.

Answer: $x = 8$ $y = 5$

Question 11

This question was reasonably well answered with most candidates scoring some marks. However a large number of candidates failed to deal with the negative sign in the numerator or else mishandled the denominator.

Answer: $\dfrac{-18}{(2x + 3)(x - 3)}$

Question 12

This question was also well understood and most candidates scored 1 or 2 marks for algebraic manipulation. The very common errors were to fail to reverse the inequality sign when dividing by a negative number or more unusually reversing the inequality and then dropping the negative sign so that $x < -\frac{4}{25}$ or $x > \frac{4}{25}$ were very common incorrect answers

Answer: $x > -\frac{4}{25}$

Question 13

This was generally very badly done and only the more able candidates could answer this question correctly. A large number of candidates could not deal with the inverse and the square in the same question. The standard structure of $p = \frac{k}{(q+2)^2}$ followed by substitution was rarely seen.

Answer: 1.25

Question 14

This question was well understood by most candidates. Inability to give the answer to the nearest kilometre was the most common problem in **part (a)** and using the area instead of the circumference was the most common in **part (b)**.

Answers: **(a)** 45498 **(b)** 7240

Question 15

The first two parts of this question were very well done. Most candidates knew the required operations for $g^{-1}(x)$ but were unable to correctly incorporate the cosine into it.

Answers: **(a)** 0.5 **(b)** –1 **(c)** $\frac{\cos x - 4}{2}$

Question 16

This was generally very well answered with very few candidates scoring no marks. The table was usually correct, the graph plotted correctly and well drawn and the value read off correctly. Some candidates again failed to take note of the accuracy requirement in the question.

Answers: **(a)** 1000 1400 1960 2740 3840 **(b)** smooth graph **(c)** 3.2 or 3.3

Question 17

Examiners reported a very wide range of responses to this question but very few candidates scored full marks or used the correct notation. Some candidates thought that a position vector required a column vector, others used column vectors throughout, some used co-ordinates, many failed to simplify their answers and the negative sign in **part (a)(iii)** caused the inevitable errors. Generally this topic is not very well understood.

Answers: **(a)(i)** $-3\mathbf{p} - 2\mathbf{q}$ **(a)(ii)** $-3\mathbf{p} + 4\mathbf{q}$ **(a)(iii)** $-4\mathbf{p}$ **(b)** 8

Question 18

Large numbers of candidates tried to use unsuitable equations of motion without regard to the practical situation involved. Those that did it by the correct method made errors in reading the scales on the axes or misquoted area formulae.

Answers: **(a)** 1.05 **(b)** 3360 **(c)** 18.7

Question 19

Most candidates scored marks on this question, particularly in **part (a)**. A few did not use the correct angle of 50° and used either 60° or 90°. **Part (b)** was less well answered and many candidates just subtracted the two arc lengths.

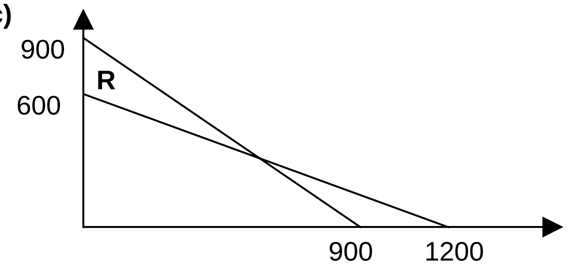
Answers: **(a)** 53.4 **(b)** 49.6

Question 20

Most candidates scored quite a few marks on this question. In **parts (a)** and **(b)** there were a few sign errors. In **part (c)** candidates mostly managed to draw the correct lines. But placing R correctly was not so well done. The final part was also not too well done with many candidates reading the lowest value of y on the y-axis rather than at the intersection.

Answers: **(a)** $600x + 1200y \geq 720000$ **(b)** $x + y \leq 900$ **(d)** 300

(c)



MATHEMATICS

Paper 0580/22

Paper 2 (Extended)

General comments

The level of the paper was such that all candidates were able to demonstrate their knowledge and ability and the marks ranged from 0 to 70. The paper again provided challenge for the most able this year but a significant number of candidates scored full marks. There was no evidence at all that candidates were short of time. The general level of performance was about the same as last year with most candidates finding some questions that they could do. A few Examiners reported a substantial number of candidates who should have been entered for the Core paper. Failure to give answers to the correct degree of accuracy was a concern this year, candidates need to read the general rubric carefully but also to make sure that they have noted the requirements of particular questions.

Particular Comments

Question 1

This was generally very well answered by all the weaker candidates but some of the more able seemed not to have revised this topic. Candidates should be aware that tracing paper and a ruler are useful aids to answering this question.

Answers: **(a)** 2 **(b)** 0

Question 2

This question was generally poorly done. A lot of candidates wrote the order of the given matrices correctly but were unable to state the order of the answer. Some candidates multiplied out the matrices but were still unable to give the correct answer whilst other candidates had no idea how to do the question at all.

Answer: $a = 4$ $b = 3$

Question 3

This had been intended as an order of operations question using a calculator. Many candidates chose to treat it as a fraction question but failed to handle all the operations correctly. Those that went into decimals were usually rounding prematurely and not getting near to the correct decimal value to 3 sf, as required in the rubric. This question was a good discriminator at the top of the mark range.

