Examiner's Report

Q1.
Most students were successful with this question through a variety of approaches. The most common incorrect calculation seen was $\frac{20}{32} \times 25$.

Q2.

Many candidates successfully drew both bearings and correctly identified the position of T as the point of intersection. When only one of the bearings was drawn correctly this was more often the bearing of 060° rather than the bearing of 285°. The main problems were incorrect use of a protractor and failing to realise that T would lie where the two lines crossed. Some candidates drew both bearings correctly but did not extend the lines far enough to give an intersection.

Q3.

Though there were many fully correct answers to part (a) of this question, there were as many responses which were worthy of only 1 mark either because students had plotted points at the upper boundary of each interval or because they had joined the first and last points to make a closed polygon. A significant number of responses were worthy of no marks because students misinterpreted the scale on the frequency axis. Some students drew histograms. Many students gave a succinct and clear answer to part (b) but students often lost marks through not giving sufficient detail. The phrase "at least" caused problems for some students

Q4.

Students scored high marks on this question about repayments on a car loan. Most students scored all five marks and those that didn't made errors in working out the percentage discount but were able to gain marks if they subtracted £1500 and divided by 24 in the correct order.

Q5.
No Examiner's Report available for this question

Q6.
No Examiner's Report available for this question

Q7.

Only a minority of students gained full marks here. There was no particular pattern to the confusion that surrounded the majority of students. Many clearly simply guessed.

Q8.
Most found an acute angle of a rhombus by considering the angles around the point at the centre of the diagram. Some went no further but gained 2 marks credit to this point, having stated this angle as 65°. A few spoiled their working by using 180° as the sum of the angles of a quadrilateral. Some worked out 360/9 but in many cases the labelling and their explanations suggested that they thought that they were finding an exterior angle of a quadrilateral. It is particularly important for candidates to realise that the instruction "you must show your working" must be adhered to in order to gain full marks.

Q9.

Most candidates presented a fully correct and ordered stem & leaf diagram, though for a small number marks were lost due to omission, unordering, or the absence of a key.

In part (b) most candidates demonstrated the ability to divide by a ratio, but far too many then gave the number of games the team did not win, rather than those who won, even after having found both these numbers. The question clearly stated what was needed.

Q10.

This was successfully completed by most candidates. For the rest the first problem was to decide the number of packages and parcels; those misinterpreting the ratio frequently gave incorrect answers of 30 and 10. A significant number spoilt their work by finding 32×25.6.

Q11.

Many students worked out 360 ÷ 9 but were often unsure which angle of the polygon they had actually found. If they marked 40° as an internal angle then they were not awarded the mark. Those students who did find 140° as the internal angle did so from 180 – 40 or from 7 × 180 ÷ 9. It was very unusual to find students progressing further than this. Those that did so realised they had a trapezium with angles of 140 (twice) and 40 (twice). Few used co-interior (allied) angles.

Q12.

This non-standard locus question caught many students unawares. About half of the students shaded the intersection of the two circles rather than more that 10km from *M* and less than 6 km for *N*. About a half of the students gave a fully correct solution.

Q13.
No Examiner's Report available for this question

Q14.

There were many successful answers in part (a). But in part (b) students frequently chose the wrong inequality sign, or used an equals sign instead. Those who could see the relationship between the numbers in part (c) just wrote down the correct answer; others merely wrote out the sequence for one of the series, or included all possible numbers from either series.

Q15.

Some students could recall the need to consider multiplying the recurring decimal by powers of ten but not many could use a correct combination to eliminate the recurring nature of the decimal. A small number of students gave a clear, accurate and complete solution to score full marks.

Q16.
No Examiner's Report available for this question

Q17.

Success in all three parts of this question was very variable.

The most common error in part (a) was to fail to expand both brackets correctly. Of those who did expand correctly many seemed unable to simplify, with 12 and −2 being combined incorrectly to give −10.

