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MATHEMATICS

Paper 0580/12
Paper 12 (Core)

Key messages

To succeed in this paper candidates need to have completed full syllabus coverage, remember necessary formulae, show all necessary working clearly and use a suitable level of accuracy.

General comments

Overall there was a good response by candidates to the demands of this paper. Working was shown extensively but it still needs emphasising that only candidates showing working will have opportunity for some credit if final answers are incorrect or given to insufficient accuracy.

Candidates should consider more carefully if their answers are sensible in relation to the context or to the form expected for the type of question.

Comments on specific questions

Question 1

Nearly all candidates gained the mark but there were a few answers of 12 15 and 11 15 seen. While the various ways of writing 12 20, such as 12:20 were allowed, writing 12 h 20 min was not acceptable as this indicated a time period rather than an actual time of day.

Answer: 12 20

Question 2

The most common error was an answer of 0.3 but most candidates answered this correctly. A small number gave responses of $\frac{1}{0.97}$ or the original probability as a fraction, $\frac{97}{100}$.

Answer: 0.03

Question 3

Most candidates recognised the types of angle shown in the examples. For those not knowing or remembering the definitions there was a mix of all three incorrect letters offered. Just a few felt a word, rather than a letter, was needed as the answer.

Answer: *C*

Question 4

This question proved challenging for many since the 11 had to be subtracted from −3 rather than added to it, resulting in a very common response of 8. While there were a lot of correct answers there were a significant number who gave 14.

Answer: −14

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Question 5

Only a few of the least able candidates didn't work out the required product of 22 and 15 correctly.

Answer: 330

Question 6

'Angles in a triangle total 180' alone doesn't answer what the given angles total. '55 + 85 + 50 = 190' alone or even 'it doesn't add up to 180' still needs more proof that the statement is incorrect.

Question 7

Some candidates offered 2-dimensional shapes, for example rectangle or triangle, even though a solid suggests 3-dimensions. Other incorrect responses included pyramid, cube or cuboid.

Answer: Triangular prism

Question 8

(a) Some candidates did not start the significant figures at the first non-zero digit resulting in answers of 0.0 or 0.5, while others added extra zeros to replace one or all of the digits dropped. While there were many correct responses, some gave 0.046 by not considering the next digit, 8.

(b) Standard form was well known and the vast majority gained the mark. Common errors were 276×10^4, 2.76×10^4 and 27.6×10^5. A significant number of candidates rounded the figures to 2.7 or 2.8.

Answers: **(a)** 0.047 **(b)** 2.76×10^6

Question 9

Most candidates drew correct reflections but a few slipped up on one of the points to gain 1 mark. A few drew a translation of the shape or a reflection incorrectly positioned.

Question 10

Nearly all candidates correctly listed the six factors although a few missed out one of them, usually 1 or 12. A small number of candidates gave multiples instead of factors.

Answer: 1, 2, 3, 4, 6, 12

Question 11

(a) This was correctly answered by the vast majority. However, a small number of candidates omitted the – sign or did not multiply the second component by 3.

(b) Directed number rules caused quite a few to not score this mark by subtracting a negative number incorrectly. However errors were less common when the subtraction of the vectors was set out in the working space. Just a small number of candidates did not understand vectors and either gave a single component or gave a 'fraction line' between the components.

Answers: **(a)** $\begin{pmatrix} -15 \\ 12 \end{pmatrix}$ **(b)** $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$

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Question 12

(a) While most candidates correctly multiplied the 5 and 3, a significant number added to give an index of 8. There were a few who gave just the index without the letter (in both parts).

(b) This part was also well answered but again a number did not deal correctly with 7 – (–2) leading to responses of w^5 or w^{-9}.

Answers: **(a)** y^{15} **(b)** w^9

Question 13

This question stated it was to be answered without a calculator. Many candidates wrote 104 instead of 100 for the approximate value of 104.3. Another error was incorrectly rounding 8.72 to 8 instead of 9 while quite a significant number did not attempt any rounding, not following the instructions of the question.

Answer: 5 from 100, 9 and 7 used in the calculation

Question 14

While most candidates correctly converted dollars to euros, a significant number multiplied by the exchange rate instead of dividing, leading to 534.85.

Answer: 467.42

Question 15

(a) Many candidates answered this conversion of units correctly but there were many writing 6.45 from dividing by 100 or 6450 from multiplying by 10.

(b) This was not answered well with quite a number of candidates working out 4.1^3. Those who gave answers starting with 41 gave various numbers of zeros; the most common was to multiply by 100.

Answers: **(a)** 64.5 **(b)** 4100 000

Question 16

This question had metres for the width and centimetres for the accuracy. This was challenging for many candidates who often gave centimetre bounds, 415 and 425 even though the '*w*' was in metres. Others subtracted and added 0.5 instead of 0.05 or did not halve the 10 cm.

Answer: $4.15 \leq w < 4.25$

Question 17

This enlargement with scale factor 3 meant that all sides had to be 3 times the original, namely 6 cm and 12 cm, for the vertical and horizontal sides respectively. Many triangles did not have these lengths of sides. Those who drew construction lines from the centre through the points almost always scored full marks. Candidates must realise that grids are always large enough for correct solutions to be shown.

Question 18

Subtracting 0.0028 from 25 000 or dividing 25 000 by 0.0028 produce totally unrealistic answers but were seen at times. Errors in the decimal place or number of zeros often led to answers of 7 or 700. Dividing the correct answer by 100 gave another answer which had no meaning for the context.

Answer: 70

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Question 19

This factorising question was quite well answered with only a small minority reducing the answer to a single algebraic expression. However, many did not achieve the complete factorisation, most often giving $2g$ as the common factor of the expression. Others included g in the second term inside the bracket when it was already a common factor.

Answer: $4g\,(2g - 1)$

Question 20

To eliminate y from the equations, a simple addition of them was all that was needed. However many who realised no multiplication was needed subtracted the x terms leading to $4x$ and usually an answer of -1. Some of those who used multiplication to eliminate x did manage to find the correct answers but many made sign errors. Substitution was not really suitable for this case and rarely scored more than the method mark. Just a few ignored the instruction to show all working.

Answer: $x = 3.5$ $y = 3$

Question 21

A significant number of candidates found the volume, rather than the surface area. A correct approach often just resulted in three areas found rather than the required six. Some managed to find one area but then got mixed up between adding and multiplying lengths and areas. A number thought that four of the faces were 12 by 7.5.

Answer: 375

Question 22

The denominator of the fraction for percentage increase has to be the original amount but many candidates used a denominator of 77. Others did not understand the question and found 14% of either 63 or 77. Others who made good progress gave an answer of 22 with the general rule of 3 significant figures not being applied.

Answer: 22.2

Question 23

(a) Nearly all candidates knew the name of this quadrilateral. Rhombus was the most common incorrect answer but others were seen.

(b) Many candidates thought they had to find the area by counting squares and part squares to give an estimate. This question asked for the area to be worked out, not estimated. A significant number did multiply the diagonals and halve the answer while others split the shape into 2 or 4 triangles. When this working was recognised, some credit could be given even if errors were made. Some measured and then added or multiplied the sides. Most candidates gained the mark for the units but some omitted units or gave cm^3.

