PRINCIPAL EXAMINER'S REPORT

BOTSWANA
EXAMINATIONS
COUNCIL

BGCSE MATHEMATICS

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PAPER 1: WRITTEN PAPER

General Comments

Most of the candidates attempted all the questions, although most of them erased or cancelled their working which led to loss of marks. Candidates need to be advised not to erase or cancel their working. Candidates lacked computational skills, e.g. multiplication: they resorted to adding repeatedly, which also had numerical error. Use of free hand in drawing r graphs or polygons still evident, there is need to advice candidates that they lose marks when using free hand. Some candidates did not show their working which disadvantaged them.

For each question, candidates should be advised to use of working and answer spaces provided under each question to avoid loss of marks. It was realised that in some instances, part of the working of the previous question appeared below a different question.

Comments on Individual Items

1 Majority of the candidates were able to divide 1650 by 15 to get 110. The weaker candidates had problems resolving 1650 ÷ 15, they had 11 or 10 as their answers and some multiplied 1650 by 15.

Answer: 110

2 This question was poorly done as most of the candidates failed to remove the brackets of terms with negative signs, mostly they gave their answers as $17a - 6a^2 - 15a$ which simplified to $2a - 6a^2$. Others failed to resolve $-3a \times 2a$ correctly, they obtained $-6a$ instead of $-6a^2$.

Answer: $32a - 16a^2$

3 Majority of the candidates performed poorly in this question; they were able calculate the 4% but failed to add the results to P15 200 instead subtracted from P15 200. Some failed to calculate the 4% of P15 200.

Answer: 15 808

4 The question was poorly done. Majority of the candidates were not able to express 0.0005475 in standard form and correct to 2 significant figures. The common responses were 5.4×10^{-4}, 5.47×10^{-4} and 5.50×10^{-4} for those who got 2 significant figures correct mostly they wrote their answers as 5.5×10^4.

Answer: $5.5 \times {}^{10\,-4}$

5 The question was well done as most of the candidates managed to get the 5th term as 38 and 8th term as 50 by continuously adding 4 from 34. The weaker candidates stated the 5th term and the 6th term which shows that they stated the next two terms as 38 and 42.

Answer: 38, 50

6 The question was well done by most of the candidates as they were able to calculate the largest share: $\frac{3}{5} \times 5000 = P3000$.The weaker candidates had either: $\frac{5000}{2}$ or $\frac{5000}{3}$ or $\frac{5000}{5}$ and $\frac{5000 \times 3}{2}$.

Answer: 3000

7 A fair number of candidates were able to solve the equation: $\frac{3(5x-7)}{3} = 6 \times 3$ giving $x = 5$. The weaker candidates either had: $\frac{3 \times 5x - 7 \times 3}{3 \times 3} = 6 \times 3$ which resulted to $15x - 21 = 18$ or $\frac{5x - 7 \times 3}{3} = 6 \times 3$ which resulted to $5x - 21 = 18$ or $\frac{3 \times 5x - 7 \times 3}{3} = 6 \times 3$ which resulted to $15x - 21 = 6$. The other weaker candidates were unable to eliminate -7 in their equation 5x-7=18 which results to $5x = \frac{11}{5}$, that is, instead of adding 7 both sides they subtracted.

Answer: 5

8 This question was fairly done as a fair number of candidates managed to calculate the circumference of the wheel:$3.142 \times 70 = 219.94$. Some managed to get 3.142×70 but failed to resolve. The weaker candidates either had $2 \times 3.142 \times 70 = 441$ or 3.142×35.

Answer: 220

9 **(a)** This part of the question was fairly answered. The candidates were able to use the formula for sum of interior angles of a polygon by subtracting 2 from 12 and multiplying by 180 to get 1800.The weaker candidates calculated the sum of the interior angles correctly and further divided by 12 to get the interior angle. Other candidates calculated the size of an exterior angle of a polygon and had 30°.

(b) This part of the question was fairly done. Candidates were able to divide 360 by 12 to get 30. Some were able to subtract 150 from 180 to get 30. Some divided 360 by 12 but got 20 as their answer. The weaker candidates divided 360 by 15 to get 24.

Answer: **(a)** 1800 **(b)** 30

10 The question was poorly done as majority of candidates could not calculate the magnitude of the vector, those who attempted couldn't resolve -5^2 resulting in $\sqrt{12^2 + -5^2} = \sqrt{144 - 25}$.

Answer: 13

11 This question was poorly done. Save for the few candidates who managed to get the square root of 225 as 15. Most of the candidates divided 225 by 4 and got 56.25 and some just divided 225 by 2 to get 112.5.

