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MATHEMATICS

Paper 0580/01
Paper 1 (Core)

General comments

This paper proved accessible to the majority of candidates and allowed them to demonstrate their understanding and knowledge of mathematics. The majority of candidates were able to attempt all questions in the time allowed. The amount of working and method shown was a slight improvement on previous years although it remained a problem for some candidates. Method marks were available in **Questions 2**, **4**, **5**, **6**, **9**, **12** and **16**. The use of three significant figures was not always appreciated with a minority of candidates giving answers to a lesser degree of accuracy (**Questions 5**, **13**, **15**, and **16**). The use and application of algebra in general was good, although the geometry/shape and space work was less successful.

Comments on specific questions

Question 1

This was generally well answered, although the common errors of 40, 0.4 and 0.004 were seen.

Answer: 400 grams.

Question 2

A good understanding of the use of percentages was demonstrated, although a significant mistake seen was in giving the new price (15.3) rather than the actual discount as the answer. It was disappointing to see $2.7 rather than $2.70 given as the final answer.

Answer: $2.70.

Question 3

This was well answered with the majority of answers for the required probabilities given as fractions.

Answers: **(a)** 2/5; **(b)** 0.

Question 4

(a) This was generally well answered although a small number of candidates omitted the '90°' from their calculation.

(b) This was generally well answered although a significant common error was 144/100 x 360.

Answers: **(a)** 126; **(b)** 40%.

Question 5

Those candidates who recognised the use of trigonometry were generally successful, although the final answer of 1.7 rather than 1.71 was common. Common method errors included the use of the cosine ratio and attempting to use Pythagoras.

Answer: 1.71.

Question 6

This question was poorly answered in general and gave rise to a number of most unrealistic answe use of different units within the question and their significance was not understood by many candidates.

Answer: 6 km/h.

Question 7

This question proved demanding for the majority of candidates. A common error was in calculating the size of the exterior angle instead and stating the answer as 36°. It was rare to see this value then correctly used to find the interior angle $(180 - 36 = 144)$. Those candidates who used the expression $(n-2)x180$ often then failed to divide by $n(10)$ or used a different value of n altogether.

Answer: 144.

Question 8

This question on limits was poorly answered. Common errors included, 1349, 1290 and 1310, 1200 and 1400, 100 and 1300.

Answers: 1250, 1350.

Question 9

This was generally well answered with the majority of candidates understanding the terms used in the question and applying the correct methods. A small number attempted to simplify incorrectly to a single term or to turn their answer into an equation and to then solve. A partial factorisation only was a common error in **(b)**.

Answers: **(a)** $10x^2 - 15xy$; **(b)** $6x(x+2)$.

Question 10

This was generally well answered though **(b)** was least successful, with 62,65 being common errors. A follow through was given in **(c)** which benefited these candidates.

Answers: **(a)** 87; **(b)** 28; **(c)** 62.

Question 11

This was generally well answered, with the majority able to gain full marks. The L shape was the least successful with the common error being to split the shape into two rectangles.

Answer: Correct diagrams.

Question 12

This question on simultaneous equations gave rise to a number of methods and answers. Although the majority of candidates were able to demonstrate knowledge of a correct method, arithmetic errors often led to incorrect answers. There was little evidence of checking, either formal or for the candidates own benefit. The use of the 'elimination' method and the 'substitution' method were equally seen.

Answers: $x = 4$; $y = 12$.

Question 13

Part **(a)** was generally well answered although a small number truncated their calculator answer instead of rounding. Part **(b)** was less successful with premature approximation the common error.

Answers: **(a)(i)** 2.409677419, **(ii)** 2.41; **(b)** 19.3.

Question 14

This was generally well answered. Common errors in **(a)** were the inclusion of Sunday, all the days than -3°C, or a list of numbers not days. Common errors in **(b)** were the omission of the negative giving rise to 22/7, or the calculation of the median.

Answers: **(a)** Monday, Tuesday, Saturday; **(b)** -2.

Question 15

This was generally well answered, although the conversion of $\frac{2}{7}$ proved difficult for a number of candidates. The 'correct' answer of 0.285714r was rarely seen with 0.29 or 0.285 seen as often as the expected answer of 0.286 (i.e. correct to 3 s.f.). The number of answers in part **(b)** given in reverse order was disappointing.

Answers: **(a)** 0.28,0.275,0.286; **(b)** $\frac{275}{1000} < 28\% < \frac{2}{7}$.