In part (b), candidates who knew how to find the product of two linear expressions frequently made arithmetic errors when simplifying, with $-8x + x$ often being simplified to $9x$ or $-9x$ rather than the correct $-7x$. Another common error was to give −3 as the product of 1 and −4, adding rather than multiplying the numbers.

In part (c), some candidates failed to factorise fully but did gain 1 mark for a correct partially factorised answer. A significant proportion of incorrect answers occurred when candidates tried to factorise into two brackets.

Q18.
No Examiner's Report available for this question

Q19.

Almost all students were able to rotate the shape 180° about (0, 0) in part (a) but the success rate dropped significantly in part (b) as about a quarter of students forgot to give the centre of enlargement.

Q20.

Correct answers to this part (a) were reasonably frequent. However, there were substantial numbers of students who showed a complete lack of understanding of basic algebraic processes. Commonly seen were $5ab + ab = 5a^2b^2$, $6ab - 5g - 2g = 6ab + 7g$ as well as $6ab + 3g$ all displaying basic flaws in understanding that the student should have addressed earlier in their career. Part (b) was generally well answered. Part (c) was also generally well answered although a surprising number of students gave t^{24} as an answer. In part (d) many students scored no marks. It was clear that they did not have an understanding of what factorising meant (unlike part (b)) when the terms were more complex. Many answers had brackets in them – in some cases more than one pair, but the expressions were completely wrong or simply had the number "2" outside the brackets. Others simply ignored or misunderstood the mathematical instruction "factorise" and gave an answer of $6x3y^3$ from adding 4 and 2 and then adding the powers in the two terms.

That said there were some fully correct answers and also some good partial factorisations which scored a mark. One answer which was very close was $2xy(x + 2xy)$, displaying possibly a misunderstanding of the meaning of $4xy^2$

Many students scored no marks in part (e). It was clear that they did not have an understanding of what expanding in this context meant. Answers of the form $w^2 + 10$, $w^2 - 10$, $w^2 + 25$ and $w^2 - 25$ were common. Of those who carried out a correct initial expansion to get $w^2 - 5w - 5w + 25$, this often became $w^2 + 25$ or $w^2 - w + 25$ or even $w^2 + 10w + 25w$

Q21.
No Examiner's Report available for this question

Q22.

In part (a) many did not factorise and just cancelled from the initial equation, gaining no marks. Those who did factorise frequently made mistakes in cancelling.

In part (b) the few that made an attempt did so in a very haphazard way. Examiners had great difficulty in identifying exactly what students were trying to do; there were many cases of ambiguous working through students merely showing contradictory examples of manipulation; some correct, some incorrect. Putting the left hand side over a common denominator was the most successful approach, with some going on to show some skill in isolating the m terms, and some even factorising the m terms once brought together.

Q23.

This question was very well answered by a great many students of all levels of ability, gaining at least one mark for realising that the sequence was a quadratic sequence. Having found the second differences of '4', many gave $4n^2$ as the first part of their *n*th term. Having found a correct first term of $2n^2$, many students continued to employ a differencing approach. Others successfully arrived at a correct solution from solving simultaneous equations. Where students were not successful it was common to see $4n$, $2n$ or n instead of $2n^2$; thus many 2 term linear expressions.

Q24.

This was another well answered question. Most students completed the table of values correctly and went on to plot points accurately in part (b). By far the most common loss of marks was because students either joined their points with straight line segments or because they did not join them at all. Many students scored full marks.

Q25.
The most common mistake was calculating 20% of 464 (=92.8) and then having variations of 464 ±92.8 Of those who correctly recognised that 464 was 80% on original price many incorrectly gave 580 as the final answer, even though many had correctly already calculated 116 as the reduction.

Q26.

This question was not answered well. Only the most able students produced fully correct answers. However, a much greater number of students gained one or two marks for finding the gradient of line N or for using the relationship connecting the gradients of perpendicular lines. Many students would have benefitted from making a common sense check on the gradient of their perpendicular line - from the diagram it should clearly be negative but "$\frac{1}{3}$" was quite often used. Some stronger students missed out the "y =" in their final equation For weaker students, confusion between the terms "parallel" and "perpendicular" was quite common.

