PRINCIPAL EXAMINER'S REPORT

BOTSWANA
EXAMINATIONS
COUNCIL

JCE MATHEMATICS

2024

PAPER 1: MULTIPLE CHOICE

General Comments

The performance of the candidates in this component has been declining since 2021 and this year was no exception. The mean for this year was 12.78 down from 15.87 last year. As usual, the performance varied across the items, the proportion correct for items varied between 8% and 69% which is a very worrisome performance. The questions were generally spread across topics.

There is need to help candidates to improve this performance. The strongest distractors and distribution of the candidates across the options generally indicate the misconceptions that the candidates may have. Where reported, such information should be used to improve the teaching and learning.

Generally, Multiple-Choice items have a guessing factor that is considered to be the lowest proportion of being able to get the item correct without knowing the answer. For a Multiple-Choice item with four options, the guessing factor is 25% and any item which has the proportion of candidates who got it correct lower than the guessing factor is a cause for concern. Candidates should be encouraged to always read the question for understanding before they select an answer. The report is mainly in table format showing the number of candidates at each of the options. The key for reading the table:

N number of candidates that selected the option as their answer

Key the option that was taken as the answer for the item

Comments on Individual Items

Item 1

Option	N	KEY.	Comment
A	25870	A	Most of the candidates did well in this item, they showed good understanding reflection symmetry. A good number of those that got it wrong, went for option D four lines of symmetry options B and C attracted fewer candidates.
B	1872		
C	14593		
D	1860		

Item 2

Option	N	KEY.	Comment
A	5660	D	Candidates performed poorly in this item, most of the candidates do not understand addition of vectors. Amongst those that got this item wrong, most of them went for option B showing lack of understanding of addition of negative numbers.
B	18961		
C	5736		
D	13838		

Item 3

Option	N	KEY.	Comment
A	5440	D	Most of the candidates did well in this item, they were able to workout the total salary for the month. Most of those who failed to get it correct simply added basic pay and rate of commission.
B	12881		
C	4249		
D	21625		

Item 4

Option	N	KEY.	Comment
A	7348	C	Candidates did well in this item, showing that they understand reflection. Most those that failed went for option B.
B	12679		
C	22122		
D	2046		

Item 5

Option	N	KEY.	Comment
A	10609	D	This item was poorly done, few candidates were able to find an expression for the nth term of the linear sequence, most of the candidates went for option C it shows that candidates cannot handle linear sequences involving negative numbers.
B	7397		
C	16253		
D	9936		

Item 6

Option	N	KEY.	Comment
A	8508	B	The item was fairly done, most of the candidates could fail to spot the correct net for a triangular prism showing their weakness in spatial reasoning.
B	14220		
C	16339		
D	5128		

Item 7

Option	N	KEY.	Comment
A	19911	C	The item was poorly done, Most of the candidates went for options A and B showing that a lot of the candidates failed to notice that by the time the passenger arrives in Jwaneng, the first bus had already left, so they had to get the second bus and by the time it arrives in Gaborone, The 0900 bus has already left so they have to get the 1000 bus.
B	15079		
C	5591		
D	3614		

Item 8

Option	N	KEY.	Comment
A	5853	B	The item was well done most of the candidates were able to workout the length of time the journey from Gaborone to Jwaneng would take.
B	24942		
C	4684		
D	8716		

Item 9

Option	N	KEY.	Comment
A	22819	A	The item was fairly done, a good number of the candidates failed to factorise and simplify algebraic fraction with two term denominator.
B	6389		
C	8498		
D	6489		

Item 10

Option	N	KEY.	Comment
A	16851	A	The item was poorly done, most of the candidates failed to interpret the probability space diagram.
B	6598		
C	9276		
D	11470		

Item 11

Option	N	KEY.	Comment
A	22053	C	The item was poorly done, the candidates failed to show any knowledge of BODMAS (order of operations), most of them did not see any need for brackets, went for option A.
B	9944		
C	10236		
D	1962		

Item 12

Option	N	KEY.	Comment
A	3475	B	The item was poorly done, it shows that most of the candidates have not made an observation of how many is rounded off in everyday life in Botswana. Candidates are used to rounding off the nearest ten thebe or Pula.
B	7318		
C	25677		
D	7725		

Item 13

Option	N	KEY.	Comment
A	3254	B	The question was poorly done. Most of the candidates either multiplied by 22 by 4 or did 22 + 22 and went for options C and D.
B	9318		
C	16490		
D	15133		