Question 16

A significant number of candidates failed to appreciate the methods to be used in this question. Those who did apply the correct methods were generally successful, although a significant number then failed to give the answer to the required level of accuracy. A common error in **(a)** was 25+4=29 instead of 25-4=21. In **(b)** a number of candidates were unable to go from $\cos(x) = \frac{2}{5}$ to $x = \text{inv.}\cos\left(\frac{2}{5}\right)$.

Answers: **(a)** 4.58; **(b)** 66.4.

Question 17

This question proved a good discriminator for the better candidates, with parts **(c)** and **(d)** proving more difficult. Common errors were **(b)** 4, **(c)** 1, **(d)** 2, although a full range of incorrect answers were seen.

Answers: **(a)** 3; **(b)** -4; **(c)** 0; **(d)** -2.

Question 18

This question was answered with a very mixed response. In part **(a)** a significant number were unable to use the given graph, or to realise that the intercept values on the *x*-axis were required to solve the given equation. Unsuccessful attempts to solve this equation algebraically were often seen. In part **(b)** whilst the correct value of y=0 was generally seen a common error was to 'start' the graph from (0,0) or (0,-1), rather than (-1,0). Another common error was to 'finish' the graph at (3,4), although this was often rectified when part **(c)** was done. Part **(c)** itself was generally well answered particularly as follow through was applied where possible although in these cases incorrect reading of the scale often led to errors.

Answers: **(a)** 0.4, 2.6; **(b)** 0; **(c)** (0 , 1), (4 , 5).

Paper 0580/02
Paper 2 (Extended)

General comments

The level of the paper was such that most candidates were able to demonstrate their knowledge and ability. Less than 5% of the candidates scored under 10 marks but concern was expressed at the continuing number of candidates who are entered at the wrong level and who clearly should have taken the Core Paper. The paper was slightly more challenging this year with a limited number of candidates scoring over 65 marks. There was no evidence at all that candidates were short of time. The general level of performance was slightly lower than last year with candidates finding a number of questions difficult to do.

Comments on specific questions

Question 1

This was generally well answered but $\frac{1}{4}$ was a common error due to incorrect order of operations.

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

Question 2

This was reasonably well answered but a substantial number of candidates added instead of subtracting the altitudes.

Answer: 4504.

Question 3

Most candidates were able to cope with part **(a)** but only the most able could obtain the formula.

Answers: **(a)** 121; **(b)** $(n + 1)^2$.

Question 4

Most candidates knew what was required and converted into decimals but almost all candidates failed to convert 1/8% correctly.

Answers: 3/2500, 1/8%, 0.00216.

Question 5

Very few candidates were able to answer this correctly. The terms irrational and integer were not well understood as answers often had a mixture of the two types.

Answers: **(a)** –1, $\sqrt{36}$; **(b)** $\sqrt{2}, \sqrt{30}$.

Question 6

Most candidates knew how to do this question but were unable to handle the algebra involved. The most common errors were either not to convert the months into years or to fail to simplify the answer.

Answer: $I = \frac{mr}{5}$.

Question 7

This question was badly answered even by the more able candidates. Most answers seemed to have been obtained from a denominator of 6 kg rather than 3.6 kg. The other common error was to calculate 6/3.6.

Answer: 66.7.

Question 8

This topic proved to be a source of difficulty for most candidates. There were very few correct answers to this question.

Answers: **(a)** –1; **(b)** 5k.

Question 9

Part **(a)** was generally well answered but most candidates still do not understand the topic of limits.

Answers: **(a)** 32000; **(b)** 25450, 25550.

Question 10

This question was not very well answered with few candidates scoring all three marks. There was some confusion as to whether the start should be $F = kv$ which was very common, $F = kv^{1/2}$ or $F^2 = kv$ rather than $F = kv^2$. Premature approximation for the value of k often prevented the more able candidates from achieving a correct final value.

Answer: 11.5.

Question 11

This question was generally well answered. Premature approximation once again caused some candidates to lose accuracy marks.

Answers: **(a)** 3110; **(b)** 322.

Question 12

Most candidates were able to answer part **(a)** but correct answers to **(b)** were rare. Some candidates did not use the graph to obtain answers but tried to use their calculator.

Answers: **(a)** 45°, 225°; **(b)** 157.5°.

Question 13

Part **(a)** was very well done but **(b)** was not so well done as many of the candidates decided to, incorrectly, divide by 2 rather than 8. Quite a few candidates tried to do the question by Pythagoras or the formula for the volume of a cone, usually unsuccessfully.