Answer: 15

12 This question was well done as most of the candidates managed to get 41, by subtracting either the sum of 90 and 49 from 1800 or by subtracting 49 from 90. Fewer candidates who failed the question just subtracted 49 from 180, that is,180 – 49 = 131 or had 180 – (49 + 49) = 82.

Answer: 41

13 This question was poorly answered as most of the candidates failed to convert litres to millilitres or vice versa. Most of the candidates had $\frac{750}{30}$ = 25 or $\frac{75}{0.3}$ = 250 or $\frac{300}{75}$ = 4 instead of $\frac{30000}{750}$ or $\frac{30}{075}$.

Answer: 40

14 Majority of the candidates performed poorly on this question. Most of the candidates multiplied the bases and added the powers to get $144^{\frac{2}{6}}$. Some of the candidates expressed the indices as mixed numbers, that is, $9\frac{1}{2} \times 16\frac{1}{4}$ and others had $\sqrt{9} \times \sqrt[4]{16}$ resulting in 3 × 4 = 12.

Answer: 6

15 This part of the question was well done as most of the candidates got 7. The weaker candidates had $x - 3 = 5$ resolved as 8 and some had $\frac{x+3}{2}$ =5 simplified to $\frac{3x}{2}$ =5, to get x = 3.3333.

Answer: 7

16 **(a)** A fair number of candidates were able to construct the triangle JKL. Some candidates were able to get both the correct length JK = 7 cm and correct angle JKL=50° but failed to complete the triangle, whereas some either had only the correct length or only correct angle. Some candidates used free hand in an attempt to construct the triangle.

(b) This part of the question was poorly done as most of the candidates did not attempt it. The few who attempted it bisected the line JK.

Answers: **(a)** correct triangle drawn **(b)** angle bisector of angle JKL

17 **(a)** This part of the question was poorly done. Most of the candidates failed to differentiate between the 24hr clock notation and the 12hour clock notation. The candidates either had 4:20 without pm or 0420 hrs.

(b) This part of the question was fairly done as some of the candidates managed to calculate the time correctly. Those who failed it had 4 hrs 75 mins or 5 hrs 15 mins or 4 hrs 15 mins, showing lack of base 60.

Answers: **(a)** 4:20 p.m. **(b)** 4 h 35 min

18 **(a)** **(i)** This question was fairly answered. Some of the candidates managed to write the correct expression as $x + 12$. Those who did not get it, just multiplied x by 12 to get $12x$.

(ii) This question was poorly done as most of the candidates were not able to form an expression for the total masses. Some had $x + 12x$ to get $13x$ or $12 + x$.

(b) **(i)** This part of the question was fairly done as some of the candidates were able to equate their answer in **(a)(ii)** to 102. Some miscopied 102 as 120.

(ii) This part of the question was fairly done as some of the candidates were able to solve their equations in part **(b)(i)** save for the weaker ones who had problems in solving their equations, that is, some of them failed to collect like terms.

Answers: **(a)(i)** $x + 12$ **(a)(ii)** $2x + 12$ **(b)(i)** $2x + 12 = 90$ **(b)(ii)** 45

19 **(a)** Majority of the candidates did well in this part of the question as they were able to calculate the sector angle. Fewer candidates had $\frac{8}{30}$.

(b) This part of the question was poorly done as most of the candidates failed to calculate the sector angles. In some instances, it was evident that the use of protractor was a challenge especially those who managed to calculate the sector angles correctly but failed to construct the pie chart. Some used free hand to draw a pie chart.

(c) This part of the question was well done as majority of the candidates had $\frac{4}{30}$ or $\frac{2}{15}$.

Answer: **(a)** 96 **(b)** correct pie chart constructed **(c)** $\frac{2k}{15k}$

PAPER 2: WRITTEN PAPER

General Comments

There was a significant number of cases where candidates were prematurely approximating in the working stages leading to answers that were often out of range. The expectation is that the **final answers** should be approximated to three significant figures. Answers to angles should be approximated to one decimal place.

There was a significant number of cases where candidates omitted essential working. There were significant cases where candidates used a ratio and then wrote an answer. A ratio by itself is not a method, its interpretation is the method. Candidates need to be encouraged to adequately interpret how they obtain answers from a ratio. The issue of accuracy in numerical answers was especially observed in questions involving money. Although the required accuracy to the nearest thebe was given, candidates very often wrote their amounts to the nearest five thebe. A lot of numerical answers that did not involve money were approximated to two significant figures leading to a loss of marks. The cohort was especially challenged in the lowest common factors of fractional equations.