Answer: 1.59 or $1\frac{22}{37}$

Question 4

Quite a large number of candidates did not seem to understand that standard form is a very specific format. Many divided instead of multiplying and others were also adding incorrect rounding into the question. This should have been an easy mark for converting 38500×10^{-6} into standard form. **Part (b)** on the other hand was generally well done so it is not easy to explain why **part (a)** caused so much confusion.

Answers: **(a)** 3.85×10^{-2} **(b)** 0.0385

Question 5

This was poorly done with over half the candidates failing to notice that a locus had been asked for and they simply identified the final position of *D* or the final position of the square.

Answer: Arc, centre *B*, radius *BD* from *D* to *D*', where *D*' is the final position of *D*

Question 6

Most candidates were able to find the first solution but only the more able could locate the second solution. The knowledge that the angles are supplementary was not very common.

Answer: 45° and 135°

Question 7

This topic continues to be one that candidates do not answer very well. The bounds for 2.4 correct to one decimal place are 2.35 and 2.45. Similarly for 6.4, they are 6.35 and 6.45. The upper bound for the area comes from multiplying the two largest together and not from calculating the area and then giving it bounds. No other rounding should take place; the answer must be to its full accuracy.

Answer: 15.8025

Question 8

About half of the candidates answered **part (a)** correctly. Almost no candidates saw any connection with **part (b)** and began this part from first principles. The common errors when dividing by $a + b$ was to leave $x^2 + x^2$ on the left hand side, this in turn became x^4 or, if taking the square root incorrectly, $x + x$.

Answer: $x = \sqrt{\dfrac{p^2 + d^2}{a+b}}$

Question 9

The question was understood but not well answered. Most appreciated that the gradient was 2 but assumed that *OA* and *OB* were equal or else tried to solve $2x + 3 = 11$. **Part (b)** was very well done although Examiners saw answers with the *x* co-ordinate as zero.

Answer: **(a)** $y = 2x - 6$ **(b)** (3, 0)

Question 10

This remains the best understood topic on the syllabus and large numbers of correct solutions were seen. Those that made arithmetic mistakes usually made them when multiplying the zeros.

Answer: $x = 5$ $y = 2$

Question 11

This question was reasonably well answered with most candidates scoring some marks. However a large number of candidates failed to deal with the negative sign in the numerator or else mishandled the denominator.

Answer: $\dfrac{-17}{(5x+1)(2x-3)}$

Question 12

This question was also well understood and most candidates scored 1 or 2 marks for algebraic manipulation. The very common errors were to fail to reverse the inequality sign when dividing by a negative number or more unusually reversing the inequality and then dropping the negative sign so that $x < -\frac{4}{25}$ or $x > \frac{4}{25}$ were very common incorrect answers

Answer: $x > -\frac{4}{25}$

Question 13

This was generally very badly done and only the more able candidates could answer this question correctly. A large number of candidates could not deal with the inverse and the square in the same question. The standard structure of $p = \frac{k}{(q+2)^2}$ followed by substitution was rarely seen.

Answer: 0.64

Question 14

This question was well understood by most candidates. Inability to give the answer to the nearest kilometre was the most common problem in **part (a)** and using the area instead of the circumference was the most common in **part (b)**.

Answers: **(a)** 45498 **(b)** 7240

Question 15

The first two parts of this question were very well done. Most candidates knew the required operations for $g^{-1}(x)$ but were unable to correctly incorporate the tangent into it.

Answers: **(a)** 1 **(b)** 0 **(c)** $\frac{\tan x - 6}{2}$

Question 16

This was generally very well answered with very few candidates scoring no marks. The table was usually correct, the graph plotted correctly and well drawn and the value read off correctly. Some candidates again failed to take note of the accuracy requirement in the question.

Answers: **(a)** 1000 1400 1960 2740 3840 **(b)** smooth graph **(c)** 3.2 or 3.3

Question 17

Examiners reported a very wide range of responses to this question but very few candidates scored full marks or used the correct notation. Some candidates thought that a position vector required a column vector, others used column vectors throughout, some used co-ordinates, many failed to simplify their answers and the negative sign in **part (a)(iii)** caused the inevitable errors. Generally this topic is not very well understood.

Answers: **(a)(i)** $-3\mathbf{p} - \mathbf{q}$ **(a)(ii)** $-4\mathbf{p} + 2\mathbf{q}$ **(a)(iii)** $-5\mathbf{p}$ **(b)** 10

Question 18

Large numbers of candidates tried to use unsuitable equations of motion without regard to the practical situation involved. Those that did it by the correct method had difficulty reading the scales on the axes or misquoted area formulae.

Answers: **(a)** 1.05 **(b)** 3360 **(c)** 18.7

Question 19

Most candidates scored marks on this question, particularly in **part (a)**. A few did not use the correct angle of 50° and used either 60° or 90°. **Part (b)** was less well answered and many candidates just subtracted the two arc lengths.