Answers: **(a)** 5.5; **(b)** 21.5.

Question 14

Even the weakest candidates were able to gain marks on this question which was very well answered by most candidates. Only some poor cancelling at the end of **(a)** prevented most candidates scoring full marks.

Answers: **(a)** $\frac{x+3}{x(x+1)}$; **(b)** –3.

Question 15

Almost all of the candidates knew what to do in **(a)** and did it well. Only about a quarter of the candidates knew what was required for **(b)** and most of those were unable to answer it accurately.

Answers: **(a)** angle bisector drawn; **(b)** radius from T or U, perpendicular to the tangent, to the bisector in **(a)**.

Question 16

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

A significant number of candidates reversed the coordinates of A and B. A few calculated the gradient in **(b)** instead of using Pythagoras or the formula. The mid-point was very well done.

Answers: **(a)** $A(2, 0)$ $B(0, –6)$; **(b)** 6.32; **(c)** (1, –3).

Question 17

This was generally well answered with very few candidates failing to score 3 marks and at least ha candidates scoring full marks.

Answers: **(a)** 20; **(b)** 98°; **(c)** 62°; **(d)** 124°; **(e)** 36°.

Question 18

Standard form was generally well done. About half of the candidates correctly answered **(b)** with the exception of writing the answer correct to the nearest whole number which was not well understood. Correct solutions to the last part were very rare, with most candidates not knowing that there are 1, 000, 000 m^2 in a square kilometre.

Answers: **(a)** 5.8×10^8; **(b)** 98; **(c)** 10200.

Question 19

The topic of functions is not well understood. The most common error in **(a)** was to attempt to multiply the functions together producing expressions of the form (1 – 2 x 7)(7/2). The equation $1 - 2x = x/2$ proved to be too difficult for most candidates to solve correctly. One common error was to reach $5x = 2$ and give an answer of $2\frac{1}{2}$.

Answers: **(a)** –6; **(b)(i)** 0.4, **(ii)** (0.4, 0.2).

Question 20

The use of vectors was very good this year but the majority of candidates had difficulty with the direction of their vectors and the signs in the answers were often incorrect. Manipulating fractions caused loss of marks in **(b)** as candidates did not always use the most straightforward route.

Answers: **(a)(i)** $-\frac{2}{3}$ p + q, **(ii)** $-\frac{3}{4}$q + p; **(b)** $\frac{1}{3}p - \frac{1}{2}q$.

Question 21

Parts **(a)** and **(b)** were very well done by most candidates. Many candidates scored al least one mark in **(c)**, and **(d)** was often correct.

Answers: **(a)** $60x + 80y \leqslant 1200$; **(b)** $x \geqslant y$; **(c)** triangle (0, 0) (20, 0) (60/7, 60/7); **(d)** 20.

Paper 0580/03
Paper 3 (Core)

General comments

This paper successfully catered for the whole ability range. It included some quite testing questions and some that were accessible for the weaker candidates.

Every mark on the paper is available separately, so, for example, if the question has 2 marks one will be available for working or some intermediate step, or some indication that the question has been attempted along the right lines. See the comments on **Question 2 (a)(iii)** below.

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

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

Comments on specific questions

Question 1

The whole of this question was generally well answered, the main problem being with the term 'pr... number'.

Answers: **(a)** 24; **(b)** 25; **(c)** 27; **(d)** 23, 29; **(e)** 26; **(f)** 28; **(g)** 21, 27.

Question 2

(a)(i)(ii) These two parts caused few problems. The most common wrong answers were 10.5, 10.50 or 1005 instead of 1030.

(iii) This part of the question seemed to be more difficult. There was often no working at all, although a mark had been allocated for either the numbers 24 or 33 seen, or both positions marked on the vertical axis. This is a good example of working being a possible mark winner even if full marks are not obtained. This meant that those candidates who put 24 in the answer space could gain a mark for showing that they knew how to read the correct scale on the correct axis, even though they had not finished the question.

(b)(i) For some reason many candidates rounded the correct answer of \$4.35 to \$4.4. It is difficult to justify this, so they lost the mark.

(ii) Many graphs were poorly drawn. The candidates should appreciate that this sort of conversion graph will be a straight line that should of course be ruled. Those candidates who rounded 4.35 to 4.4 were unable to draw a straight line, but could gain one mark if (10, 8.7) was correctly plotted. Some candidates calculated many intermediate points and then joined them up freehand.