Answers: **(a)** Kite **(b)** 24 cm^2

Question 24

The question asked for the range but it needed the fifth number found first. While there were a significant number of fully correct answers, many found the two stages challenging. Having found 17 this was often given as the answer rather than continuing to the range. Many who struggled with the question simply gave $12 - 3$ or 9 as the range. While the total, 30, of the four numbers was often found a number then worked from $30x = 9.4 \times 5$ rather than $30 + x = 9.4 \times 5$.

Answer: 14

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Question 25

Division of fractions can be approached by inverting the second fraction and multiplying or working with a common denominator. Quite a number of candidates confused the two methods leading to incorrect solutions. Nearly all changed the mixed number to an improper fraction and most of these progressed to one of the correct methods leading to an improper fraction. However, a large number lost the final mark as they did not change their answer to a mixed number or if they did, it was not in its simplest form.

Answer: $7\frac{1}{2}$

Question 26

(a) While many candidates correctly applied Pythagoras' theorem, the final mark was often lost for answers of 2.9 or 3 without more accuracy in the working. The common error was to square and add the sides, leading to an answer of 6.89. Trigonometry could be used here in two calculations but that rarely produced a correct answer or one that didn't lose accuracy.

(b) Most candidates who were familiar with trigonometry gained the mark for recognising sine and giving the correct fraction, although 8.2 divided by 5.3 was seen. However, many lost the second mark for a variety of reasons. Some did not know how to find the angle from the decimal but most rounded the decimal, for example 0.65, before finding the angle.

Answers: **(a)** 2.95 **(b)** 40.3

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MATHEMATICS

Paper 0580/22
Paper 22 (Extended)

Key messages

To succeed in this paper candidates need to have completed full syllabus coverage, remember necessary formulae, show all necessary working clearly and use a suitable level of accuracy.

General comments

The level of the paper was such that all candidates were able to demonstrate their knowledge and ability. There was no evidence that candidates were short of time, as almost all attempted the last few questions. Candidates showed evidence of good basic skills with particular success in **Questions 2**, **4(b)**, **5**, **6**, **13(a)** and **17(a)**. Candidates were good at showing their working although sometimes stages in the working were omitted and so all method marks were not always awarded. It was rare to see candidates showing just the answers with no working. The main issue seen was not working to an appropriate accuracy; some candidates lost marks due to rounding or truncating prematurely within the working or giving answers to less than the required 3 significant figures.

Comments on specific questions

Question 1

Most candidates obtained the correct answer of –14. The most common incorrect answer was 8 from the working 11 – 3. A rare incorrect answer was 14.

Answer: –14

Question 2

This question was almost always answered correctly. Those with an incorrect answer occasionally attempted some sort of ratio work or made an arithmetic slip.

Answer: 330

Question 3

This question was answered correctly by many candidates. Most used the method that equated the fraction to a letter and multiplied by 100, e.g. $n = 0.2323\ldots$ and $100n = 23.2323\ldots$ and subtracting gives $99n = 23$ from which the correct answer is obtained. Common incorrect answers seen were $\frac{23}{100}$, $\frac{23}{90}$ and $\frac{21}{90}$ obtained from 0.2333… .

Answer: $\frac{23}{99}$

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Question 4

The majority of candidates understood what was being asked in both parts of this question. More errors were made in part **(a)** with two common errors apparent. The first was to confuse significant figures with decimal places, giving 0.05 as the answer; the second was to add zeros after the second significant figure, e.g. 0.047000. The vast majority of candidates demonstrated that they could convert a value to standard form in part **(b)** with only a few using an incorrect form, e.g. 27.6×10^5 or 276×10^4. Candidates should be aware that an exact answer should not be rounded and a common incorrect answer was 2.8×10^6.

Answer: **(a)** 0.047 **(b)** 2.76×10^6

Question 5

Most candidates produced a fully correct solution to this question. Just a small number incorrectly multiplied, rather than divided, 500 by 1.0697.

Answer: 467.42

Question 6

This was very well answered by most candidates. In a few cases division was used leading to answers of either over 8 million or 1.12×10^{-7}; candidates should consider the common sense of their answers. A small number gave an answer of 7 or 700, presumably from incorrect entry of the digits into the calculator or a misread of the figures. In some cases these candidates showed the correct working and still gained the method marks, even if there was a misread of the figures, but many did not.

Answer: 70

Question 7

This bearings question was one of the more challenging questions on the paper for candidates although many earned full marks. Common incorrect working and answers included 180 – 128 = 52 and 360 – 128 = 232.

Answer: 308

Question 8

Many of the less able candidates found this question challenging. Some tried to equate the routes $\overrightarrow{OA}$ and $\overrightarrow{BA}$ in an attempt to solve an equation. Of those who understood the idea some simply added the routes giving 3x – y, not taking the direction of the routes given into consideration. Candidates who did realise they needed to subtract $\overrightarrow{BA}$ often had a sign error; instead of $2\mathbf{x} + 3\mathbf{y} - (\mathbf{x} - 4\mathbf{y})$ they wrote $2\mathbf{x} + 3\mathbf{y} - \mathbf{x} - 4\mathbf{y}$ so a very common incorrect answer was $\mathbf{x} - \mathbf{y}$. Some candidates were able to gain partial marks for demonstrating an understanding of the meaning of a position vector, e.g. writing the route as the letters *OB*, *OA* – *BA* or *OA* + *AB*.

Answer: $\mathbf{x} + 7\mathbf{y}$

Question 9

A few candidates produced work with the proportional symbol used throughout. Most did start by writing the basic equation $y = k(x - 4)$. Most substituted the values $x = 16$ and $y = 3$ but a common error was to obtain $k = 4$ from $3 = 12k$. Therefore a common incorrect answer was $4(x - 4)$.

Answer: $y = \frac{1}{4}(x - 4)$

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Question 10

The majority of candidates could find the surface area of the cuboid correctly, with many quoting the correct formula at the top of their working. A significant minority thought that four of the faces were the same, the most common being four faces of 12 by 7.5 with a very common incorrect answer of 435 from $12 \times 7.5 \times 4 + 7.5 \times 5 \times 2$. Others did not consider the faces that were hidden on the diagram and so only gave half of the total surface area. The volume of the cuboid was calculated by quite a few candidates.

Answer: 375

Question 11

Many fully correct answers were seen in this question. A few candidates incorrectly gave the percentage increase as 122.2% rather than 22.2%. A small number of candidates divided the increase by 77 rather than by the original amount of 63. Some candidates lost the accuracy mark as the answer was often only given correct to 2 significant figures.

Answer: 22.2

Question 12

This question was generally well answered with most candidates scoring full marks having correctly used the given formula to find the radius. The most common reason for loss of marks was giving the answer correct to only 2 significant figures with 4.2 seen fairly often as the final answer. In some of these cases the working was shown in full and 2 marks could be awarded but in other cases the method was not fully shown so only 1, or occasionally 0, marks could be given. Occasionally candidates prematurely rounded part way through their calculation or did not use a value of π as instructed on the front cover of the exam paper causing a loss of the accuracy mark.