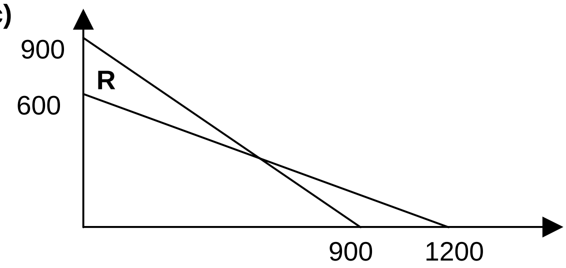
Answers: **(a)** 37.1 **(b)** 41.3

Question 20

Most candidates scored quite a few marks on this question. In **parts (a)** and **(b)** there were a few sign errors. In **part (c)** candidates mostly managed to draw the correct lines. but placing R correctly was not so well done. The final part was also not too well done with many candidates reading the lowest value of *y* on the *y*-axis rather than at the intersection.

Answers: **(a)** $600x + 1200y \geq 720000$ **(b)** $x + y \leq 900$ **(d)** 300

(c)



MATHEMATICS

Paper 0580/03

Paper 3 (Core)

General comments

The paper seemed accessible to the majority of candidates if a little challenging for some. 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. Once again the lack of working shown proved detrimental to a number of candidates. Working was expected, and method marks were available, in **Questions 1** all **parts, 2** all parts**, 3(c)(i), 6** all parts and **10(c)(d)**. This working should be shown clearly and fully in the space provided by each question. Another area of concern noted this year was that clearly a significant number of candidates were not able to attempt certain questions, particularly the right angled trigonometry question. The breakdown of individual questions follows.

Question 1

(a) (i) Questions of this type do need the full working and justification to show that the given answer is true. This was generally answered well though a significant number simply stated 30000 – 12000 = 18000 which did not show the use of fractions needed to justify the answer.

(ii) This part was generally well answered with the majority of candidates able to apply a correct ratio method. One common error was simply dividing by 3, 4 and 5.

(b) (i) This was generally well answered although a small number having correctly calculated 35% went on to give a final answer of 19500 (65%).

(ii) This was generally well answered although a number did not give their answer as a fraction in its lowest terms. Common errors included continuing the work to give an answer as a decimal or percentage and starting with 30000/6500.

(iii) This was generally well answered particularly with a follow-through mark available though a small number omitted to subtract the 6500 or the 10500.

(c) Candidates found this part of the question more difficult. Whilst many started correctly with 15500 – 12500 = 3000 seen this was often either left as the answer or simply became 30%. The less common alternative method of starting with 15500/12500 × 100 was generally more successful.

Answers: **(a) (i)** clear justification such as 30000 – 2/5 × 30000
(a) (ii) 7500, 6000, 4500 **(b) (i)** 10500 **(b) (ii)** 13/60 **(b) (iii)** 13000 **(c)** 24

Question 2

(a) In general this was a poorly answered question with either no response at all or responses with no reference to trigonometrical ratios or methods. The other major error here was the assumption that the shaded rectangle was a square and using *AD* incorrectly as 12 m.

(b) Many candidates did not realise that a simple subtraction of *FD* – *AD* was all that was required to justify the given value.

(c) (i) Those candidates who recognised the use of Pythagoras were generally successful.

(ii) This part proved difficult for all but the best candidates. Correct use of a trig. ratio was rarely seen.

Answers: **(a) (i)** 52.3 **(ii)** 24.4 **(iii)** 17.0 **(b)** 7.4 justified **(c) (i)** 14.1 **(ii)** 31.7

Question 3

This was generally a well answered question although as usual weaker candidates mix up the definitions leading to incorrect answers.

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

(ii) This was generally well answered although a common error was leaving the answer as 12 – 5 or 5 – 12.

(iii) This was less successful with common errors of 12, 8 or 9 often seen. A method mark for the correct ordering of the data was available and this working should have been clearly seen.

(b) The points in general were plotted well although the scale going up in 2's caught out a significant number of candidates.

(c) (i) The calculation of the mean was generally well done although a common error was to attempt to use both sets of data involving 6x70 etc. A method mark was available for a clear attempt to total the data and divide by 12.

(ii) Many candidates did not appreciate the values required to plot this point. A common mistake was to plot it at (5, 38.8)

(d) (i) The line of best fit was generally correctly drawn showing an improvement on previous years. A common error still was to join up all the points in a series of straight lines.

(ii) This was generally well answered although a great variety of mathematical terms was seen.

Answers: **(a) (i)** 12 **(ii)** 7 **(iii)** 8.5 **(b)** points correctly plotted **(c) (i)** 8.58
(ii) point plotted **(d) (i)** line of best fit plotted **(ii)** negative

Question 4

In general candidates found it difficult to give a reason in words for their numerical answers although these properties are stated in the syllabus. The geometric reason was required rather than just the calculation required to find the sizes of the stated angles. It was also felt that a significant number may not have been able to identify the correct angle to be calculated e.g. not understanding the definition of "angle *CEG*

(a) The angle was often calculated correctly though few were able to state the correct property as the reason.

(b) The angle was again often correctly calculated. The correct property was seldom seen.

(c) With a follow through allowance the required angle was usually correctly calculated. Simply stating the calculation of 180 – 90 – 22 as the reason is insufficient for the second mark.