There is still use of free hand in the drawing of diagrams. Some candidates drew the image after a rotation in free hand. The same thing was observed in the drawing of the linear graph. Some candidates completed the drawing of the cubic curve by using a straight edge to join the endpoints of the curve, probably because their distances from the other points were longer.

The effective use of the calculator was wanting. Some candidates had correct working but were not able to use the calculator to get the final answer. This was observed in questions that required the use of the square root in question 8, question 16(b), and the cube root in question 17.

Comments on Individual Items

1 **(a)** This part of the question was well done. Most of the candidates were able to interpret the ratio correctly to calculate the mass of phosphorus. The most common wrong answer was 8.3 due to approximating to one decimal place. Some candidates had 300 due to $\frac{12}{2} \times 50$. The expectation is that the accuracy of numerical answers is three significant figures.

(b) A fair proportion of the candidates was able to calculate the mass of fertilizer. Some candidates had 14.3 due to $\frac{2}{12} \times 86$. Other candidates divided 86 by the mass of phosphorus and had 10.4. Few candidates had 86 – 8.33 = 77.67.

Answers: **(a)** 8.33 **(b)** 516

2 **(a)** A fair proportion of the candidates were able to calculate the upper bound. Other candidates had 800.5 while some had 810, a few candidates had $\frac{800}{50} = 16$.

(b) Most of the candidates repeated what they had in part (a). Some candidates had 830 due to approximating 825 to the nearest 10.

Answers: **(a)** 825 **(b)** 824

3 **(a)** This part of the question was attempted correctly by a large proportion of candidates. Some candidates lost the accuracy mark by writing the amount to one decimal place and had 44,985.6. Other candidates went further to either add the customs duty to the value of the car and had 211,175.60 or subtract it and had 121,38440. The expectation is that money should be given correct to two decimal places or the stated accuracy.

(b) A fair proportion of the candidates calculated the VAT on both the customs duty and value of the car but lost the accuracy mark due to approximation to the nearest five thebe and had 29, 564.6. Some candidates calculated VAT on the value of the car, had 223,279.20 and went no further. Other candidates added the VAT on the value of the car to the customs duty and had 68,174.80. A few candidates calculated the VAT on the customs duty, had 6285.38 and went no further.

(c) A fair proportion of the candidates were able to calculate the total cost of the minibus. Some candidates lost the accuracy mark by approximating to the nearest five thebe and had 240,740.20. Other candidates added the VAT on the value of the car to the customs duty and had 68,174.80 while others added the customs duty to the value of the minibus and had 211,175.60. A few candidates went further to add the VAT on the value of the car and had 234,454.80.

Answers: **(a)** 44 895.60 **(b)** 29 564.58 **(c)** 240 740.18

4 This question was poorly done. A few candidates were able to calculate the mean mass of peas. A fair proportion were able to calculate the total number of pea plants but then divided by 5 to obtain 51.4, while some divided by 15 to obtain 17.1. Other candidates had $\frac{1+2+3+4+5}{5} = 3$, while some had $\frac{80}{5} = 16$ and $\frac{80}{15} = 5.33$.

Answer: 3.21

5 Performance of candidates in this question was poor. A large proportion of the candidates were able to multiply each term on both sides by the LCM (3, 4, 5) = 60 but were challenged in collecting like terms and had $20x - 15x = -24$ resulting in the answer $x = -4.8$. Some candidates had $\frac{20x - 24 = 15x}{60}$.

Answer: 4.8

6 Poor performance was observed on this question. Very few candidates were able to calculate the water charge. Some candidates had only two correct products. Other candidates added the given amounts and had 3.50 + 11.78 + 20.62 + 31.72 = 67.62. There were cases where linear interpolation was used to estimate the water charge. Several candidates had 27 × 31.72 = 856.44.

Answer: 404.94

7 **(a)** Candidates performed poorly in this part of the question. Some candidates had 21.1 due to $\text{Sin } 25 = \frac{(BC)}{50}$ while others had 10.7 as a result of $\text{Tan } 25 = \frac{50}{(BC)}$. A few candidates assumed that the line segment BD is a line of symmetry and had 50.

(b) Poor performance was also observed in this part of the question. A few candidates correctly used the sine rule after calculating BD but had accuracy errors from premature approximation in the working stages. The expectation is that approximation should only be done in the final answer. To that end BD = 55.16 is appropriate instead of 55.2. Some candidates used the sine ratio instead of the sine rule after calculating BD.