Q27.

This question was accessible to almost all students with the modal mark being 4 out of 6. Most students gained at least two marks on part (a). They were able to list the numbers correctly in the various sections of the Venn diagram but the commons errors seen were a failure to use labels or to place the remaining numbers in the universal set correctly. Students who performed best wrote out all potential values and ticked them off to ensure all were included in the Venn diagram.

Part (b) was generally well answered with most students able to follow through their Venn diagram correctly.

Q28.
No Examiner's Report available for this question

Q29.
In part (a) relatively few students appreciated that working out an estimate for the distance the train travelled required them to find the area under the curve. Those that did usually showed 4 strips of equal width on the graph and made an attempt at working out the area. Some very good answers were seen but attempts were often spoilt by values being read incorrectly from the graph or by the formula for finding the area of a trapezium being used incorrectly. Some students worked with rectangles and triangles, often successfully. Many students, though, simply used distance, speed, time formulas and finished with wrong answers of 320 or 360.

Part (b) was only accessible to those students who had attempted to work out an area in part (a). Some students did state that their estimate was an overestimate and gave a reason linked to their method. However, many of the reasons given had nothing to do with the method used to work out the area.

Q30.

Most students did not realise that they needed to set up a pair of simultaneous equations. The students who did successfully set up two equations sometimes got no further than this. It was surprising to see just how many students mistakenly based their method on working out £28.20 ÷ 5 and £44.75 ÷ 8. Attempts using a trial and improvement approach were again frequently seen. They were almost always unsuccessful.

Q31.
No Examiner's Report available for this question

Q32.
Many students taking this paper found part (a) of this question to be straightforward. Common errors included a confusion between the signs $\leq$ and $<$. Some students scored 1 mark because they omitted one of the values required or they included one extra value.

In part (b) of the question a large proportion of students were able to identify $x = 3$ as the critical value but far fewer were able to give the correct inequality, $x > 3$, as their final answer. It was interesting to see that many students gave their (correct) final answer in the form $3 < x$ rather than $x > 3$.

Q33.

Only a small proportion of students scored full marks here. Many students multiplied each of the equations through by a constant to ensure that either the coefficients of x or the coefficients of y were such that terms in that variable could be eliminated by either subtraction or addition of the two equations. Unfortunately, students did not indicate whether they intended to add or subtract the equations and accompanying errors often meant that it was not possible to give any marks to reward a correct method. It seemed that most students did not really understand what to do at this stage. Some students did manage to retrieve the situation to some extent by showing a correct substitution of one value as a method to find the value of the other.

Q34.

No Examiner's Report available for this question

Q35.

Part (a) was a novel variant of listing integers which satisfied certain inequalities with the additional constraint of having to satisfy an equation. Many students had some idea on how to go about finding suitable values of *x* and suitable values of *y* and then finding correct pairs to write the values 5 and 6 on the answer line. There were also many students who were unsure of what the lowest and highest values of *x* should be presumably from uncertainty of the exact meaning of the '<' sign. In addition, many students thought the answer was 4, 5 and 6 which may have come from a similar misunderstanding for the '*y*' inequality.

Part (b) proved to be challenging for the majority of the students with many blank grids. There were few students who linked the linear inequalities in *x* and *y* with appropriate straight lines. Those that did sometimes drew the line with equation $y = -1$ as the line with equation $x = -1$. Students who produced tables of values were generally more successful.

Q36.

In part (a) most candidates identified Pythagoras as the best way forward in this question and ended up with the correct answer. Some attempted to use trigonometry and this was generally unsuccessful. Many showed no working.

In part (b) few candidates were completely successful on this part. Many attempted to use trig ratios, although these were often incorrect. Those using the sine or cosine rule together with their answer from (a) were less successful. Some assumed the triangle was isosceles. Some seemed not to realise that one of the triangle angles was needed. Many did not appreciate which angle was needed and, since the angles were often not labelled, it was not always clear to which angle they were referring. It was clear that many students did not know how to find a bearing, with angles being subtracted from 180 or the acute angle being given. Since the question asked for a calculation of the bearing, measuring the angle gained no credit.