(d) The angle was again often correctly calculated. This part was most successful in terms of the reason given although a common insufficiency was in simply stating "parallel lines".

Answers: **(a)** 22º because tangent and diameter (radius) meet at 90º.
(b) 90º because angle in a semicircle (or angle subtended by a diameter).
(c) 68º because angles in a triangle = 180º.
(d) 68º because alternate or Z angles (or alternate segment).

Question 5

This question was surprisingly poorly answered, to some extent due to weaknesses in using the correct relationships between distance, speed and time, but also the common error of using 100 minutes to the hour. The application of common sense to the magnitude of the answers would have benefited a number of candidates. A number did not seem to appreciate the "story" or real life situation involved in the question.

(a) The fact that 3 kilometres in 30 minutes is equivalent to 6 kilometres in 60 minutes, and so a speed of 6 km/h, was not realised by most candidates. A number of candidates were able to substitute correctly to get 3/½ = 6. The errors of 3/30 = 0.1 and 30/3 = 10 were both very common. The error of 3/0.3 = 10 was also seen.

(b) (i) Although the majority of candidates were able to gain the method mark by doing 15/20, few were able to convert this correctly to 45 minutes. A significant number appeared to omit the 15 minutes spent waiting for the bus as given in the question. A small number gave a time period as their answer rather than the time of day as asked for.

(ii) Most candidates drew lines up to 18 km but quite a number did not use the scale with the words "shopping centre" clearly marked and ended at 20 km or 15 km. The majority did realise that a horizontal line was required to show the waiting time even if this time was not considered in **part (i)**.

(c) (i) The fact that 54 kilometres in 60 minutes is equivalent to 18 kilometres in 20 minutes, and so a time of 20 minutes, was not realised by most candidates. A number of candidates were able to substitute correctly to get 18/54 = 1/3 or 20 minutes.

(ii) A significant number were unable to show the correct journey on the grid even on a follow-through basis.

(d) (i) In this **part,** a significant number were able to show the correct journey home on the grid.

(ii) The ratio method that 18 kilometres in 45 minutes is equivalent to 6 kilometres in 15 minutes and then equivalent to 24 kilometres in 60 minutes, and so a speed of 24 km/h, was not realised by most candidates. A very small number of candidates were able to substitute correctly to get 18 / ¾ or 18 / 0.75 or 18 /45 x 60. The errors of 18 / 45 and 18 / 45 x 100 were both very common. A significant number of candidates were not able to attempt this part or gave a spurious answer with no working.

Answers: **(a)** 6 km/h **(b) (i)** 10 30 **(b) (ii)** lines drawn from (09 30, 3) to (09 45, 3) and then to (10 30, 18) **(c) (i)** 20 minutes **(c) (ii)** line drawn from (11 15, 0) to (11 35, 18) **(d) (i)** line drawn from (12 00, 18) to (12 45, 0) **(d) (ii)** 24 km/h

Question 6

Method marks were available for all parts of this question though could not always be awarded due to the lack of working shown.

(a) (i) This was generally well answered although 75 – 7 = 68 and 75 – 77 = –2 were common errors.

(ii) This part was less well answered with the required transposition to either 12 – 75 = – 7*x* or 7*x* = 75 –12 beyond all but the better candidates. The incorrect answer of –9 was common as a result.

(b) To some extent this part required the same transposition as the previous part though surprisingly it was better answered. (75–2*y*) / –7 and (2*y*–75) / 7 were however the common errors. A significant number did not appear to understand the concept of changing the subject of a formula and tried to get a purely numerical answer.

(c) This question on solving simultaneous equations was generally well answered particularly by those candidates who multiplied the first equation in order to eliminate the y terms. However a common error was then to subtract the two equations rather than adding. A number multiplied both equations in order to eliminate the x terms but this was generally less successful, with the common errors of adding the two equations and making $(–7y) – (8y) = y$ or $–y$. A small number used a substitution method but correct answers were rare.

Answers: **(a) (i)** y=13 **(a) (ii)** x=9 **(b)** (75–2y) / 7 or (2y–75) / –7 **(c)** x=11, y=–1

Question 7

(a) The table was mainly correct, though for $x = –3$ the y value was most often wrongly calculated.

(b) The curves drawn were generally of a good standard and did show an improvement on recent years. However the joining of the plotted points with a series of straight lines was still a common error. There was also a tendency for weaker candidates to draw a horizontal line for the lower part of the graph. The majority of candidates were awarded 3 or 4 marks for this part of the question.

(c) Partly because of the problems in the previous part, this part was generally poorly done. Common errors were (–1, –3) and (0, –3) even when the curve went below $y = –3$.

(d) (i) This part was generally well answered with some candidates able to recover from mistakes in **part (b)** by presumably using the table of values.

(ii) Only a small, yet significant, minority of candidates were able to state the required equation of symmetry correctly. Those few who tried to calculate it tended to be unsuccessful. Common errors were y=–1, y=–0.5, x=0.5, plus surprisingly $y=x^2+x–3$.