Answer: **(a)** 23.3 **(b)** 36.5

8 A significant number of the candidates were able to calculate the distance between the given points. The most common wrong answers were $\sqrt{((2 - 4)^2 + (1 - 5)^2)} = 6.71$ and $(1 - 4)^2 + (2 - 5)^2 = 34$. Some candidates had 14 due to adding 9 to the square root of 25. A few candidates added both the x–coordinates and the y–coordinates and had $(-3,7)$.

Answer: 5.83

9 **(a)** A large proportion of the candidates were able to use the correct formula for the area of the triangle but were challenged in evaluating the resulting expression. it. Some candidates had $\frac{1}{2} \times 21.9 \times 30.8 \text{ Sin } 37.8 = 207$ while others had $\frac{1}{2} \times 21.9 \times 3.2 \text{ Sin } 37.8 = 236$.

(b) A large proportion of the candidates were able to use the sine rule correctly, however, evaluating the inverse sine was a challenge. Some candidates were able to substitute correctly into the sine rule and were not able to evaluate. A few candidates had $\frac{\text{Sin } 37.8}{\text{Sin } 21.9} = \frac{\text{Sin Q}}{\text{Sin } 30.8}$.

Answer: **(a)** 332 **(b)** 59.5

10 **(a)** Two-thirds of the candidates were able to solve the inequality. Some candidates removed the brackets, collected the like terms but then changed the inequality sign into an equal sign and had $x = 9$. Of those who successfully removed the brackets, a few stopped at $3x \leq 27$. Some candidates could not to multiply out the signs correctly in removing the brackets and had $x \leq -4.33$. A few had $x \leq 2.45$ from $11x - 20 \leq 7$. It was rare to see $(7x - 4)(x + 5) \leq 7$ from treating the left-hand side as a binomial product.

(b) Almost all the candidates had one correct factor thereby scoring a mark had $(5t + 2r)(4 + 3y)$. Some candidates omitted writing $y$and had $(5t + 2r)(4 - 3)$. A large proportion of the candidates were not able to factorise the signs leading to $(5t - 2r)(4 + 3y)$.

Answer: **(a)** $x \leq 9$ (b) $(5t + 2r)(4 - 3y)$

11 **(a)** A pair proportion of the candidates calculated the volume of the sphere. The most common wrong answers were $\frac{4}{3} \times \pi \times 8^3 = 2144$ and $\frac{4}{3} \times \pi \times 3^2 = 37.7$. Some candidates had $\frac{3}{4} \times \pi \times 3^3 = 63.6$.

(b) This part of the question was poorly done save for strong candidates. A large proportion of the candidates had $\pi \times 8^2 \times 7.25 = 1457$, the volume of a cylinder with a height of 7.25 cm and went no further. Other candidates had $\pi \times 8 \times 7.25 - 113 = 69.2$ while others had $\pi \times 8 \times 7.25 = 182$ and went no further. The answers $\pi \times 8^2 = 201$ and $2\pi \times 8^2 \times 7.25 = 2915$ were rare.

Answer: **(a)** 113 **(b)** 1340 – 1350

12 They were, indeed, very few correct attempts at this question. Some candidates added the given distances and had 38,000. Some candidates divided the sum of the distances by three and had 12667. Other candidates calculated the lower bound and had either $38000 - \frac{1}{2} \times 1000 = 37500$ or $38000 - \frac{1}{2} \times 1 = 37999.5$. Some calculated the highest common factor of the distances and had 2000.

Answer: 240 000

13 Poor performance was observed in this question. The point (0, 8) was often plotted as (1, 8) while the point $(-2, 5)$ was often plotted as $(-3, 6)$ in the few attempts with two correct vertices. Some candidates rotated the object clockwise and had an image with vertices (1, 1), (2, -4) and $(4, -1)$. Some candidates reflected the object in the x −axis and had an image with vertices $(2, -2)$, $(4, -5)$ and $(7, -3)$ and a reflection on the line $y = -x$ and had an image with vertices (1, 1), $(-2, -1)$ and $(0, -4)$. There were translations with vectors $\begin{pmatrix} 0 \\ -4 \end{pmatrix}$ and $\begin{pmatrix} 0 \\ -6 \end{pmatrix}$.

Answer: Triangle with vertices (–2, 5), (0, 8), and (1, 3)

14 **(a)** The question was poorly attempted. The candidates had 7, 8, 9 and 10.3 due to the misinterpretation of the scale.

(b) A fair proportion of the candidates correctly attempted the question. Some candidates added their lower bound to the upper bound and divided by 2. Others had 60, the cumulative frequency of the upper bound, while some candidates divided the 60 by the upper bound and had 5.45.