(iii) A common wrong answer here was 9, even when the graph had been drawn correctly, and another was 6.96, probably from the conversion of euros into dollars.

(iv) Again, there was a common wrong answer of 435, which was the conversion of €500 to dollars. Answers either from the graph by extrapolation, or by a proportional calculation were acceptable, many choosing to do the proportion calculation.

Answers: **(a)(i)** 1300, **(ii)** 10 30, **(iii)** 9; **(b)(i)** 4.35, 8.70, **(iii)** 9.2, **(iv)** 575.

Question 3

(a) This was quite well answered.

(b)(i) Incorrect answers included 439.8, from $\pi \times 10 \times 14$ or 8796, from $2 \times \pi \times 10^2 \times 14$.

(ii) A follow through mark was available here for adding their answers to parts **(a)** and **(b)(i)** together, but many failed to achieve even that.

(iii) This was not well done. Many candidates merely added 14 and 8 together, not appreciating that the water would no longer be in a cylindrical shape when it was poured into the tank. There were follow through marks available for dividing their **(b)(ii)** by 25×30, or even one mark for dividing their **(b)(i)** by 25×30, thus finding the extra depth of water in the tank.

Answers: **(a)** 6000; **(b)(i)** 4400, **(ii)** 10400, **(iii)** 13.9.

Question 4

(a) The frequency table was quite well done. Some candidates gave only tally marks without their totals, which lost them one mark.

(b) The modal number of fillings was usually correct.

(c) Two marks were available for the median, one of which could be awarded for an attempt at a ranking list seen. This could be, for example, a cumulative frequency column, or an attempt to make a list of the number of fillings: 0, 0, 0, 0, 1, 1….and so on. Some candidates ranked the frequencies, or wrote: 0, 1, 2, 3, 4…etc. neither of which gained any marks. Another error was to give 3 as the answer, from the middle number in the frequency column.

(d) Either the correct answer of 2.5 was required here, or some indication of an attempt … total number of fillings by the total frequency. The number 3 with no working gained … However, 2.5 in the working space and 3 in the answer space was awarded one mark. A … problem was to make 4 × 0 = 4. Also seen several times was an answer of 4.29, from add… the frequency column and dividing by 7.

(e)(i)(ii) It is simplest to leave the answers to probability questions as fractions. The correct answer written as a decimal or as a percentage is acceptable, but introduces the problems of rounding. Other forms such as 7:30, 7 in 30, or 7 out of 30 are not acceptable and are penalised at least once. In the second part the usual problems of interpreting 'more than' were seen, thus $\frac{13}{30}$ was common.

(f) The correct answer or a follow through correct answer gained the mark. The common error of 39.9, arising from premature approximation, gained no marks. Another common wrong answer of 270 came from 300 – 30.

Answers: **(a)** 4, 7, 6, 4, 4, 2, 3; **(b)** 1; **(c)** 2; **(d)** 2.5; **(e)(i)** $\frac{7}{30}$, **(ii)** $\frac{9}{30}$; **(f)** 40.

Question 5

(a) Some candidates reversed the signs, and some confused the *x* and *y* directions. Frequently 4 was given instead of –4.

(b)(i) The Examiners were looking for the correct words for the transformations, although in this case 'turn' was allowed for 'rotation', and 'half turn' for 'rotation of 180°'. Candidates should be encouraged to learn the words transformation, rotation, translation, enlargement and reflection as is required in the syllabus. The most common errors were to leave out the centre of the rotation or to give 'reflection' as the answer.

(ii) In this case 'made larger' was not accepted for 'enlargement'. Enlargement followed by 3 was just acceptable as the scale factor, but again, for the best marks the candidates should write 'scale factor 3'. *H* was sometimes given as the centre of the enlargement.

These types of questions appear so frequently in the examination papers it is perhaps worth spending a little extra time on the topic. It should be possible for candidates to get high marks for transformations. Encouraging the use of tracing paper would be beneficial.

(c)(i) Some candidates gave the area of the triangle as 2 × 3 = 6.

(ii) This was not so well done, some lost a mark for the answer not in its lowest terms, but a mark was available for the number 27 seen.

(d) The best way to give the gradient is as a fraction. Decimals are acceptable, but as with the probabilities they introduce the problem of rounding. One mark was available for the correct fraction or decimal, and one for the negative sign.

Answers: **(a)** 6, –4; **(b)(i)** rotation, 180°, about (2.5, 6), **(ii)** enlargement, scale factor 3, centre (1, 7) (or B); **(c)(i)** 3, **(ii)** 1:9; **(d)** $-\frac{2}{3}$.