Answer: 4.21

Question 13

In part **(a)** most candidates were able to score the mark for their factorisation. The most common incorrect method involved trying to write the 15 or 7 outside the bracket leading to a fraction inside the bracket. Part **(b)** was a good discriminator as the most challenging question in the paper. A common incomplete solution was to take only the 4 out as a factor and stopping at $4(3(m+p)+2(m+p)^2)$. A correct partial factorisation of $(m+p)$ gained many candidates the B1 mark, e.g. $(m+p)(12+8(m+p))$. A significant number of candidates expanded the brackets but then could not factorise the resulting expression; some were able to factorise by grouping from this point.

Answer: **(a)** $k(7k-15)$ **(b)** $4(m+p)(3+2m+2p)$

Question 14

There were very few candidates confusing simple and compound interest. A common incorrect answer was 7788.60 from $6999.31 \times \left(1+\frac{2.16}{100}\right)^5$. A few used $\left(1-\frac{2.16}{100}\right)^5$. Most candidates gave the correct answer using an unrounded value for $\left(1+\frac{2.16}{100}\right)^5$. Some lost the accuracy mark as they prematurely rounded $\left(1+\frac{2.16}{100}\right)^5$ to a variety of rounded values. Most candidates were able to score 1 mark for $\left(1+\frac{2.16}{100}\right)^5$. Very occasionally 21.6% was used instead of 2.16%.

Answer: 6290

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Question 15

Most candidates found angle *OPA* to be 55° by using the triangle *OPA* and calculating 180 – 104 – 21. Many wrote it in the correct place on the diagram but very few used the correct angle notation. Candidates are advised not to write $P = 55°$ as there are several angles at *P* so it is not clear which one they are referring to without it also marked on the diagram. Many were also able to find angle *BPC* as 55° and again usually this was credited on the diagram. Only the best answers recognised angle *PBC* as half of angle *AOP*. The common incorrect methods assumed that triangle *PBC* was isosceles and from this incorrect assumption they calculated *w* as 62.5°, 55° or 70°. Another common incorrect method was to think that *OAP* and *BCP* were angles in the same segment and so $w = 21°$ was also a common incorrect answer.

Answer: 73

Question 16

Candidates demonstrated an excellent understanding of the term 'tangent' and the vast majority drew it with the accuracy required. The majority then successfully used their tangent to find the correct gradient. Candidates should check to see whether they would expect a negative or positive gradient as some gave a positive value rather than negative. After drawing a good tangent, some candidates then chose points on the curve to find a gradient, rather than finding the gradient of the tangent. Other errors included choosing points too close together to be able to complete an accurate calculation or incorrectly using $\frac{x_2 - x_1}{y_2 - y_1}$.

Answer: –0.7 to –0.3

Question 17

In part **(a)** most candidates gave a correct answer of –3. A small number of candidates incorrectly gave the value of *n* as 5^{-3}. In part **(b)** candidates were more often able to fully simplify the numerical part of the term rather than the algebraic part. Sometimes answers were not presented in their simplest form; for example, a commonly seen partially correct answer was $\frac{0.25}{m^{-1}}$.

Answer: **(a)** –3 **(b)** $\frac{m}{4}$

Question 18

This question was a challenge for many candidates. Many were able to score at least 1 mark for part of the relevant method. Many found the cross-sectional area correctly with only a relatively small number using an incorrect formula such as $2 \times \pi \times 2.6^2$, $\pi \times 2.6^3$ or $2 \times \pi \times 2.6$. Quite a few were also able to find the total length of the water that passed in one hour as $12 \times 60 \times 60 = 43\,200$ cm and many used the correct conversion from cm^3 to litres. However, there were few who managed to do all of these steps correctly. Some common incorrect answers were 0.255 from those who found the number of litres per second, 15.3 which is the number of litres per minute, 255 which is the volume in cm^3 per second or 43.2 which does not take into account the cross-sectional area. A few tried to convert to metres before finding the volume but they were rarely successful. As with other questions on the paper several candidates lost the final mark due to prematurely rounding part way through the calculation.

Answer: 917

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Question 19

This question was well answered. A small number of candidates spoiled their answer of $\frac{b}{a+b}$ by continuing to cancel the b's to arrive at an answer of a or $\frac{1}{a}$. The most common mark was for the correct factorisation of $ab-b^2$. A common error for the denominator was $a^2-b^2=(a-b)(a-b)$. A small number of candidates gained the first two marks, then incorrectly cancelled the wrong bracket in the denominator or did not cancel at all. A significant number of candidates did not realise that they needed to factorise and merely incorrectly cancelled one a and one b in the numerator and denominator.

Answer: $\frac{b}{a+b}$

Question 20

Part **(a)** was usually correct and working was often shown. Of those that did not score full marks, 1 mark was often scored for two correct elements. The elements were usually found by multiplying a row and a column, but not always the correct row and column. Some candidates made arithmetic slips and it was quite common for the 7 to be 10 (from 2×5 instead of $2+5$). Part **(b)** was often answered correctly but less able candidates sometimes did not attempt it. Some candidates used $3x+7=5$ giving $x=-\frac{2}{3}$. The most common incorrect method was to use $\frac{1}{3x-7}=5$ giving $x=2.4$.

Answer: **(a)** $\begin{pmatrix} 7 & 8 \\ -11 & 36 \end{pmatrix}$ **(b)** 4

Question 21

A few candidates wrote the mixed number as $\frac{24}{8}$ rather than $\frac{25}{8}$. Most gave the correct working, e.g. $\frac{25}{8}\times\frac{12}{5}$. From this the most efficient method was to cancel down to $\frac{5}{2}\times\frac{3}{1}$ and hence $\frac{15}{2}$ to $7\frac{1}{2}$. A few worked with a common denominator, $\frac{125}{40}\times\frac{96}{40}$, and then $\frac{12000}{1600}$ which was cancelled down to $\frac{15}{2}$ but this made the calculation very difficult without the use of a calculator. Some worked out $\frac{75}{24}\div\frac{10}{24}$ or $\frac{300}{96}\div\frac{40}{96}$ which are much easier to simplify to $\frac{75}{10}$ or $\frac{300}{40}$ and hence to $7\frac{1}{2}$. Very few used decimals although quite a few gave an answer of 7.5 or used 7.5 in the working then changed to $7\frac{1}{2}$. The most common errors were arithmetic errors and a few who attempted to add the fractions.

Answer: $7\frac{1}{2}$

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Question 22

The vast majority of candidates showed the correct calculation to find the acceleration in part **(a)**. More care should be taken with rounding and accuracy as many did not gain the mark available because they gave the answer 1.6, 1.66 or 1.7. Candidates should be reminded to give answers correct to 3 significant figures or indicate the recurring decimal. Some, who did not understand acceleration, calculated the area under the first section of the graph. In part **(b)** the majority of candidates understood the need to calculate the area under the graph in order to find distance travelled and most did this successfully. There were a few errors in the calculation, sometimes forgetting to halve the 15×25 for the first area, or not subtracting, or incorrectly subtracting, 15 from 50 to find the length of time in the second part of the journey. In these cases candidates were showing working and so generally gained a method mark for calculating one of the areas correctly. Candidates who did not score any marks were usually stating that distance is speed multiplied by time and simply multiplied 25 by 50. Candidates are reminded that this formula is only correct for a constant speed.