(c) Save for a few candidates, this part of the question was poorly done. Some candidates estimated the number of cars that use 10 litres, had 33 and went no further. Those who went further had $\frac{10}{33} \times 100 = 30.3\%$ while others had 80 – 33 = 47 and went no further. Other candidates had $\frac{33}{80} \times 100 = 41.25\%$, the percentage of cars that use exactly 10 litres of fuel. A few candidates had $\frac{10}{14} \times 100 = 71.4\%$ where 14 is the maximum amount of fuel given in the diagram.

Answer: **(a)** 9.15 ± 0.05 **(b)** 1.85± 0.05 **(c)** 58.75 ± 1.25

15 **(a)** A fair proportion of the candidates were able to state the geometrical name of the line segment ST. Some candidates had the tangent while others had the diameter. A few candidates had the segment.

(b) **(i)** A fair proportion of the candidates were able to calculate the perpendicular distance of the chord from the centre of the circle. Some candidates had 22.8 because of 29.65Cos 39.7 while others had 24.6 from 29.65Tan 39.7. A few candidates had 29.65.

(ii) A fair proportion of the candidates were able to calculate the length of the chord, ST. A significant number of candidates calculated half the length of the chord and had 22.8. Some candidates had 29.65 × 2 59.3. Other candidates had $\frac{39.7}{360} \times \pi \times 59.3 = 20.5$ while others had $\sqrt{(2 \times 29.65^2)} = 41.9$.

Answers: **(a)** chord **(b)(i)** 18.9 **(b)(ii)** 45.5 – 45.7

16 **(a)** Almost all the candidates were able to calculate the area of the cross-section. Very few candidates had $\frac{1}{2}$ × 2.45 × 3.9 Sin 90 = 4.7775 Sin 90.

(b) Almost all the candidates were able to use the Pythagoras rule correctly to calculate the length of *ST.* Some attempts were punctuated by accuracy errors such as 4.6 due to approximation to one decimal place and 4.60 due to truncation error. Some candidates had $\sqrt{3.9^2 + 2.45^2} = \sqrt{21.2}$ or $\sqrt{21}$ and went no further.

(c) Poor performance was observed in this part question. The candidates calculated the area of either one rectangle or two rectangles and went no further. It was common to multiply the area of the cross-section by 2 and add it to the area of one or two rectangles. Some candidates calculated the volume and had 59.7 while some calculated the product of the three sides of the cross-section and had 44.0.

Answer: **(a)** 4.78 **(b)** 4.61 **(c)** 147

17 Poor performance was observed on this question. The candidates were not able to effectively use the calculator to evaluate the given numerical expression. Some candidates multiplied the square root by three instead of cubing and had 2.298 × 3 – 0.05797 = 6.84. Other candidates cubed the square root instead of obtaining its cube root and subtracting the quotient and had 12.1.

Answer: 1.68

18 **(a)** Two-thirds of the candidates were able to draw the cubic curve. Some candidates seemed to want the curve to look like a parabola and plotted the point (–5, –40) as (–5, 40) and had a curve that looked like W**.** Other candidates plotted the point (4, 32) as (4, –32) and had a curve that looks like M. There was a tendency to use a ruler to join the endpoints of the cubic curve by a ruler.

(b) Poor performance was observed in this part of the question. There was a tendency for candidates to join the linear graph points with a free hand. Some candidates drew the graphs $y = 4$, $y = -x + 4$ while others drew $x = 4$.

(c) Poor performance was observed on this part of the questions. Of the few that were able to solve the cubic equation by graphing, some candidates forgot the negative sign and had $x = 0.3$. Some candidates solved the cubic equation $x^3 + x^2 - 12x = 0$. Some candidates were able to identify the points of intersection of the cubic curve and wrote them as solutions. There were several no attempts at this part of the question even with candidates who had a correct curve and linear graph.

Answers: **(a)** correct cubic curve **(b)** correct linear graph
(c) $x = -4$**,** $x = -0.3 \pm 0.1$**,** $x = 3.3 \pm 0.1$

PAPER 3: WRITTEN PAPER

General Comments

Candidates in this series have shown a great improvement in their presentation. The candidates also showed a better understanding on some concepts including the cosine rule, linear programming and sequences. There was a significant decrease on the number of candidates who drew their graphs on a line paper, even where there was an omission of the instruction for them to draw on graph paper.