Question 6

(a)(i) This was correct in most cases.

(ii) This also was well done, although a common error was –6.

(iii) What was possibly intended as the correct answer was often spoiled by the way in which it was written. The answer given as *P*–3/6 is wrong without brackets and cannot receive full marks. Some candidates tried to use the value of 39 given in the earlier part of the question. Many candidates merely interchanged *P* and x to give $x = 6P + 3$.

(b)(i) The whole of this part caused many problems. Some candidates used x as the third because this is the most usual letter for an unknown quantity). This inevitably led to a answer. Others appeared to assume that two of the sides were of length 2 x centimetres, third one was $3x + 1$ centimetres. The idea of subtracting the two known sides from the perimeter to find the third side was not often seen, and candidates often wrote for exam $x + 2x + 3x + 1 = 9x + 4$, or just $2x + 3x + 1 = 9x + 4$.

(ii) There were few correct answers to this part of the question. Many candidates equated all the sides to 49 separately. Others assumed that the triangle was equilateral, so 16.3 was a common wrong answer.

Answers: **(a)(i)** 27, **(ii)** 6, **(iii)** $\frac{P-3}{6}$; **(b)(i)** $4x + 3$, **(ii)** 10, 16 and 23.

Question 7

(a)(i)(ii) In this question it was common for candidates to see the lowest of the rectangles as a square of side 4 centimetres rather than a 4 by 3 centimetre rectangle. They were still able to gain some, but not all of the marks. This question tested the candidate's ability to work methodically with two relatively simple concepts of area and perimeter, but few were able to set their work down clearly enough to lead them to the correct answers. Those candidates who wrote the dimensions on the diagram usually did the best. The middle rectangle was often counted twice.

(iii) Rectangular prism was allowed, but the answer expected was cuboid. Cube, cubical box, rectangle and rectangular box were not acceptable.

(iv) A follow through mark was available here, but not many saw the connection between **(a)(ii)** and this part.

(v) Many did not attempt this part of the question. The response to this question suggests that more practical experience with nets would help the majority of the candidates.

(b)(i) Very few achieved full marks for this surface area, and the weakest candidates measured the diagram and gave a numerical answer. One mark was available for pq etc, that is, demonstrating that the area is two dimensional.

(ii) Many candidates introduced powers of 2 or 3 in these questions on area and volume. For example pqr^3 was seen.

Answers: **(a)(i)** 44, **(ii)** 52, **(iii)** cuboid, **(iv)** 52; **(b)(i)** $2(pq + qr + rp)$, **(ii)** pqr.

Question 8

(a) There were few correct answers to this part of the question. Some struggled through the conversion of 'per year' to 'per month' or vice versa but then calculated the answer as a percentage of the 'per month' charge. Others failed to do a subtraction at any stage.

(b) This was slightly better, but many candidates gave 180 as the answer, again failing to notice that a subtraction was required.

(c)(i) The bisectors of the side and of the angle required correct, useable arcs for full marks. They were also expected to be a reasonable length, at least reaching to the other side of the quadrilateral. Some candidates drew the line AC instead of the angle bisector, and more candidates gained marks for the perpendicular bisector than for the angle bisector. Some drew perpendicular bisectors of all the sides instead of an angle bisector.

(ii) The area required should be shaded from line to line, not as many candidates did, just a small patch in the centre. For some reason many candidates shaded up to their arcs, apparently not realising that these were of arbitrary radius for the purposes of construction only.

Answers: **(a)** 12.5; **(b)** 120.

Question 9

(a)(i) Most candidates gave the correct answer here.

(ii) Most gave the same answer here as in the previous part, failing to notice the different units. It was rare to see the correct answer although a few candidates did make an attempt to multiply by some power of ten and thus gained one mark.

(b)(i) The mark scheme gave a generous range of the answer for this part of the question, to allow for careless measurement of *JC*, but quite a few candidates used 8cm which was too far out and could have come from the distance between the North lines. A common error was 3 × 450.

(ii) The question did not specify three figure bearings, so in this case North East was allowed as 45° was within the acceptable range of accuracy. Many candidates appeared not to know anything about bearings, and gave distances instead.

(iii) Here, however South West was not acceptable as it was outside the range. One mark was available for demonstrating that the three figure bearing would be in the range $180 < x < 270$.