A significant number gave an expression rather than an equation, most commonly –½

Answers: **(a)** 3, –3, 3 **(b)** correct curve **(c)** (–0.5, –3.25) **(d) (i)** correct line
(d) (ii) $x = –0.5$

Question 8

(a) (i) This was generally well answered although regrettably the reversed coordinates of (–2, –3) was a common error.

(ii) This part, requiring column vectors, was surprisingly poorly done with a full range of digits and signs used. A significant number appeared to be confused between coordinates and vectors.

(b) Those who understood the definition and notation used were generally able to plot all 3 points correctly and gain full marks. However, this was not always the case, with common errors being translations of –4, 3 and triangles based on the point (4, –3).

(c) (i) Candidates seemed to find difficulty with not being asked to find the value of the vectors ***AP*** and ***AQ*** before plotting the points, or realising that the diagram itself could be used, and there was an enormous variety of positions P and Q plotted.

(ii) Those candidates who drew the triangle APQ to help them were able to identify and fully describe the correct transformation. A small number were able to use the information given rather than the actual diagram to give correct if incomplete answers. As usual the centre of enlargement was least successfully given.

(d) The choice of a midpoint value for the centre of rotation was unusual but was easy to identify as (–1, –1). However, this part was in general poorly answered. This may also be due to a lack of tracing paper provision as there was little evidence of this, or possible over reliance on the use of standard rotations.

Answers: **(a) (i)** (–3, –2) **(a) (ii)** column vectors of 4 , 2 and –3 , 2 **(b)** (1, –5) (5, –3) (2, –1)
(c) (i) P (5, 2) , Q (–1, 6) **(c) (ii)** Enlargement, scale factor 2, centre (–3, –2) or A
(d) (0, –4) (–3, –2) (1, 0)

Question 9

(a) (i) This was generally well answered although a common error was simply stating 10 as the answer.

(ii) This was generally well answered although a common error was to give the acute angle rather then the correct obtuse angle.

(b) (i) Only the best candidates were able to gain full marks on this part involving constructions. It did appear that fewer candidates were able correctly and accurately to draw the constructions from the information given within the question about the paths rather than just being asked to bisect the side and bisect the angle. It was pleasing to note that most candidates used arcs to draw their constructions even if they were not always correct or indeed accurate.

(ii) Consequently few candidates were able to identify and label correctly the region T. Those who did score full marks on **part (b) (i)** were generally correct here too. A small number seemed to indicate a point rather than a region.

(c) Only a few candidates were able to identify correctly and then draw accurately both parts of the required locus. Many were unable to attempt this part.

Answers: **(a) (i)** 100 m **(a) (ii)** 104º **(b) (i)** bisector of angle *ABC* and bisector of line *AD* drawn. **(b) (ii)** closed region T indicated **(c)** correct locus drawn (lines parallel to and 3 cm from *AB* and *BC*, with lines joined by arc, centre *B* and radius 3 cm)

Question 10

(a) This was well answered by the vast majority of candidates.

(b) This was well answered by the majority with most simply and correctly continuing the sequence to find the 10^{th} terms.

(c) (i) (ii) The algebra involved in finding the general term was only done successfully by the more able candidates. Common errors were n+3 and n+2. A disappointing number gave purely numeric answers.

(d) Most candidates found this part too difficult with few seeming to appreciate the mathematical meaning of the term “difference”. Of those who did indicate a subtraction very few managed to arrive at a correct answer even allowing for a follow through, although the method mark available was usually gained by these candidates.

Answers: **(a)** (lines) 10 , 13 (dots) 8 , 10 **(b)** (lines) 31 , (dots) 22 **(c) (i)** $3n + 1$ **(c) (ii)** $2n + 2$ **(d)** $n–1$ or $1–n$

MATHEMATICS

Paper 0580/04

Paper 4 (Extended)

General comments

Overall this paper proved slightly less difficult for candidates than last year's paper. Most candidates were able to at least attempt all questions, although the final question was often only partly attempted. The questions on arithmetic (percentages, ratio etc.), sine rule and cosine rule and drawing graphs were generally well attempted. The questions on functions, algebra – proof and solutions, volume of prisms and surface area, angles in circles and the final question proved difficult for many candidates.

There were as usual some excellent scripts, scoring high marks and many candidates were appropriately entered at extended tier and achieved success. There were, however, still substantial numbers entered for the wrong tier. They found this paper too challenging and the core examination would have been a much more suitable and positive experience for these candidates, who often scored their only marks in the arithmetic and drawing questions.

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 noted by most candidates this year and fewer marks were lost from premature approximation or for inaccurate final answers.

Most candidates followed all the rubric instructions but it is worth offering reminders that all working and answers should be together. A small number of candidates wrote on both the question paper and the answer paper. Some candidates attempt parts of questions in different parts of their scripts and on occasions did not cross out work when replacing it. In these situations it is often difficult to follow their working and answers and candidates do put themselves at risk of not demonstrating their ability.

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.

From 2009 this exam will require candidates to answer on the question paper in specified answer spaces, which should alleviate some of these problems.