Item 14

Option	N	KEY.	Comment
A	10252	A	The item was poorly done. Most of candidates seem to have problems dealing with the minus sign, so they went for the other options C,B and D.
B	11626		
C	13617		
D	8700		

Item 15

Option	N	KEY.	Comment
A	16832	B	The item was poorly done, most of the candidates could not relate the size of the angles to the lengths of the opposite sides.
B	20643		
C	4152		
D	2568		

Item 16

Option	N	KEY.	Comment
A	18621	D	The item was poorly done, most of the Candidates only worked out angle at the centre (angle FOE) but did not continue to find angle OEF so they went for option A
B	13492		
C	7683		
D	4398		

Item 17

Option	N	KEY.	Comment
A	10324	D	The item was poorly done, most of the candidates simply moved the term 2bh to the other side without using the minus operator and therefore went for option B.
B	16375		
C	5118		
D	12377		

Item 18

Option	N	KEY.	Comment
A	9183	C	The item was fairly done. Most of the candidates who it wrong, went for options A and B.
B	8567		
C	20471		
D	5972		

Item 19

Option	N	KEY.	Comment
A	12467	A	The item was poorly done. It is almost as if the candidates were guessing the answer between options A, B and D. This means the candidates have not mastered this method of factorising quadratic equations and they find it more difficult when the operations are negative and the coefficient of the square term is not 1.
B	11237		
C	7491		
D	12998		

Item 20

Option	N	KEY.	Comment
A	12718	A	The item was poorly done. Again, here candidates' responses are almost evenly distributed across options, again showing that most of the candidates could not write the given expression as a single fraction or just failed to simplify the denominator because of the minus operator.
B	10782		
C	9989		
D	10704		

Item 21

Option	N	KEY.	Comment
A	15724	D	The item was poorly done. Most of the candidates failed to solve the linear equation involving a fraction. Some did not multiply all the terms by the denominator while others failed subtract 36 from both sides of the equation, with some forgetting or ignoring the negative sign. These were more or less equally distributed between options B, C and D.
B	9668		
C	10001		
D	8800		

Item 22

Option	N	KEY.	Comment
A	13072	D	The item was poorly done. Most of the candidates could not figure out the pattern for numbering pages of a magazine.
B	14239		
C	6142		
D	10739		

Item 23

Option	N	KEY.	Comment
A	6965	D	It was poorly done, candidates failed to apply the law $(x^3y^2)^4 = (x^{3\times4}y^{2\times4})$.
B	9680		
C	12215		
D	15331		

Item 24

Option	N	KEY.	Comment
A	11522	C	The item was fairly done. A good number of the candidates were not able to find the circumference of a circle. They mostly multiplied the diameter by 2 and therefore opted for option A.
B	7297		
C	17574		
D	7798		

Item 25

Option	N	KEY.	Comment
A	3650	D	The item was fairly done, most of the candidates failed to express 180 as a fraction equivalent to $\frac{60}{360}$ of the whole university population and use that to find the total population.
B	9121		
C	11372		
D	20048		

Item 26

Option	N	KEY.	Comment
A	17556	C	The item was poorly done, most of the candidates just added the length and the width of the mosaic tile and divided by 2 and therefore went for option A.
B	8245		
C	10767		
D	7623		

Item 27

Option	N	KEY.	Comment
A	16099	D	This item was also poorly done, the candidates failed to calculate the volume of the tile.
B	11673		
C	6925		
D	9492		

Item 28

Option	N	KEY.	Comment
A	10830	D	The item was poorly done, most of the candidates failed to calculate a point given the midpoint and the other point.
B	13434		
C	10847		
D	9073		

Item 29

Option	N	KEY.	Comment
A	5728	B	The item was poorly done. Most of the candidates failed to recognise that they can use the Pythagoras theorem but instead just added the lengths of the two given sides which lead then to option C.
B	14979		
C	19744		
D	3729		

Item 30

Option	N	KEY.	Comment
A	21978	B	The item was very poorly done, most of the candidates lost the information that rental depends on area not length, so used the given lengths to calculate the rental, others used the given lengths to calculate area and multiplied that area by 2000 forgetting that the lengths are for different office spaces. Therefore, most of the candidates so went for options A and D.
B	4474		
C	5611		
D	12109		

Item 31

Option	N	KEY.	Comment
A	16521	B	The item was poorly done. Most of the candidates failed to form an equation by using the given points to find the gradient of the straight line, they mostly went for option A.
B	13257		
C	10444		
D	3941		

Item 32

Option	N	KEY.	Comment
A	7466	D	The item was poorly done. Most of the candidates failed to solve the simultaneous equations, they mainly went for the wrong options B and D.
B	12693		
C	12696		
D	11301		