Answers: **(a)(i)** 150, **(ii)** 15 000 000; **(b)(i)** 1305, **(ii)** 045 to 048, **(iii)** 245 to 248.

Question 10

(a) This question gave even the weakest candidates a chance to finish the paper on a good note. Full marks were obtained by many of the candidates, while others made only one mistake.

(b)(i) This was quite well done also.

(ii) This was difficult and was a good discriminator for the top candidates.

(c) Many candidates found the correct answer for this part, or were able to obtain one mark for realising that there should be a symmetry in their answer, so that the first six numbers should be repeated in reverse order.

Answers: **(a)** 1 6 15 20 15 6 1 sum 64 **(b)(i)** 512, **(ii)** 2^n; **(c)** 165 330 462 462 330 165 55 11 1.

1 7 21 35 35 21 7 1 sum 128;

Paper 0580/04

Paper 4 (Extended)

General comments

The standard of the question paper was similar to that of last year and it was encouraging to see a good proportion of scripts with high marks. However there is still too large a number at the opposite end of the scale with very low marks which cannot be awarded any classification at all. These candidates would be much better advised to study and enter for the Core Level Papers where they would have a better chance of showing some positive achievement.

Time did not seem to be a problem and very few candidates did not attempt all the questions.

One general source of mark loss was a disregard for accuracy. Only once in the paper (**Question 6 (b)(ii)**) was there a specific accuracy request but for other answers candidates should know that only giving two significant figures when the answer is not exact will cost marks. Similarly, knowing that the answer should be accurate to a minimum of three significant figures means an even greater accuracy should be kept in the working. If the value of the sine of an angle is approximated to two decimal places in the working then the answer cannot be expected to be correct to three significant figures. Candidates are reminded about accuracy on the front of the examination paper. There are also always some candidates who take the examination with their calculator set in "grad" or "rad" mode, making only the method marks possible in trigonometry questions.

Comments on specific questions

Question 1

The ratio was not always reduced to its lowest terms or written as requested in the form of a ratio, but mo this proved to be an easy start to the paper.

Some candidates did not worry about leaving fractions of children or adults on or off the train and others confused on with off.

The value for x proved to be the least well answered part with 90 being a common error.

Few had difficulty finding the number of children on the train after the second stop. The time at the end of the journey proved to be more of a problem. 20 73 was seen and 21 hours 13 *minutes* is a length of time, not a time of day. The mention of "hours" is acceptable but not minutes. The answer 9:13 *had* to have "p.m." after it to score.

The final reverse percentage needed the given time to be associated with 110% before any credit could be given. The time 7h 20min was often taken as 720 minutes or 7.2 hours. The predictable wrong answer of 44 minutes was common.

Answers: **(a)** 3 : 2; **(b)(i)** 32, **(ii)** 54, **(iii)** 110, **(iv)** $x = 26$; **(c)** 80; **(d)(i)** 21 13, **(ii)** 40 minutes.

Question 2

The first section of this question was usually answered well. Some were careless in their reading of the given formula and others did not know how to square both sides of an equation. The formula transformation involved three steps and most were able to perform some of them correctly.

Finding the factors of the three expressions proved harder than expected. $x^2 – 16$ was sometimes $(x – 4)^2$ or $x(x – 16)$ or abandoned. $x^2 – 16x$ was sometimes $x(x – 16)$ but then continued to $x(x – 4)(x + 4)$.

$x^2 – 9x + 8$ had factors with sign errors, or the figure 9, or "solved" but not factorised.

Some tried to multiply $3x – 9$ by $2x^2 – 9$ rather than x but most had the right idea. Careless errors could appear and then disappear to give the quoted equation. There always has to be correct *working* seen when an answer is given in the question as everybody can copy a "correct" answer from the question paper.

Few realised the connection with this equation and their previous factorising and so started again, usually using the quadratic formula. Both answers had to be found but only $x = 8$ produced sensible results for the time and distance. Some unfortunately did not see anything amiss with negative answers here.

Answers: **(a)(i)** 1.8(0)m^2, **(ii)** 178cm, **(iii)** $h = 3600A^2/m$; **(b)(i)** $(x + 4)(x – 4)$, **(ii)** $x(x – 16)$, **(iii)** $(x – 8)(x – 1)$; **(c)(i)** $x(3x – 9) = 2x^2 – 8$ or equivalent, **(ii)** $x = 1$ or 8, **(iii)** 15 seconds and 120 metres.