A final point is that 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

Section A

Question 1

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

In **part (a)(i)**, many candidates worked out the required percentage correctly but some ignored the first line and evaluated 25% of $30 000. The weaker candidates often assumed that the total tax was 35% of 30 000 or 40 000. Most then knew how to find the total tax as a percentage of $40 000 even if the answer to **part (i)** was incorrect.

In **part (b)** most were successful and a follow-through mark was allowed for those who had made an error in **part (i)** and then gone on to use their value correctly. Weaker candidates often omitted one or more of the relevant amounts.

Part (c)(i) was very well answered, apart from the few who gave the savings instead of the shopping, and a few that multiplied by 12 after finding the correct answer, presumably confused by the use of the word 'year' in the question.

In the second part of **(c)** nearly all responses involved \$4 500 but with very few giving $\frac{9}{80}$ as the answer.

A considerable number gave the improper fraction $\frac{80}{9}$ or 4 500/12 000 = 3/8. Some adopted ratio form.

In the final part, many recognised the reverse percentage aspect and were successful in obtaining \$8 640. However a considerable number reduced \$10 800 by 25% to give \$8 100 which is the predictable error on this type of percentage question, but generally candidates appear to be improving in this topic area.

Answers: **(a)(i)** \$6000, **(ii)** 15% ; **(b)** 11200 ; **(c)(i)** \$7500, **(ii)** $\frac{9}{80}$; **(d)** 8640.

Question 2

There were mixed responses, with **part (b)** proving to be the most difficult part, presumably because it was a bit unusual. The standard algebraic parts were answered well.

In the first part of **(a)**, many were able to gain partial credit for making a correct area statement involving the base and height and the value 48. To score both marks, candidates had to ensure that no errors were made in arriving at the required equation and many made the error of omitting brackets within their working.

Part (ii) was generally well done, most solving by factorising, some others chose to use the quadratic formula. Sign errors were sometimes seen resulting in answers of –8 and 12.

Part (iii) was also well answered and a follow through was allowed from the positive root in **part (ii)**.

Very few were able to interpret the requirements of **part (b)** and many calculated the angle *y* by $\tan^{-1}\left(\frac{1}{6}\right)$ but then made no further progress. Others made incorrect statements such as $\tan\frac{1}{6} = \frac{x}{12}$. A large number of candidates appeared to think that this part still referred to **part (a)** so it was very common to see *x*/12.

In part of **(c)(i)**, the proof was generally well done and the risk of omitting brackets was much less. It is pleasing to note that $(x+4)^2 = x^2 + 16$ was quite rare.

Many were well prepared for the next part on solving the quadratic equation by using the formula and most could recall it correctly. For those that did not obtain the correct answers, the common errors included the initial substitution or later when miscopying from a previous line, for example the denominator became 2 instead of 4 fairly frequently. Some used a short division line and others did not give answers correct to required accuracy of two decimal places. Many were successful with **part (iii)** and a follow through was available for use of the positive root in the previous part. A small number gave 2*x* + 13 as the answer.

Answers: **(a) (ii)** –12 or 8, **(iii)** 12 ; **(b)** $\frac{4}{5}$; **(c)(ii)** –8.04 and 4.04 , **(iii)** 21.1.

Question 3

This was often the highest scoring question on the paper.

The majority of candidates gained full marks in **part (a)** but there were some who gave 4.96 or –5.04 for *p* and 8.6 for *r*.

In **part (b)**, almost all used the correct scale for the graph and the majority plotted their points to the required accuracy of within one millimetre and drew reasonable curves through their 10 points. A minority lost the curve mark by joining at least two points by a straight line. Some then did not recognise the nature of the function and joined the two curved sections together thus losing the final mark as they failed to recognise that there should be two separate curves.

Part (c) was not well done. Many did not attempt it at all and of those who did, the line f(x) = $-3x$ was rarely correct. It was often seen as $y = -3$ or $x = -3$.

Only the more able candidates were successful in **(c)(ii).**

In the final part the tangent was usually drawn correctly at the correct point although the gradient was done less well, with a common error to attempt a rise /run method with lengths but then to omit the negative as the tangent is downward sloping. Candidates were often given credit for the correct method in this part provided they showed their working clearly. A clear right-angled triangle on the tangent is recommended in this situation.

Answers: **(a)** 5.0, 0, 8.7 ; **(b)** graph ; **(c)(i)** –2.95 to –2.6, –0.75 to –0.6, 0.5 to 0.6 ,
(ii) 3, –1 ; **(d)** –4.5 to –3

Question 4

There were very mixed responses to this question, and the topic of mensuration generally tends not to reflect performances in other questions. Some candidates misunderstood the actual situation of the question, despite the diagrams provided.

Many found **part (a)** very straightforward and divided 360 by 5 to arrive at 72°. A very common error was to give 60° or sometimes 90° or 108°.

For the area of the triangle in **part (b)(i)**, many used the ½*ab*sin*C* method and usually earned at least one mark for the correct method. A surprising number, however, worked out the base and height of the triangle in order to find the area and this was less efficient because rounding errors within the method sometimes spoiled the final answer. Fortunately, the base was useful for a later part of this question. Most were successful in **part (b)(ii)** in multiplying their answer to **part (i)** by 5 correctly, although a few inexplicably chose to multiply by 4.