Comments on Individual Questions

1 **(a)** This part of the question was well done. Most of the candidates were able to calculate the percentage of new students in the college. Most of the candidates that did not score any marks on this part of the question had responses like $\frac{1350-730}{730} \times 100 = 84.9$ or $\frac{730}{1350-730} \times 100 = 117.7$.

(b) **(i)** This part of the question was also well answered by most of the candidates. Some common incorrect responses were 23 100 as a result of 220 × 105.

(ii) This part of the question was fairly answered. Most of the candidates that did not score marks gave answers like $\frac{15}{100} \times (1350 - 730) \times 105 = 9765$.

(c) This part of the question was also fairly done. The candidates who did not score marks in this question had $\frac{88}{12} \times 1350 = 9900$ as their response.

Answers: **(a)** 54.1 **(b)(i)** 160 600 **(b)(ii)** 170 365 **(c)** 11 250

2 **(a)** This part of the question was poorly done. A lot of candidates had the correct answer, cancelled it and wrote a different one, probably because the value was appearing for the second time in the sequence. Most of the responses that did not score were 2 or 4 or 8 or 10.

(b) This part of the question was poorly done. Some common responses from the candidates that did not score marks were $3n^2 + 6n - 17$ or $3n^2 + 6n + 7$.

(c) **(i)** This part of the question was fairly done since the candidates substituted correctly in an incorrect expression. Most of those responses were $3 \times 31^2 + 6 \times 31 + 7 = 3076$ or $3 \times 31^2 + 6 \times 31 - 17 = 3052$.

(ii) This part of the question was poorly done. Some candidates substituted –5044 into their expression. Some were able to form the expected equation but could not solve it properly and gave their answers as –45 and 37.

Answers: **(a)** –4 **(b)** $-3n^2 + 24n - 49$ **(c)(i)** –2188 **(c)(ii)** 45

3 **(a)** This part of the question was poorly done. Most of the candidates did not know how to calculate the required lower bounds. Some of the responses that did not score marks were $3.1 \times 2.4 = 7.44$ or $(3.1 - 0.5) \times (2.4 - 0.5) = 4.94$ or $3.15 \times 2.45 = 7.7175$.

(b) This part of the question was also poorly done. Some of the common responses that did not score marks were $\frac{636.5}{7.7175} = 82.5$ or $\frac{636}{7.17} = 88.7$ or $\frac{636}{7.7175} = 82.4$ or $\frac{635.5}{7.7175} = 82.3$.

Answers: **(a)** 7.17 **(b)** 88.8

4 **(a)** This part of the question was fairly done. Most of the candidates showed lack of understanding of bearings. Most of them drew a triangle with an angle of 70°.

(b) This part of the question was poorly done. Most of the candidates that did not score any marks had answers like 64.8 or 68.8.

(c) **(i)** This part of the question was well done. Most of the candidates were able to correctly construct the perpendicular bisector of the right side.

(ii) This part of the question was fairly done. The candidates that did not score marks either constructed a broken arc, a shorter arc that did not cross the required sides on an arc with an incorrect centre.

(iii) This part of the question was poorly done. Most of the candidates showed no understanding of intersecting loci hence could not locate the position of S.

Answers: **(b)** 89, 6 to 103

5 **(a)** This part of the question was well done. Most of the candidates were able to successfully form the expression. Most of the candidates who did not score were swapping the variables and giving their answer as $20y + 18x$. There were also candidates who gave their answer as $\frac{20x}{2} + \frac{18y}{2} = \frac{35500}{2}$ which translates$10x + 9y = 17\,750$.

(b) This part of the question was also well done. The most common errors made by candidates were those of misreading the values and their answers were $20x + 18y = 35\,500$ or $20x + 18y = 3550$.

(c) This part of the question was also well done. The most common incorrect responses were $x + y = 31200$.

(d) **(i)** This part of the question was also well done. Most of the candidates that did not score all the marks were able to calculate the value of one variable and stopped without calculating the value of the second variable. Some other incorrect values were $x = 16\,804.54, y = 772.72$, which came as a result of misreading the values in part (b) and (c).

(ii) This part of the question was also well done. The most common incorrect response was $20 \times 1100 = 22\,000$.

Answers: **(a)** $20x + 18y$ **(b)** $20x + 18y = 35\,500$ **(c)** $12x + 24y = 31\,200$
(d)(i) $x = 1100, y = 750$ **(d)(ii)** 1100

6 **(a)** This part of the question was fairly done. Most of the candidates were able to find the angle but could not give the correct property. They mostly gave reasons like alternate angles or co-interior angles.

(b) The question was fairly done. The most common incorrect answer was 90 – 42 = 48 with the reasons alternate angles, co-interior angles or angles in a cyclic quadrilateral.