Question 3

With the exception of a few who used a perpendicular from *B* to *FT*, only the weaker candidates did not attempt to use the Cosine Rule to find *BT*. Common errors were then to collect the terms as 225cos40° or to add instead of subtract. Some with correct working never produced an answer with more than two significant figures which is not enough for the final accuracy mark in this part and is not able to produce an accurate answer for the subsequent angle. The Sine Rule was the quickest way to find the required angle but the Cosine Rule was again available for those who preferred it.

The second bearing had to be 180° more than the first. The final bearing had to be the candidate's angle *BTF* added to their previous answer.

The three dimensional aspect of the final part caused some difficulty and some did not realise that the angle of elevation was at *F*, not at the top of the tree. The most direct way was to use the tangent ratio. Those who used Pythagoras' Theorem followed by a different ratio often did not retain enough accuracy in their working to produce the correct minimum three significant figure accuracy in their answer.

In any question of this type candidates help themselves by drawing a diagram which makes clear which angles and sides they are using.

Answers: **(a)(i)** 21.9m, **(ii)** 29.9°; **(b)(i)** 125°, **(ii)** 305º, **(iii)** 335º; **(c)** 43.2º.

Question 4

Most were able to plot the given points and draw the curve. Inevitably some were not accurate eno their plots or ignored the word "curve" in the question and joined the points linearly.

Weaker candidates often were unable to calculate *f*(8) and *f*(9). Even those who did were not always able to recognise the limiting value of the function.

Most could draw a reasonable tangent at the right place. Some tried to use the coordinates of points on the curve rather than on the tangent to find the gradient. Provided a good tangent had been drawn, the answer for the gradient had to be correct for that tangent. Most omitted to suggest what quantity the gradient represented – the most common wrong answer here was distance.

The line for *g*(*t*) should have been ruled and extended from (0, 10) to (7, 52). The answer for the range of values of *t* had to be between the two *t*-values of the points of intersection of the candidate's line and curve, which had to be correct for *their* graph. No marks were available in the final part unless the reason given referred to the *area* under the curve representing the distance travelled. Many thought *f*(*t*) travelled further because it was a curve rather than a line, or because the velocity was greater at times.

Answers: **(b)(i)** 49.8, 49.9, **(ii)** ≈ 50; **(c)(ii)** Acceleration or m/s^2 o.e.; **(d)(iii)** Distance given by area under graph ⇒ *f*(*t*) travels further.

Question 5

This relatively simple question often exposed a lack of deeper understanding about probability and caused many candidates considerable mark loss.

The first problem arose with the probability that the card is red *or* D. Most happily translated the word "or" into "+" without thought of any overlap in their counting, so 0.4 + 0.2 = 0.6 was the most common answer seen.

Similarly in the next two parts the word "and" became "×" without any further consideration, so "red and D" became 0.4 × 0.2 = 0.08 and "red and N" became 0.4 × 0.1 = 0.04.

All three problem parts were sometimes dealt with correctly by weaker candidates who simply asked themselves each time how many cards fitted the criteria and found that five cards were either red or D, only one was a red D and none at all were red Ns.

When two cards were chosen the most common error was not to realise that the second card was picked after the first one had gone, which affects both the numerator and denominator of the second fraction. Thus for both Ds, 2/10 × 2/10 or 2/10 × 1/10 were seen instead of 2/10 × 1/9.

Most did get some credit for realising they should add their probabilities for both Ds and both As to get the probability that both cards were the same. Luckily only a few attempted to find the probability of two different cards without using 1 – their previous answer.

There was still a small number of candidates who did not know that probabilities cannot be expressed with a ratio symbol as this has a different meaning – odds. So an answer of 1: 5 is actually giving odds of 1 to 5 and hence a probability of 1/6, which is wrong.

Answers: **(a)(i)** 0.2 (or equivalent), **(ii)** 0.4, **(iii)** 0.5, **(iv)** 0.1, **(v)** 0; **(b)(i)** 1/45, **(ii)** 1/15, **(iii)** 4/45, **(iv)** 41/45.

Question 6

The cylinder volume was occasionally omitted or thought to have a factor of 2 or 1/3 in its formula but usually was correct.

Some took *OX* to be 12cm or tried to find *OX* when *AX* was 12cm but again this was often correct. There were many methods for finding angle *AOB* and any correct method was acceptable but the final answer had to be correct to *two* decimal places as requested in the question.