Part (b)(iii) was found to be challenging but there were many good solutions and from different methods. The most popular method was to take the volume of the prism from the volume of the cylinder. The weaker candidates may have earned a mark for the area of a circle or the volume of a cylinder but little else. Some candidates gave the volume of the prism as their answer.

In **part (c)**, the difficult part of this question was realising that the length of *AB* was needed and then how to work it out. A large number of candidates missed this and used the length 15 cm for *AB*, but gained a consolation mark by adding the two ends of the prism to five rectangles. A few formulae involving π appeared, even though there was nothing circular about the prism. As in **(b)(iii)**, weaker candidates scored 1 or 0 in this part.

Answers: **(a)** 72 ; **(b)(i)** 107, **(ii)** 535, **(iii)** 8590 to 8625 ; **(c)** 5470 to 5480.

Question 5

Parts (c) and **(d)** offered most candidates the opportunity to demonstrate their knowledge of trigonometric formulae and their ability to apply them accurately. Converting hours into minutes continues to be a problem for many. The final **part (e)** proved to be more difficult than expected.

In **part (a)**, most candidates divided 100 km by 35 km/h to gain the first mark but it was disappointing to see so many at this level convert, for example, 0.86 hours into 1 hour and 26 minutes. Many left the final answer as the length of time of the journey and not the time of the day. A very common answer was 14 47, which was arrived at by an approximation earlier in the working. Some used the distances 60 km or 40 km instead of 100 km in the initial calculation.

In **part (b)** there were mixed responses, with quite a number of candidates omitting this part. In **(i)** common errors were 280°, 100° and 080°. There was more success with **(ii)**, often following through from **(i)** where candidates seemed to understand that the two bearings differed by 115°.

In **part (c)**, the cosine rule was chosen by most candidates and used very well generally, Examiners noted that a common error was to use sin115 instead of cos115; only a few chose to use Pythagoras.

The sine rule was chosen by most in **part (d)** to find angle *BAC* and it was used very well. Both the sine rule and the cosine rule were strong areas for candidates this year.

Part (e) was found to be quite difficult. Many could not see which distance was required and omitted this part. Others gave angles as answers. The most successful answers were from using one large right-angled triangle rather than the two components e.g. using 85sin60.2° or 85cos29.8°.

Answers: **(a)** 14 46; **(b)(i)** 260, **(ii)** 145 ; **(c)** 85 ; **(d)** 39.76 to 39.8 ;
(e) 73.76 to 73.81 .

Question 6

This question provided mixed success for candidates. The straightforward calculation of a mean in **(b)** was the part most candidates could attempt. The problem solving aspect of **(a)** proved to be difficult for many. Frequency density continues to be a difficult area of the syllabus.

Part (a)(i) was usually well done although a few mixed up mean, mode and median. Another common error was to give an answer of 10 or 7.

In the second part, many obtained one median but did not seem to realise that the median would shift as x changed. 30.5 was often omitted by those who realised there was more than one median. Several gave a range, 30 – 31. There were many attempts at the average of 30, 31 and 32 by adding and dividing by 3.

In **part (iii)**, many candidates set up an equation and went on to solve it perfectly. In a surprising number of cases, $17 + x$ became $17x$ when multiplying out the fractions in the equation. There were some reasonable trial and improvement solutions, especially for those who realised that the answer was an integer. The only risk with trial and improvement is that candidates must obtain the correct answer to score any marks.

In **part (b)**, the estimated mean calculation was very well done. Most candidates were well organised and usually showed excellent working. A few made errors in midpoints included using either end of the class intervals, or, more commonly, using the class width instead. Only a very few divided by 4 instead of 200.

In the final part many candidates seem to be unaware of how a histogram is drawn and frequency density seemed to be beyond their knowledge. The second height of 2.6 was often the only mark scored, somewhat fortunately. The most common mistake was thinking that all of the frequencies had to be divided by 10 regardless of the width of the class. Histograms continue to be an area of the syllabus needing attention.

Answers: **(a)(i)** 30, **(ii)** 30, 30.5, 31 , **(iii)** 3; **(b)(i)** 20.93 or 20.9 , **(ii)** 2.6, 0.7 and 0.8.

Question 7

In **part (a)**, where descriptions were required of the transformations shown on the grid, most candidates recognised the translation but often could not describe the movement as 11 down accurately. Column vectors were not required here, but some chose to use them; poor notation was penalised however. The first reflection was well done and the mirror line was usually correct. The second reflection was often given as a rotation however. The enlargement in **part (iv)** was identified more often than the stretch in **part (v)** but the scale factor was sometimes given as 2 instead of 0.5 and the centre of enlargement was often not given. In **part (v)**, it was expected that the candidates made reference to the scale factor and the invariant line to describe the stretch, many mentioned the scale factor but few gave the correct invariant line as the x-axis.

Some candidates gave more than one transformation in each part and where this was the case no marks were scored as a **single** transformation was asked for.

In **part (b)**, candidates usually scored both marks for each part or none, with the first matrix correct more often than the second. Some chose to use the method of simultaneous equations to find the unknown matrices without success; this method is lengthy, prone to error and inefficient and should be discouraged. Knowledge of the unit vector method is more efficient for candidates.