Q37.

Many students employed inappropriate methods in their attempts to find the unknown angle *x*. Pythagoras' theorem was often applied to triangle *ADC* or to triangle *ABC* with *AB* taken as 10.4 cm. Some students assumed triangle *ADC* to be isosceles and came close to the correct answer by taking *DC* equal to 10.4 cm. Other incorrect methods involved the incorrect use of the sine or cosine rules again in triangle *ADC*. Those using the sine rule correctly often gave angle *ADC* as an acute angle. This did gain some credit but no marks were awarded for subsequent working which sometimes led to the correct answer by incurring further errors. Students who took the direct route to find angle *ACB* usually gained full marks, however at times premature approximation resulted in the loss of the accuracy mark. Another common successful approach was to find *BC* using Pythagoras' theorem and then use trigonometry to find the required angle.

Q38.

This question was designed to assess the problem-solving capabilities of more able students. They had to recognise that by equating $\frac{1}{2}ab \sin C$ the area, solving for the missing side *a*, they could then use the cosine rule to find the side opposite the 40°. This proved to be very difficult for the students who sat this question paper. There were a few students who scored all the marks, and some who scored two marks, but for many the working space was blank or they attempted to use right angled triangle trigonometry inappropriately.

There was some indication that students could equate the formula $\frac{1}{2}ab \sin C$ to 100, substitute in the values correctly and even find the answer of 37 although some divided the

100 by 2 instead of multiplying by 2. However, they then stopped because they thought they had solved the problem. They had confused the *ab* in the area formula with the *AB* they were being asked to find. Students who went on after finding side *a* often secured all 5 marks. Although some lost 1 mark because of overenthusiam in approximating their answer as they proceeded through the calculation.
A few students used a more indirect approach, first using sine to find the height of the appropriate altitude and then $\frac{1}{2}$ × base × height to work out the base. They then used a combination of right-angled triangle trigonometry and Pythagoras to find the length of the side.

Q39.

The most common correct method seen was the use of the cosine rule; other candidates used the sine rule successfully; others dropped a perpendicular line and used the two right-angled triangles. The majority of candidates who could see an appropriate method to use went on to gain full marks. Those who used the sine rule method often substituted the numbers correctly, but were unable to proceed further. The most common incorrect method was to attempt to use Pythagoras' Theorem.

Q40.
No Examiner's Report available for this question

Q41.
No Examiner's Report available for this question

Q42.
Most made a first step of doing a distance /time calculation often getting as fat as 1.15... or an equivalent calculation, but then not knowing how to proceed.

There were many correct answers from candidates who had a good understanding of what the question was asking and who could work confidently with compound measures and time. Failure to include correct units with their numerical answer was penalised. Errors were also caused by premature rounding, leaving final answers outside tolerance. A common error was to write 26 minutes as 0.26

Q43.

Many students achieved one mark in part (a) for correctly obtaining at least 3 correct terms after expansion. Some of those that got 4 terms correct were unable to simplify them correctly.

Part (b) proved difficult for the majority of students with many not realising that two brackets were needed. When two brackets were used it was common to see either (e − 12) or (e − 6) as one of the brackets. Some of those that did use 3 and 4 in the brackets did not get the signs correct.

Those using the formula in part (c) had difficulty coping with the fact that both *b* and *c* were negative and a large majority of the errors seen were caused by '− *b*'. Although the fraction lines were often not long enough subsequent calculations usually showed that a correct order of operations had been used. The majority of students using the formula did use 2*a* in the denominator and had '±'. Students should be encouraged not to round values prematurely, as this often leads to a lack of accuracy in the final answers. Many students, however, did not attempt to use the formula but tried unsuccessfully to work with the equation or used trial and improvement to find one solution. If trial and improvement is used then both solutions must be found before any marks can be awarded.