The sector formula was usually known although a radius of 30cm was not always used and ang 106.3° (or 106.26°) were sometimes seen. Some very long methods were seen to find the t which occasionally was *OAX* rather than *OAB*. The segment area came from the difference betwee previous areas. The water volume should have been found by multiplying the segment area by 50c the cm^3 volume divided by 1000 to give litres. All three marks in this section were available for the co method using the candidate's segment area. The method for the final part involved halving the cylinde volume and subtracting the water volume using consistent units. The final answer had to be in litres as requested.

Answers: **(a)** 141000 cm^3; **(b)(i)** 18 cm, **(ii)** 106.26°; **(c)(i)** 834 to 835.3cm^2, **(ii)** 431.8 to 432 cm^2, **(iii)** 403 cm^2; **(d)(i)** 20 100 to 20 200 cm^3, **(ii)** 20.1 to 20.2 litres; **(e)** 50.3 to 51 litres.

Question 7

In the first part of this question the candidate had to name the correct triangle. A correct translation vector, for example could not earn a mark if the candidate thought any triangle other than *F* was the translation of *T*. The first three parts usually scored well for triangle names, not so well for the descriptions. The mirror line equation was sometimes $y = 1$ or $y = x$ or $x + 1$ and the rotation centre was not always correct. The triangle involving a stretch was often suggested to be *A* or *B* and the name for the transformation by M was sometimes "stretch".

The matrices presented no problems to those who knew this topic but showed up a lack of understanding in weaker candidates.

Those who were able to find **QP** and **RS** correctly usually knew that the other three were not possible but were not allowed to score full marks if they offered extra wrong answers. **PQ** was often "calculated" as was **P + Q**. The answer for **QP** was often thought to be a column rather than a row and **RS** was often not completed to a single number.

Answers: **(a)(i)** *F*, $\begin{pmatrix} 2 \\ -4 \end{pmatrix}$, **(ii)** *D*, $x = 1$, **(iii)** *E*, (2, –1), **(iv)** *C*, 3, **(v)** *A*, shear; **(b)** **QP** = (–11 – 17) and **RS** = (12) only.

Question 8

The modal class and its frequency were sometimes confused so that 32 was offered as the only answer or part of the answer.

Errors made in finding the mean included not using the class midpoints, using class widths instead of either frequency or midpoints and dividing by 5 rather than 120.

The pie chart angle was often thought to be 90°, presumably because 0 - 10 represented 25% of 0 - 40 and hence 25% of 360°.

Some excellent histograms were seen but most common errors were with the horizontal scale (5 equal width classes) or with the area scale where the 1 cm^2 = 1 passenger instruction was simply ignored. The horizontal scale needed to start at 0 and reach 40 after 16 cm. Given the correct scale, the five bars should have heights of 3 cm, 16 cm, 14 cm, 12 cm and 4 cm respectively over the correct base. If this was not the case, then credit was given when the heights were in this ratio. Occasionally a candidate decided to label the vertical axis starting at a *non - zero* number. This made a nonsense of the whole thing and could not score. Others wrongly thought there should be gaps between their bars or drew a polygon instead or produced a cumulative frequency.

Answers: **(a)(i)** $10 < M \leqslant 15$, **(ii)** 18.9 kg, **(iii)** 36°.

Question 9

The first part of this question tested a knowledge of locus and only a minority managed all three ... Many gave a choice of answers for one or more parts. Only one was correct in each case so those ... suggested extras did not score. The first part was the hardest, to judge from the answers. Many thou... Diagram 1 was an alternative or the only answer.

Calculating the shaded areas often involved more work than necessary by the candidate. Not everyone realised the area of the basic triangle *ABC* was 18 cm^2. All sorts of methods were seen using Pythagoras' Theorem and trigonometry and trapezia. Any correct method was acceptable but it had been expected that the simpler methods of $\frac{1}{2}(6 \times 3)$ and $\frac{1}{2}(3 \times 3)$ might have been used more often for the first three Diagrams.

Many knew to subtract the area of a quadrant from 18 for Diagram 4 but some lost accuracy and finished with 11 cm^2.

The quickest way for Diagram 5 was to realise that $x = 22.5°$ and that the base of the shaded triangle was $(6 - 6\tan 22.5°)$cm. The common error for this final part was to imagine that it was the same case as Diagram 1, wrongly assuming that a median and an angle bisector are necessarily the same thing.

Answers: **(a)(i)** Diagram 5, **(ii)** Diagram 4, **(iii)** Diagram 2; **(b)** 9 cm^2, 4.5 cm^2, 4.5 cm^2, 10.9 cm^2, 10.5 cm^2.