(c) This part of the question was also fairly done. Most of the candidates were able to find the angle but struggled with the reason. They gave reasons like angles in a cyclic quadrilateral or angles in a cyclic quad instead of quadrilateral.

Answers: **(a)** 42 **(b)** 15 **(c)** 123

7 **(a)** This part of the question was fairly done. The candidates who did not score marks gave answers like $\frac{4}{9}+\frac{3}{7}=\frac{55}{63} or \ \frac{7}{16}\times\frac{6}{15}=\frac{7}{40}$.

(b) This part of question was poorly done. Some of the common incorrect responses were $\frac{4}{9}\times\frac{3}{9}+\frac{4}{7}\times\frac{3}{7}=\frac{520}{1323}$ or $2\left(\frac{5}{9}\times\frac{3}{7}\right)+\left(\frac{4}{7}\times\frac{4}{9}\right)\times 2=\frac{62}{63}$.

Answers: **(a)** $\frac{4}{21}$ **(b)** $\frac{31}{63}$

8 **(a)** **(i)** This part of the question was well done. Some incorrect responses given by the candidates were a – b or –b – a or –ab.

(ii) This part of the question was poorly answered. Most of the candidates failed to interpret the ratio $3:2$. Some responses given by candidates that did not score any marks were $-\frac{2}{5}b$ or $-\frac{2}{5}b$. Some were able to interpret the ratio but did not consider the direction hence their response was $\frac{2}{3}b$.

(iii) This part of the question was also poorly answered. Most of the candidates failed to interpret the ratio 3:2. Some of the candidates' incorrect responses were $\frac{2}{5}(a-b)$ or $\frac{2}{5}b$.

(b) This part of the question was poorly done. Most of the candidates were not able to show understanding of the relationship between ratio of lengths and ratio of areas. Some responses that were given by candidates that did not score were $\frac{3}{5}\times 489=293.4$.

Answers**: (a)(i)** $a-b$ **(ii)** $-\frac{2}{3}b$ **(iii)** $\frac{2}{3}(a-b)$ **(b)** 339

9 **(a)** **(i)** This part of the question was poorly done. Most of the candidates still struggle with calculating midpoints that will enable them to calculate the mean. They either use the lower bound or the upper bound for each class in place of the midpoint.

(ii) This part of the question was also poorly done. From the incorrect mean the candidates continued to use incorrect values for the midpoint, which made them lose marks. Most of those who had correct midpoint were calculating variance and not standard deviation giving their answer as 9137.5.

(b) **(i)** This part of the question was also poorly done. Most of the candidates were not able to interpolate, they calculated the positions only and hence giving their answers as either 12.5 or 13.

(ii) This part of the question was also poorly done. Most of the candidates were not able to interpolate, they calculated the positions only and hence giving their answers as either 19.5 or 20.28.

(c) This part of the question was poorly done. Most of the candidates treated the data as if all the classes had the same interval hence the height of the bars were given as frequency instead of frequency density'.

Answers: **(a)(i)** 16 **(a)(ii)** 10.5 **(b)(i)** 13.6 or 14.3 **(b)(ii)** 28.2 or 26.3

10 **(a)** This part of the question was poorly done. Some of the incorrect responses were $\tan x = \frac{6.3}{6.9}$, giving their angle as 42.4 or $\sqrt{6.3^2 + 6.9^2} = 9.34$.

(b) This part of the question was very well done. Looks like a lot of candidates know the cosine rule very well. The few that did not score were not able to observe the BODMAS rule and gave their answer as $(6.3^2 + 7.2^2 – 2 \times 7.2 \times 6.3) \times \cos 102.9 = 0.81$.

Answers: **(a)** 47.6 **(b)** 10.6

11 **(a)** **(i)** This part of the question was fairly done. Most of the candidates that did not score either did not divide by 2 and gave their answer as $125 – 2 \times 1.5 = 122$ or did not subtract the other 1.5 and gave their answer as $\frac{125-1.5}{2} = 61.75$. The other incorrect response was $\frac{125}{2} = 62.5$.

(ii) This part of the question was also fairly done. Most of the candidates that did not score gave answers like 285, took the value as given in the question without considering other parts or 285 – 1.5 = 283.5.

(iii) This part of the question was poorly done. It was evident that candidates did not know what capacity is. Some of their common incorrect responses were $\pi \times 61^2 = 11689.9$ or $\frac{\pi \times 61.75^2 \times 283.5}{2} = 1\,081\,003$ or $\pi \times 62.5^2 \times 285 = 3497476$.