Answer: **(a)** 1.67 **(b)** 1062.5

Question 23

In part **(a)** most candidates correctly found the co-ordinates of the midpoint. The most common error was for the relevant co-ordinates of *A* and *B* to be subtracted rather than added before division by two. A few candidates wrote the co-ordinates the wrong way around. In part **(b)** candidates found it more challenging to obtain full marks with the most common score being 2. Most candidates were able to correctly find the gradient of *AB.* Fewer candidates were able to correctly find the gradient of the perpendicular to *AB* but still quite a significant number did. Some candidates either omitted to find the gradient of the perpendicular or made an error in doing this. The most common error, having correctly found the perpendicular gradient, was for candidates to find the equation of the perpendicular bisector of *AB*, by using the midpoint from part **(a)**, rather than finding the equation of the perpendicular line through point *A*. Therefore the most common incorrect answer was $y = \frac{5}{8}x - \frac{61}{16}$. A small number gave the value of the gradient of the required line as $\frac{1}{1.6}$ rather than simplifying it to an appropriate fraction or decimal such as $\frac{5}{8}$ or 0.625.

Answer: **(a)** (4.5, –1) **(b)** $y = \frac{5}{8}x + \frac{7}{4}$

Question 24

In part **(a)** most candidates were able to use the sine rule correctly to obtain full marks. Some rounded their answer to 6.0, 5.9 or sometimes just 6. Many of them showed a 3 significant figure or better answer in the working as well and so were able to achieve the final mark as their most accurate answer was credited. Those who did not show a correct figure to a greater accuracy than 2 significant figures lost the final accuracy mark. Some missed the fact that angle *PSR* is marked as 97° and treated the triangle as right-angled. In part **(b)** many candidates were able to use the cosine rule correctly and gain full marks. Some forgot to take the square root and, having reached $RQ^2 = 13.94$, stopped at that point. While most were able to solve correctly, a small number treated the cosine rule as if there were an extra pair of brackets and effectively solved $RQ^2 = (8.5^2 + 7.4^2 - 2 \times 8.5 \times 7.4) \times \cos 26$. Some candidates incorrectly assumed that triangle *PQR* was right- angled and used Pythagoras' theorem or right-angled trigonometry. In both parts of **Question 24** premature rounding part way through the calculation was sometimes a problem.

Answer: **(a)** 5.95 **(b)** 3.73

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MATHEMATICS

Paper 0580/32
Paper 32 (Core)

Key messages

To succeed in this paper candidates need to have completed full syllabus coverage, remember necessary formulae, show all working clearly and use a suitable level of accuracy. Particular attention to mathematical terms and definitions would help a candidate to answer questions from the required perspective.

General comments

This paper gave all candidates an opportunity to demonstrate their knowledge and application of mathematics. Most candidates completed the paper and made an attempt at most questions. Although a number of questions have a common theme, candidates should realise that a number of different mathematical concepts and topics may be tested within the question. The standard of presentation and amount of working shown was generally good. Centres should continue to encourage candidates to show formulae used, substitutions made and calculations performed. Attention should be made to the degree of accuracy required, and candidates should be encouraged to avoid premature rounding in workings as this often leads to an inaccurate answer and the loss of the accuracy mark. Centres should remind candidates that the rubric states that 'For π, use either your calculator value or 3.142'. When candidates change their minds and give a revised answer it is much better to rewrite their answer completely and not to attempt to overwrite their previous answer. Candidates should also be reminded to write digits clearly and distinctly. Candidates should also be encouraged to read questions again to ensure the answers they give are in the required format and answer the question set.

Comments on specific questions

Question 1

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

(ii) This part was generally answered well, with the equivalent fractions of $\frac{72}{360}$, $\frac{12}{60}$ and $\frac{1}{5}$ all seen. A common error was in stating the numerical value of 12.

(iii) This part was generally answered well although a common error was using the incorrect method of $\frac{30}{360} \times 100$ giving the unrealistic answer of 8.33 for the number of boys who choose Judo.

(iv) This part was again generally answered well, particularly with a follow through allowed. The equivalent fractions of $\frac{55}{60}$ and $\frac{11}{12}$ were both seen, with few decimal or percentage equivalences given.

(v) This part was generally answered well, although common errors of Swimming and Judo, and the reversed Judo and Tennis were seen.

(b) This part was generally answered correctly and accurately, although a small yet significant number of candidates did not appreciate that the angles for Running and Swimming had changed and consequently repeated the given pie chart.

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(c) This part on interpreting the two given statistical charts proved more challenging although a good number of valid answers were seen. The similarity comment was more successful with 'Swimming is most popular for both boys and girls' the most common statement, although the varieties of comments seen were not always clear or sufficient. The difference comment was less successful, with many candidates not appreciating that the original data came from 'name their favourite sport'. The common valid statements were 'Hockey least popular for girls but Judo least popular for boys', 'more boys choose Hockey than girls', 'twice as many girls chose Judo as boys' and '5 more girls than boys chose Judo', though with 'play' often used in place of 'chose'. Common errors included statements that were not differences, such as '10 chose Hockey' and '5 times as many girls chose Judo than Hockey'.

Answers: **(a)(i)** swimming **(ii)** $\frac{72}{360}$ **(iii)** 5 **(iv)** $\frac{55}{60}$ **(v)** tennis, judo

Question 2

(a) This part was generally answered well, although a small number of candidates left their answer as $\frac{8}{30}$ and so scored the method mark only. Errors included $\frac{8}{22}$ or $\frac{4}{11}$ by comparing shaded and unshaded squares, and a small number, who presumably miscounted the squares, gave answers such as $\frac{8}{25}$ and $\frac{7}{30}$.

Parts **(b)**, **(c)** and **(d)** on fractions were a challenge for a considerable number of candidates with many appearing to use a calculator and work in decimals instead.

(b) Although the common equivalent fractions of $\frac{14}{24}$, $\frac{21}{36}$ and $\frac{70}{120}$ were often seen, common errors included $\frac{583}{1000}$ (coming from $\frac{7}{12} = 0.58333$), $\frac{6}{11}$, $\frac{5}{12}$, $\frac{12}{7}$ and $\frac{-7}{12}$.

(c) Although the fraction of $\frac{11}{13}$ was often seen, and occasionally $\frac{22}{26}$ and $\frac{33}{39}$, common errors included $\frac{13}{11}$, $\frac{11}{11}$ and $\frac{-13}{11}$.

(d) Few candidates appreciated that changing $\frac{7}{9}$ to $\frac{14}{18}$ and $\frac{8}{9}$ to $\frac{16}{18}$ gave $\frac{15}{18}$ or the equivalent $\frac{5}{6}$ as one of the acceptable answers. A very common error was $\frac{7.5}{9}$ which is not an acceptable fraction. A significant number appeared to use their calculator to obtain the decimals of 0.777… and 0.888… and then to find a fraction whose decimal equivalent was between these two values; fractions such as $\frac{7}{8}$, $\frac{6}{7}$ or $\frac{9}{11}$ found in this way were acceptable.