Some candidates quoted the matrices from memory and often had values in incorrect positions, e.g. $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$.

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

Answers: **(a)(i)** Translation $\begin{pmatrix} 0 \\ -11 \end{pmatrix}$ or equivalent , **(ii)** Reflection in $x = 1$, **(iii)** Reflection in $y = -x$,
(iv) Enlargement, scale factor ½ , centre (2, 0) , **(v)** Stretch, factor 2 with x-axis invariant ;
(b)(i) $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$, **(ii)** $\begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$.

Question 8

This was a short, but surprisingly challenging question. Giving reasons for answers is not popular, even with the more able candidates, and Centres should be aware that precise mathematical language is expected when describing geometric properties.

In **part (a)**, there were many correct values given and some gave the correct reason of either 'alternate angles' or 'Z angles'. Many fell short of acceptable reasons however e.g. "parallel lines" was not sufficiently precise. Responses for y and z were mixed as those candidates who appreciated that $ACDE$ was a cyclic quadrilateral usually went on to calculate both correctly. Some then gave correct reasons but others only gave a partial reason such as 'opposite angles of a quadrilateral'. Those that did not give the correct answers made a false geometric assumption such as assuming that x and y are equal, usually leading to $x = y = 123°$. Another error was to assume that ED is parallel to AC, in spite of **(b)** stating that they are not. These candidates gave $y = 180° – 78° = 102°$ and $z = 144°$.

In **part (b)** there were similar problems in giving a reason referring to angles. Common incorrect answers were "the lines do not meet", "x and z" are not equal, and even "there are no arrows on the lines in the diagram".

Part (c) was often omitted, with 36° being a common wrong answer. In **part (d)**, there was confusion over which sides were equal in what should have been a very straightforward question. Answers of 78° and 24° were quite common.

Answers: **(a)** $x = 78°$ alternate angles, $y = 144°$ opposite angles of a cyclic quadrilateral add up to 180°, $z = 102°$ opposite angles of a cyclic quadrilateral add up to 180° or angle sum of a quadrilateral is 360°; **(b)** $z + 36° \neq 180°$; **(c)** 72° or 288° ; **(d)** 51° .

Question 9

Most candidates were able to score marks on this question although very few candidates earned full marks.

In **part (a)**, most gave p, q and r correctly. One of the few errors seen was $p = 3$ (from using 40 rather than 42) but these nearly always gave $q = 12$ and then went to earn the final mark for $r = 3$ as a follow through mark.

Part (b) was very well answered.

In **part (c)(i)**, most candidates gave 100 – 74 = 26 but some used the alternative method of $p + q + 8 + r$ and occasionally just gave $p + q + 8 = 25$.

Part (ii) was less well done than **part (c)(i)** with a variety of errors seen. Interpreting the set notation used in this part proved difficult.

In **part (d)**, both probabilities were well done again with no common errors noted.

The final part proved challenging and many gave a fraction with a denominator of 74 even though they were then unable to give a correct second fraction. Those who did use the correct approach sometimes gave $\frac{20}{74}\times\frac{19}{73}$ from interpreting the question as 'basketball only' with a similar error giving $\frac{17}{74}\times\frac{16}{73}$. A few candidates added the fractions and some gave an answer derived from a method involving replacement. A number of candidates attempted to use a tree diagram but with mixed results. Correct answers were very rare to this part.

Answers: **(a)** 5, 12, 1 ; **(b)(i)** 17, **(ii)** 12 ; **(c)(i)** 26 , **(ii)** 57 ; **(d)(i)** $\frac{8}{100}$, **(ii)** $\frac{45}{100}$; **(e)** $\frac{18}{73}$.

Question 10

"Show that" again proved to be challenging, although many candidates were successful in **(a)(i)**. Converting into algebraic expressions proved to be beyond many candidates who seemed to overlook the structure and guidance given in the question.

Part (a) was reasonably well done. A common error was not to show the list 1+2+3…+8=36. Many others did not understand the use of the formula. It was common to see the '*n* =' on the left still in the calculations and workings. Some candidates only did one half of the "show", others worked on both sides at the same time to get down to 36 =36. The candidates that left the *n* = on the left then had a problem with the resulting equation, "36" + *n* = 36", so went on to solve it (incorrectly).

Part (b) (i) was the least successful part of the whole question, with very few algebraic solutions. Most candidates seemed to think they could use the same method as in **(a)(i)** with a number of their choice.

In **part (ii)**, fortunately many candidates realised that they could use **(i)** and scored an easy mark while in **part (iii)** it was disappointing to see so many with **(a)(ii)** and **(b)(ii)** correct but then unable to connect their answers for this part.

The first part of **(c)** saw only limited success and only the stronger candidates saw the simple substitution of $2x$ for x.

For the final part there were a few correct answers, often from intuition rather than following the thread of the question. Most candidates, however, had abandoned this question by this stage.

Answers: **(a)(ii)** 80200 ; **(b)(ii)** 40200 , **(iii)** 40000 ; **(c)(i)** $\frac{2n(2n+1)}{2}$, **(ii)** n^2 .