(b) **(i)** This part of the question was also poorly done. Most of the candidates that did not score marks calculated the outer volume but did not subtract the inner capacity. Their common incorrect responses were $\frac{1}{2} \times \pi \times 62.5^2 \times 285 = 1\,748\,738$ or $\left(\frac{\pi \times 62.5^2}{2} – \frac{\pi \times 61^2}{2}\right) = 82\,932$ or $\pi \times 62.5^2 \times 285 – \pi \times 61^2 \times 282 = 200\,933.9$.

(ii) This part of the question was fairly done. Most of the candidates demonstrated that they know how to calculate density, just that they were using an incorrect value of the volume. Some of their common incorrect responses were $\frac{791\,000}{82\,932} = 9.54$ or $\frac{791\,000}{1\,748\,738} = 0.452$. Then were those candidates that failed to convert the mass from kilograms to grams, hence giving answers like $\frac{791}{82\,932} = 0.00954$.

(c) This part of the question was well done. Candidates showed an improvement on presentation. Some of the responses were $2 \times \pi \times 61.7^2 = 54706.12367$, that did not score any marks.

(d) This part of the question was also well done. Most of the candidates that did not score any marks gave $2 \times \pi \times 61^2 = 23\,379.73253$ as their response.

Answers: **(a)(i)** 61 **(a)(ii)** 282 **(a)(iii)** 1 650 000 **(b)(i)** 98 700 to 101 000
(b)(ii) 7.83 to 8.01 **(d)** 65 700

12 **(a)** **(i)** This part of the question was well done. Most of the incorrect responses were $10y$ or $10x + 12.5y$.

(ii) This part of the question was also well done.

(b) This part of the question was fairly done. A good number of candidates were able to form the inequality but did not simplify appropriately with a long division line, giving their answer as $\frac{10x+12.5y\leq 375}{2.5}$. Some who did not score any mark at all formed an equation $10x + 12.5y = 375$ instead of an inequality.

(c) The question was poorly done. The most common incorrect responses were $x \leq 2y$ or $2x \leq y$.

(d) The question was very well done. The most common incorrect response was $y > 10$.

(e) This part of the question was fairly done. Most of the candidates were able to draw 2 out of 3 lines and shade them appropriately.

(f) **(i)** This part of the question was poorly done. Even candidates who got the correct graph could not pick all the points, especially the ones on the lines.

(ii) This part of the question was also poorly done. The most common incorrect response was $10 \times 10 + 10 \times 12.5 = 225$.

Answers: **(a)(i)** $10x$ **(a)(ii)** $10x + 12.5y$ **(c)** $y \leq 2x$ **(d)** $y \geq 10$
(f)(i) (5,10), (10,10), (10,15), (10,20), (15,10), (15,15), (20,10), (25,10) **(f)(ii)** 175

13 **(a)** This part of the question was well done. It was evident that most of the candidates have mastered forming simple expressions. The few that did not score the mark mostly gave their answer as $1120x$.

(b) **(i)** This part of the question was also well done. The most common incorrect responses given by candidates were $x + 3$, $2(x + 3)$, $3x + 2$ or $x + 6$.

(ii) This part of the question was also well done. Most of the candidates were able to form the correct expression, including some that did not form the expression in part (a) correctly. Some common incorrect responses were $1120(x+3)$ or $\frac{1120}{x+3}$.

(c) This part of the question was poorly done. Most of the candidates that did not score all the marks were able to form the correct equation but failed to eliminate the denominators. Some incorrect responses were $\frac{1120\times x\times 2x+3}{x}-\frac{1120\times x\times 2x+3}{2x+3}=10\times x\times 2x+3$.

(d) **(i)** This part of the question was fairly done. There is still a significant number of candidates who are not able to round off their answers to the required accuracy in this part question, hence having answers like 57.4 and -2.9. Some other incorrect responses were coming from candidates not able to resolve their operations and their answers were 2.93 and -57.43. Other incorrect responses were coming from $\frac{109\pm\sqrt{9193}}{4}$.

(ii) This part of the question was also fairly done. Most of the candidates were able to substitute correctly in the right expression, just that they were using incorrect values from their solutions or using their incorrect expression. Some of the common incorrect responses were 2(57.43 + 3) = 120.86 or $2(57.43)^2$ = 6596.41.

Answer**: (a)** $\frac{1120}{x}$ **(b)(i)** $2x+3$ **(b)(ii)** $\frac{1120}{2x+3}$ **(d)(i)** 57.43 and –2.93

(d)(ii) 117.86 or 117.85