(e) This part was generally answered well, with a good number, though not all, of candidates showing their method by giving each of the numbers as a decimal equivalent first.

Answers: **(a)** $\frac{4}{15}$ **(b)** $\frac{7k}{12k}$ **(c)** $\frac{11k}{13k}$ **(e)** 5.7×10^{-1}, $\frac{4}{7}$, 57.2%, $\sqrt{0.33}$

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Question 3

(a) This part was generally answered well with many candidates able to reach the correct simplest form of the ratio. A significant number gave answers such as 1200 : 1000 : 800, 120 : 100 : 80, 12 : 10 : 8 and 0.4 : 0.333 : 0.266…(from dividing all by 3000), all of which scored the method mark only.

(b) This part was generally answered well, although common errors of 36 000 (15%) and 240 000 – 0.15 = 23 9999.85 were seen.

(c) This part was generally answered well with the majority able to correctly apply the formula and a small number only using a year-on-year method. A small number lost the accuracy mark by premature approximation, usually of $1.035^3 = 1.108$ or 1.11, or by spoiling the method by then adding or subtracting the value of 750. Common errors included incorrect substitution, the use of an incorrect formula, and finding the simple interest.

Answers: **(a)** 6 : 5 : 4 **(b)** 204 000 **(c)** 832

Question 4

(a) This part was generally answered well, although common errors of 80, 88 and 968 were seen.

(b) This part was generally answered well, although common errors of 660, 855 and 879.75 were seen.

(c) The multiple stage method required to answer this part proved challenging for many candidates and was a good discriminator. Very few candidates used the fractional method of $1 - (\frac{1}{40} + \frac{1}{5}) = \frac{31}{40}$. The majority preferred the numerical method of $(880 - \frac{1}{40} \times 880 - \frac{1}{5} \times 880) / 880 = \frac{682}{880} = \frac{31}{40}$ although this was generally done in stages. The common error was performing a partial method only, resulting in answers of 22, 176, 198, $\frac{198}{880}$ and $\frac{9}{40}$.

(d) (i) This part was generally answered well, although common errors of 2.50 and 8.50 were seen.

(ii)(a) This part was not generally answered well, with the common errors of 13 50, 08 50 and 21 50 frequently seen.

(ii)(b) This part was generally answered well with the majority of candidates able to work out the required change.

(iii) This part was generally answered well with the majority of candidates able to work out the saving made. A small yet significant number did not appreciate that the four times given corresponded to four visits and that the four costs needed to be found first. The common error was adding the four given times together to reach 27 hours and 2 mins, although this often included an arithmetic error as well, and then attempting to use this figure to calculate costs and/or savings.

Answers: **(a)** 800 **(b)** 220 **(c)** $\frac{31}{40}$ **(d)(i)** 4.50 **(ii)(a)** 09 50 **(ii)(b)** 11.50 **(iii)** 6.50

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Question 5

(a) This part was generally answered correctly by the majority of candidates.

(b) This part was generally answered correctly by the majority of candidates.

(c) This part was generally answered well although the common errors of $2t - 6$, $2t + 2$ and $t + 2$ were seen.

(d) This part was generally answered well, particularly with a follow through method mark available. Two distinct methods were equally used. One was to use the formula from part **(c)**, which was generally followed by a correct substitution and the calculation of the correct answer. The second was to use the pattern from the diagrams, 18 + 18 + 3 + 3, or more commonly to continue the sequence from the table, 16, 18, 20, 22, ……42. Common errors included 18 × 8 = 144 or a numerical error in either of the two methods mentioned.

(e) This part was also generally answered well, particularly with a follow through method mark available. Two distinct methods were equally used. One was to use the formula from part **(c)**, which was generally followed by a correct substitution and the calculation of the correct answer, although a common error here was 2 × 80 + 6 = 166. The second was to use the pattern from the diagrams, 37 + 37 + 3 + 3, or more commonly to continue the sequence from the table, 16, 18, 20, 22, ……80. Common errors included $\frac{80}{8} = 10$ or a numerical error in either of the two methods mentioned.

Answers: **(b)** 14, 16, 18 **(c)** $2t + 6$ **(d)** 42 **(e)** 37

Question 6

(a) This part was generally answered well with the majority of candidates able to work out the required time taken as 55 minutes, although a common error was to give the arrival time of 09 55.

(b) This part was not generally answered well. Common errors included misreading the distance scale and using 30 or 19, misreading the time scale and using 15 or 20 minutes, incorrectly or omitting the conversion of the time units to hours, or the use of an incorrect formula such as $18 \times \frac{10}{60}$.

Those candidates who converted the time separately needed to show the working of $\frac{10}{60}$ and also then to use the correct 3 significant figure of 0.167 rather than 0.16 or 0.17 or 0.166.

(c) The multiple stage travel graph required to answer this part proved challenging for many candidates and was a good discriminator with the full range of marks seen. Errors were varied but included the misreading of one or both scales, plotting the library at a distance of 32 km, not appreciating the symmetry of the graph implied by the second piece of given information, incorrectly plotting the arrival time back at Keela station at 12 00 rather than using the fifth piece of information to obtain a journey time of 15 minutes and hence an arrival time of 11 35.

Answers: **(a)** 55 **(b)** 108

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Question 7

(a) This part was generally answered well with the majority of candidates able to work out the required actual distance.

(b) This part on the measurement of a bearing was not generally answered well. Common errors of 135, 225 and 315 were frequently seen.

(c) This part was generally answered well with many candidates able to correctly and accurately draw the required perpendicular bisector. A small yet significant number however did not show or use the required two pairs of arcs, commonly using one set of arcs with the midpoint determined by the use of a ruler despite the instructions given in the question. A small number did not appreciate the construction required and drew incorrect straight lines, often parallel to the given line *AT*.

(d) This part on finding the two possible positions from the data given proved more challenging although a number of totally correct answers showing all construction lines and arcs were seen. Not all candidates appreciated that they needed to draw a line from *A* at the bearing of 203°, and to draw an arc centred on *T* to show the distance of 8.8 km, and then the required positions were at the two intersections of this line and arc.

(e) This part was not generally answered well, with few candidates appreciating the method to be used when finding a reverse bearing. A very common error was 42, possibly from 360 – 318. Few candidates drew a sketch to help them with this part. A small number did attempt to draw a scale drawing but often lost the accuracy mark.

Answers: **(a)** 19.2 **(b)** 045 **(e)** 138

Question 8

(a) This part on finding the equation of a given line on a grid was reasonably well answered and proved to be a good discriminator with the full range of marks seen. Common errors included the calculation of the gradient as $\frac{1}{2}$, –2, 2 and $-\frac{1}{3}$, incorrect values for *c* due to not appreciating that the intercept could be read directly.

(b) (i) Not all candidates appreciated that the substitution of $x = 9$ into the given equation was the method to be used, although those who did were generally correct in their solution. Common errors included attempts at using the gradient.