Q44.

Unsurprisingly at this stage in the paper, many students were unable to gain any marks. However, due to the two part nature of the solution, many who struggled in the process to find the radius, were then often able to then score one mark for their work with surface area.

With the first part of the solution most students who dropped marks did so because they didn't work with the $\frac{1}{4}$, either by dividing the formula by 4, or for multiplying 576π by 4 OR they omitted the π from one side of the equation. Many students then struggled with the manipulation of the formula and were unable to find the value of *r*; in particular a number took the square root rather than cube root as a final step.

Few students managed to arrive at a radius of 12, even if a correct formula was used, as the manipulation of algebra in the rearranging of the equation was generally poor. Many took the cube root too early, or did not know how to deal with the inverse of 4/3. Worryingly, many seemed to think that the inverse of multiplication is subtraction. In the second part of the solution, many gained the third process mark for substituting their value of r into $\frac{4\pi r^3}{4}$. Many got no further as they either forgot to find include the flat surface areas or did so incorrectly.

Q45.
No Examiner's Report available for this questio

Q46.

A respectable proportion of students scored at least one mark for recognising the right angle between a radius and the tangent. Many displayed this in their diagram.

Some students began by calculating the unknown side in the right-angled triangle using Pythagoras's theorem. Whilst on its own this scored no marks, it was sometimes used successfully by students to correctly find a suitable angle. Other students used incorrect trigonometry and so scored no further marks. Some students assumed the angle subtended by the arc as 2 × 60° which again did not merit any marks.

Once a suitable angle was found some students stopped there whilst others went on to find the arc length by using an appropriate method. Unfortunately some students used the area of the circle and found the area of the sector instead of the arc length. Another error seen in the later stages of the question was to give the length of the minor arc.

Students are advised to carefully read the question. Centres are advised to stress the use of standard 3 letter notation for angles and arc lengths.

Q47.
No Examiner's Report available for this question

Q48.
No Examiner's Report available for this question

Q49.
No Examiner's Report available for this question
Q50.
No Examiner's Report available for this question
Q51.

Many students who were comfortable working with vectors generally scored at least 3 marks on this question. For the award of the final mark a full and complete proof was required. This question was often left blank many students.

Q52.
No Examiner's Report available for this question

Q53.
No Examiner's Report available for this question

Q54.

Part (a) was correctly answered by a significant proportion of the students. Unfortunately of the incorrect answers seen some gave (1, 0) instead of (0,1).

In part (b) a significant number of students were unable to attempt this question even though they were asked to sketch a **circle** so could have started with that. A disappointing number of students were unable to write the co-ordinates as (x, y) and mixed up the order of the values thus losing the last mark because of poor and incorrect labelling. A common error seen was to translate in the positive y direction, but one mark could still be awarded if the radius was shown to be 4. Another common error was using a radius of 2 or 16.

The quality of sketches varied greatly with some being drawn free hand and others with the aid of a pair of compasses, either was acceptable; on sketches clear labelling is helpful.

Centres are advised to check that students use clear and consistent labels on this type of question going forward.

Q55.

Neither of the two parts of this question, if answered at all, were answered well. There were a few good answers to part (a) and some further students managed to score 1 mark for a reasonably convincing translation parallel to the y-axis. Part (b) was less well answered: it did involve a combination of transformations which may have confused students, as there were some who had the curve inverted with a minimum at (0, -2), but the extreme values at ±180 on $y = -1$. As the answer was a reflection in the x-axis followed by a stretch parallel to the y-axis, students should have taken care to ensure that any points of the original curve on the x-axis actually are anchored there.

Q56.
No Examiner's Report available for this question

Q57.

Some students were able to score one mark for calculating the area of the sector or for identifying a right angle between a radius and a tangent or two marks for both. A significant number of students wrote down a correct expression for the area of a circle of radius 10 cm but then did not work out the correct fraction of the circle. Few students were able to give a correct method to find a length in order to calculate the area of the kite. There were a relatively small number of fully correct answers.