(ii) Not all candidates appreciated that the substitution of $y = 3$ into the given equation was the method to be used, and those who did were not always correct in their solution. Common errors included an incorrect substitution giving $b = \frac{2}{3} \times 3 - 7$; following the correct $3 = \frac{2}{3}b - 7$ an incorrect second line of $9 = 2b - 7$; and again attempts at using the gradient.

(c) (i) The table was generally completed very well with the majority of candidates giving 3 correct values.

(ii) This part was well answered by many candidates who scored full marks for accurate, smoothly drawn curves. Most others scored partial marks, the marks being most commonly lost for one or more points being plotted out of tolerance, or for just plotting the points without drawing the curve through them. Other common errors included misreading the vertical scale, and plotting (1, 2) and (2, 2) at (1, –2) and (2, –2).

(iii) This part was not generally answered well, with few candidates appreciating the point to be used. Common errors included (2, 2) and (–4, –28) although many other incorrect answers were seen.

Answers: **(a)** $y = -\frac{1}{2}x + 3$ **(b)(i)** –1 **(ii)** 15 **(c)(i)** –28, –4, 2 **(iii)** (1.5, 2.25)

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Question 9

(a) (i) This part was not generally answered well, with many candidates not appreciating the method to be used to find the value required to complete the given statement. There were very few instances of either $\frac{60}{4} = 15$ or $\frac{120}{8} = 15$ seen. Common errors included 0.01, 0.1, 100 and 1000.

(ii) The multiple stage method required to answer this part proved challenging for many candidates and was a good discriminator with all possible marks seen including a number of fully correct answers with full and clear working. Common errors included, answers of 360 from just considering the rectangle; 548 from 428 + 60 + 60; finding the area of the running track rather than the total length; using two circles rather than two semi-circles; and the use of incorrect formulae.

(iii) This part was not generally answered well and few fully correct answers were seen. However many candidates were able to score the first method mark, particularly with the follow through allowed, by calculating their distance divided by 1.4. A number of candidates were then unable to convert this time in seconds into minutes. A further common error was writing 5.10 minutes as 5 minutes 10 seconds.

(b) (i) This part was generally answered well with many candidates able to work out the required number of laps. Common errors included the use of 80 seconds as 1.2 minutes, 80 × 60, 80 ÷ 60, 60 × 80 ÷ 60, 60 × 60 and 60 × 60 × 80.

(ii) This part was not generally answered well, with the majority candidates not appreciating the method to be used to find the values required to complete the given statement, although a small number of fully correct answers with clear and sufficient working were seen. Few candidates appreciated that the LCM of 88 and 80 = 880 could then be used to find the values, or that the two lists of 80, 160, 240, ……, 880 and 88, 176, 264, …..880 could be used. The common errors included, calculating the number of laps completed in one hour by 3600 ÷ 88 = 41 and 3600 ÷ 80 = 45 so 41 and 45 laps; and 88 ÷ 80 = 1.1 so 1.1 and 1 laps.

Answers: **(a)(i)** 15 **(ii)** 428 **(iii)** 5 minutes 6 seconds **(b)(i)** 45 **(ii)** 11, 10.

Question 10

(a) This part was generally answered well with many candidates able to construct the required equilateral triangle. Common errors included, drawing an isosceles triangle; omitting the construction arcs; and inaccurate measurement or drawing.

(b) This part was generally answered well with the majority of candidates able to state the correct formula for the area of a trapezium and then able to correctly work out the required area. Common errors included, use of the incorrect formula $(a + b) \times h$; incorrect calculation possibly due to the inefficient or incorrect use of a calculator when dealing with the brackets leading to the incorrect answers of 176, 124, 344 and 236.

(c) This part proved challenging for many candidates and was a good discriminator. Very few candidates used the exterior angle method of 360 ÷ (180 – 162) but those who did usually were successful and scored full marks. A small number were able to use the interior angle method to score full marks, but the majority of candidates who used this method usually made errors in the formula used, the manipulation stages or a numerical error.

(d) This part was generally answered reasonably well with many candidates able to correctly calculate the required value and score full marks. Common errors included, $363 = \frac{1}{2} \times h \times 6$; $363 = \frac{1}{2} \times h \times 6h = \frac{1}{2} \times 7h$; and transposition errors such as 363 ÷ 2.

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(e) The multiple stage method required to answer this part proved challenging for many candidates and was a good discriminator with all possible marks seen including a small number of fully correct answers with full and clear working. Common errors included the use of, $\frac{1}{2} \times \pi \times 7^2 + \frac{1}{2} \times \pi \times 3^2$; $\pi \times 7^2 \pm \pi \times 3^2$; $\frac{1}{2} \times \pi \times (7+3)^2$; $\frac{1}{2} \times \pi \times (7-3)^2$; incorrect formulae; calculating the perimeter; and a loss of accuracy due to the use of $\frac{22}{7}$.

Answers: **(b)** 280 **(c)** 20 **(d)** 11 **(e)** 62.8

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MATHEMATICS

Paper 0580/42
Paper 42 (Extended)

Key messages

The recall and application of formulae and mathematical facts to apply in varying situations is required as well as the ability to interpret situations mathematically and problem solve with unstructured questions.

Work should be clearly and concisely expressed with answers written to an appropriate accuracy.

Candidates should show full working with their answers to ensure that method marks can be awarded.

General comments

Solutions were usually well-structured with clear methods shown in the space provided on the question paper. Candidates had sufficient time to complete the paper and omissions were due to lack of familiarity with the topic or difficulty with the question rather than lack of time.

Most candidates followed the rubric instructions with respect to the values for π and three significant figure accuracy for answers. A few approximated values in the middle of a calculation in some parts and lost accuracy for the final answer as a result. On mensuration questions it is important to show the numeric substitution into formulae to obtain method marks.

The topics that were done very well included transformations, ratio, probability, use of scale and construction, algebraic graphs, statistics, standard function work, simultaneous equations and proportion. The topics that were found more challenging were using time correctly in calculations, problem solving with mensuration and similar shapes and dealing with mixed units, dealing with negative coefficients in inequalities, and generally in questions where candidates were asked to show working or show a particular result ensuring that each step in working was shown with no omissions and that answers, where appropriate, were rounded correctly.

Comments on specific questions

Question 1

(a) This part was almost always answered correctly.

(b) Most candidates completed this part correctly. The most common error was to multiply by 4.15 rather than 4.25. Other errors included calculating the time incorrectly or not having the correct form of the distance/time/speed formula.

(c) Whilst many candidates scored full marks on this question, there were a number of errors seen in both the working out of the time period and the conversion of the 1 hour 43 minutes into a suitable form, such as $1\frac{43}{60}$ or $\frac{103}{60}$. Errors in the time period usually came from candidates using 100 rather than 60 minutes in one hour. As in part **(b)**, some candidates used an incorrect formula. Other errors involved premature approximation of the decimal time interval, e.g. using 1.72.

(d) Most candidates answered this correctly. The most common incorrect answer was 850.5 from 17 × 50 + 0.5. Other errors included 16.5 × 50 and 17.05 × 50 and 17.5 × 50.5.

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(e) This part was almost always answered correctly. Occasionally there were slight inaccuracies in the answer, e.g. 10.3.

(f) (i) Whilst a number of candidates answered this correctly, a variety of errors were seen. These included calculating 29 × 68 = 1972 and then rounding to 2000, or only rounding the parcel value to 1 significant figure and calculating 29 × 70, or omitting to show 30 and 70 before the answer 2100.

(ii) The most successful candidates clearly stated that both the number of the parcels and the value of the parcels had been rounded up. Candidates who did not refer to both numbers, or who did not state the numbers used in the estimate were greater, did not score.

Answers: **(a)** 473 **(b)** 212.5 **(c)** 31.5 **(d)** 875 **(e)** 10.4 **(f)(i)** 30 × 70 and 2100 **(ii)** both values rounded up

Question 2

(a) (i) This part was answered well, with almost all candidates stating that it is a reflection. Most then gave the correct equation for the line of reflection, but a small number gave $y = 1.5$.

(ii) Candidates also responded well to this part with the majority scoring full marks. A small number omitted the angle of rotation and a few omitted or gave incorrect co-ordinates for the centre of rotation. It was extremely rare to see an answer giving two transformations.

(b) (i) This part proved to be challenging for some candidates. Most drew 'ray' lines from the vertices of triangle *A*, through (3, 0) but did not give the correct image, either as a result of assuming a scale factor of $\frac{1}{2}$ or using an incorrect distance from (3, 0).

(ii) This part was answered very well with just a small number giving an incorrect translation, such as misinterpreting the vector as, e.g. $\begin{pmatrix} -3 \\ -1 \end{pmatrix}$.

(iii) Many candidates recognised that the transformation matrix represents a reflection in $y = x$ and most used this to draw the correct image. A small number thought that the matrix represents a reflection in the *y*-axis and some gave a rotation. Some used the matrix multiplication method and gave the correct calculation and drew the correct image. Others incorrectly set up the multiplication with the 2 by 2 transformation matrix on the right-hand side and some made errors in the calculation.

Answers: **(a)(i)** Reflection, $x = 1.5$ **(ii)** Rotation, 90° anticlockwise, (0, –1)

Question 3

(a) Almost all candidates were able to give the correct probability of $\frac{10}{18}$ or its simplified version.

(b) Most candidates demonstrated a good understanding of probability and were able to give the correct probability. Finding the probability of only one of the two combinations, almost always red then blue, was the most common error. Multiplication of the probabilities of the two combinations was rarely seen but a few slips with the arithmetic were seen. A small number based their working on replacement of the balls.

(c) Candidates were generally more successful in this part than the previous part with many earning full marks. A small number gave only the probability of three reds and a small number gave answers that seemed to be based on picking three pairs. Again, a small number based their working on replacement of the balls.

Answers: **(a)** $\frac{5}{9}$ **(b)** $\frac{80}{153}$ **(c)** $\frac{11}{51}$

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Question 4

(a) The vast majority of candidates drew the line *AD* accurately. Most errors usually involved candidates attempting to draw angle *BDA* as 75° and misreading the protractor or drawing angle *XDA* as 75°.

(b) Almost all candidates were able to measure *BC* accurately and use it to find the actual length. Errors usually involved the inaccurate use of a ruler or using an incorrect method, such as division by 5, for the conversion.

(c) A majority of candidates were able to complete the three constructions correctly and then identify the correct region. In cases where full marks were not awarded, candidates were more likely to have drawn the arc correctly, followed by the angle bisector. In some cases, candidates drew the bisectors without showing all of the appropriate arcs or deleted them after completing the bisectors.

(d) Although many candidates were able to complete the ratio correctly, a significant number did not understand what was required and answers of 1 : 5 were very common. Other errors usually involved answers such as 50 or 5000. A number of candidates made no attempt at this part.

Answers: **(b)** 47.5 **(d)** 500

Question 5

(a) Nearly all candidates completed the table of values correctly.

(b) The graph was usually well drawn although a number of candidates joined some, or sometimes all, of the points with a ruled line. The equation of the graph indicates that this is a curve, which means that a ruler should not be used when joining the points. Candidates should draw a smooth curve with a pencil that is not so thick as to make further answers inaccurate.

(c) Many candidates drew the required straight line using a ruler. The values of *x* were usually within the accepted ranges although the answer $x = -2$ was a common error; the intersection is close to $x = -2$ but clearly to the left of it and the value must reflect this. A few omitted this part or tried an algebraic approach rather than a graphical approach to find the solutions without success.

(d) This was answered well with most candidates giving a correct answer for their curve. A few gave a fraction or decimal answer here by trying to read off the values of *x*.

Answers: **(a)** –2.1, 1.6, –1.7, 2.1 **(c)** –2.15 to –2.01, –0.45 to –0.2, 2.25 to 2.45

Question 6

(a) Whilst a number of candidates completed this part successfully, many other candidates were unable to correctly find the sector angle. Common misconceptions included assuming that angle *DOE* was 45° or that the sector area could be found using 270° and subtracting the area of the triangle *ODE* or using the minor sector angle 150° rather than 210°. Most candidates used $2\pi r$ correctly but the internal length *OA* was sometimes seen added incorrectly to the perimeter. In addition some candidates used a longer method to find angle *DOE*. These usually involved Pythagoras' theorem and then sine or tangent but frequently limited workings were shown and inaccurate figures seen.

(b) Again a number of candidates completed this part successfully. However, as with part **(a)**, there were common misconceptions with the sector angle. Most used the 'correct formula' for the area of a circle but often with an incorrect sector angle and there were a few errors seen combining the sector area with 0.75, the area of the rectangle, including some who also added the area of triangle *ODE*.

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(c) (i) This part was answered well by some candidates using the approach $\frac{their\,(\mathbf{b})}{77.44} = \frac{0.5^2}{r^2}$ and correctly rearranging to find *r* from this equation. Errors seen included rearranging incorrectly, or not squaring or square rooting correctly. Some candidates used a longer method of finding the proportion of their answer to part **(b)** that was the sector area and applying this proportion to the 77.44 to find the sector area of the larger logo. Provided they equated this to $\frac{210}{360}\pi r^2$ they were often successful in finding *r*. A number did not use the properties of the areas of similar shapes and made little progress.

(ii) A number of candidates completed this accurately and took care to convert the units from mm to cm and g to kg correctly. Common errors involved issues with the changes of units including not changing the 15 mm to cm or changing incorrectly, e.g. 150, not dividing by 1000 correctly or giving an inaccurate answer of 2.2 without any more accurate answer seen. Other errors included dividing by 19 instead of multiplying or using $V = \frac{1}{3}Al$ or $V = \frac{1}{2}Al$.

Answers: **(a)** 5.83 **(b)** 1.21 **(c)(i)** 4 **(ii)** 2.20704

Question 7

(a) (i) Most candidates were able to find the correct mid-interval values and calculate the mean correctly, although some rounded their answer and gave an answer of 111.3 or 111. Some made a slip in calculating the mid-value of an interval, e.g. $125 < p \le 150$. A small number of candidates multiplied the frequency by the group width or found the frequency density.

(ii) Almost all candidates answered this part correctly.

(iii) Most candidates answered this correctly. The most common error was an answer of $\frac{17}{20}$, the probability of a mass less than 150 g. Some used a denominator of 200 rather than 20.

(b) Many candidates were able to find the correct frequencies. Some candidates used the values in the first column in a proportion calculation and gave frequencies 40 and 24, without considering the different group widths.

(c) (i) Many candidates were able to set up a correct equation in terms of *x* for the mean and most went on to solve it correctly. Some errors were seen in simplifying the sum of the products or in the elimination of the fraction from the equation. Some candidates reached the correct answer of 5 using a trial and error approach. A common error was to set up an incorrect equation of $\frac{45+x}{8} = 4.28$ or $\frac{179+7x}{45x} = 4.28$ or $\frac{179+7x}{45} = 4.28$.

(ii) Most candidates answered this correctly. Common errors were an answer of 2, the most common frequency, or 16, the highest frequency.

(iii) Many correct answers were seen. Common incorrect answers were 5, 9.5 or 4.5, where candidates had found the median of the frequencies or of the number of books read.

Answers: **(a)(i)** 111.25 **(ii)** 2 7 11 17 **(iii)** $\frac{3}{20}$ **(b)** 20 6 **(c)(i)** 5 **(ii)** 3 **(iii)** 4

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Question 8

(a) Almost all candidates answered this part correctly.

(b) Many candidates answered this part correctly, either giving the answer as a fraction or a decimal rounded to 3 significant figures. Some gave an answer of 1.1, but they usually showed a correct method leading to this. Some candidates evaluated f(2) correctly as 0.75, but then found $\frac{3}{0.75}$ rather than $\frac{3}{0.75+2}$.

(c) Most candidates understood how to set up the expression for the function of a function and many reached the correct answer. Common errors resulted from arithmetic slips, either 8 × 8 = 16 or –40 – 5 = –35. Some did not subtract 5 from 8(8x – 5) and a small number found $(8x-5)^2$.

(d) Most candidates found the inverse function correctly. Some answers were given in terms of y rather than x and some candidates made a sign error in their rearrangement.

(e) It was common to see a correct first step of the numerator $(8x-5)(x+2)-3$ with a common denominator of $(x+2)$. Some candidates made errors in collecting terms after their expansion, usually in the negative terms. A few candidates omitted brackets around 8x – 5 in the numerator of their expression, although some recovered from this error, and others found f(x) – g(x).

(f) (i) Some clearly set out responses were seen with sufficient steps shown to demonstrate the result. It is important that candidates do not omit any steps or any terms from their working. In some cases, candidates omitted = 0 from the final equation or made slips in their working such as omitting the x in 80x, omitting + 6 or using an incorrect sign. Some candidates missed out the 80x term when squaring (8x – 5).

(ii) Most candidates quoted the quadratic formula correctly and showed correct substitution into this formula. Some made errors with the negative terms, often omitting brackets around $(-20)^2$. Most candidates reached the correct solutions, although they were not always given to the required accuracy. It was common to see 1.07 rather than 1.08, and 0.174 rather than 0.17.

Answers: **(a)** –3 **(b)** $\frac{12}{11}$ **(c)** 64x – 45 **(d)** $\frac{x+5}{8}$ **(e)** $\frac{8x^2+11x-13}{x+2}$ **(f)(ii)** 0.17 and 1.08

Question 9

(a) (i)(a) Some candidates were able to use the correct set notation, but answers such as € or $\subset$ were also seen in place of the correct element symbol. Many candidates used the subset symbol.

(i)(b) Most candidates answered this part correctly. The most common incorrect answer was $A \cup B$.

(ii) Most candidates gave a correct answer, with the most common error being $A' \cup B$.

(b) Most candidates shaded the correct region. Some shaded $C \cup D'$ or D'.

(c) (i) Candidates who identified that the key information was 19 studied two or three subjects usually set up a correct equation and clearly showed $x = 4$. Some used the fact that $x = 4$ to complete the Venn diagram to start with, and then used the values found to set up an equation which was a circular argument so not given credit.

(ii) Many candidates completed the Venn diagram correctly. Some inserted 23 in place of 8.

(iii) Many candidates used correct set notation for the empty set, although an answer of 0 was also common.

(iv) Many correct answers were seen but some candidates were unable to interpret the set notation.

Answers: **(a)(i)(a)** $\in$ **(i)(b)** $A \cap B$ **(ii)** B or A' **(c)(ii)** 8, 18 and 5 **(iii)** $\varnothing$ or { } **(iv)** 15

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Question 10

(a) This part was answered very well by candidates. A small minority who made sign errors in eliminating one of the variables, were still able to gain some credit for their work. Some candidates used their calculators to find the solutions and did not show working as required.

(b) This part was answered particularly well. Only a few candidates didn't use the fact that the proportionality was inverse and a few made arithmetic errors within an otherwise correct method.

(c) This part was answered less well. Nearly all candidates were able to multiply out the brackets correctly and to collect the terms in x and the numerical values correctly on either side of the inequality sign. Those who had $-20 < 4x$ were usually able to continue to give a correct answer. The difficulty arose for those who had $-4x < 20$. Many of these knew that if they divided both sides by a negative number (-4), they must also reverse the inequality sign, but many neglected to do this, giving an incorrect final answer. Some used equals signs throughout and although method marks were awarded, the final answer was incorrect.

Answers: **(a)** $x = 7$ and $y = -3$ **(b)** 2 **(c)** $x > -5$

Question 11

(a) (i) This part was generally well answered. A large majority of candidates gave the correct answer for the sixth term in sequence *A*, using differences of successive terms. The answer for the sixth term of sequence *B* was sometimes omitted and quite a number of candidates did not realise that all the terms are powers of 3 and attempted to use the differences of successive terms, the method that had worked for sequence *A*. This led to a variety of incorrect answers.

(ii)(a) This part produced a mixed response. Some candidates omitted this part and those giving a response often used the difference method, frequently giving the second differences as 4 but were not able to make further progress. Others using this method were not always able to give the correct expression but recognised that it was quadratic. Some assumed that the sequence was linear and gave incorrect answers such as $4n + 3$. A small number of candidates were able to reach the correct answer by solving three simultaneous equations.

(ii)(b) Some found this part challenging although, as in part **(a)(i)**, those who identified the terms as powers of 3 wrote down the correct answer. A small number gave the answer as 3^n. Some who had used the difference method in the previous part tried to use it in this part.

(b) (i) Almost all candidates answered this part correctly.

(ii) This part was answered well with many candidates giving the correct answer. The most frequent method used was to write down some working such as $4n^2 + n = 495$ and then to use a trial and improvement method, although not necessarily writing down the results of any trials apart from the correct answer of 11. The minority of candidates who gave the quadratic equation $4n^2 + n - 495 = 0$ and then solved it usually did so by using the quadratic formula, rather than by factorisation.

Answers: **(a)(i)** 77 243 **(ii)(a)** $2n^2 + 5$ **(ii)(b)** 3^{n-1} **(b)(i)** 21 **(ii)** 11

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