Item 33

Option	N	KEY.	Comment
A	6411	C	The item was fairly done. Almost half of the candidates got it correct, some candidates failed to remove the brackets and collect like terms.
B	6588		
C	19843		
D	11299		

Item 34

Option	N	KEY.	Comment
A	10351	D	The item was poorly done. Most of the candidates failed to convert second to hours and meters to kilometers.
B	13895		
C	8152		
D	11722		

Item 35

Option	N	KEY.	Comment
A	8062	B	The item was very poorly done with the least number of candidates choosing the correct option. It seems most of the candidates do not kwon that the area represents the distance travelled particle.
B	3537		
C	23230		
D	9267		

Item 36

Option	N	KEY.	Comment
A	16057	B	The item was poorly done. Most of the candidates failed to find the bearing of Ganto from Henills, they either thought it is the same as the bearing Henills from Ganto or just subtracted 41 from 360 that's why they mainly went for options A and D.
B	11890		
C	3637		
D	12470		

Item 37

Option	N	KEY.	Comment
A	16234	A	The item was fairly done. Most of the candidates went for the wrong options most probably because they do not understand what is meant by the angle of depression.
B	7776		
C	6967		
D	13032		

Item 38

Option	N	KEY.	Comment
A	7448	D	The item was also poorly done. It looks like most of the candidates could not figure out the pattern.
B	12062		
C	9889		
D	14507		

Item 39

Option	N	KEY.	Comment
A	10892	C	The item was fairly done. A good number of the candidates were able to get it right, however most of the candidates went for the wrong options with a larger number of them picking 50cm probably because it is half of 100.
B	7588		
C	18240		
D	6968		

Item 40

Option	N	KEY.	Comment
A	24932	A	The item was well done. Most of the candidates were able to read the number of people with waists less than 65 cm from the cumulative frequency curve
B	6625		
C	5424		
D	5437		

PAPER 2: THEORY

General Comments

The 2024 performance of candidates in Mathematics Paper 2 was lower than that of last year. Just like in the previous years, some candidates used wrong methods for some questions, while others did not attempt some of the questions. Questions that dealt with graphs were the most poorly done. Candidates used free hand to draw straight lines instead of rulers. The concept of directed numbers was a challenge.

Comments on Individual Questions

Section A

The questions in this section were satisfactorily done but some of the candidates clearly demonstrated that they lacked basic computational skills in dealing with numbers and operations.

1 **(a)** Most of the candidates did well in this question. They were able to complete the given sequence correctly.

(b) The candidates did not do well in this question. They failed to write an expression for the nth term of the sequence instead they substituted the numbers in the formula $Tn = an + c$ to find the value of c.

Answers: **(a)** 29 **(b)** Tn = 7n – 6

2 The question was not well done. Most of the candidates subtracted 28 from 180 and got 152 as an answer and most candidates wrote 28 instead of 028.

Answer: 028°

3 The question was well done. Candidates were able to choose Thursday as the day in which the rain is less likely to rain.

4 The question was fairly done. Most of the candidates were able to remove the brackets correctly but they failed to collect the like terms and simplify the given expression. They had 5k - 7m as their final answer.

Answer: 5k – 3m

5 The question was well done. Most of the candidates could arrange the distribution in order of size and identify the middle number, however, there were those who picked 16 as the median because it was in the middle of the distribution, not arranged in order. Some rearranged the distribution in order but wrote 24 once instead of twice. Some candidates calculated the mean.

Answer: 22

6 The question was well done as most of the candidates managed to complete the given shape correctly. Some candidates used free hand to complete the shape.

7 The question was poorly done, some candidates wrote the formula as P800+15h without equating it to w, while others multiplied P800 by 15 hours. Some of the common responses were 800w + 15h; 800 + 15 per hour; w = 800 + 15/h.

Answer: W = P800 + 15h

8 The question was fairly done. Most of the candidates managed to identify the transformation used but failed to write the correct translation vector.

Answer: Translation by vector $\begin{pmatrix} 5 \\ -7 \end{pmatrix}$

9 The question was fairly done. Candidates managed to calculate the size of the angle PQR of the kite correctly. Some candidates just added the two given angles and subtracted the sum from 360 to get 248.

Answer: 124

10 The question was poorly done. Most of the candidates failed to calculate the length of the line segment correctly. They failed to round off their final answer correctly to 3 significant figures whilst others were calculating the gradient and or the midpoint.

Answer: 7.62

11 The question was poorly done. Most of the candidates wrote their answers as (12 24). Some added the entries as $\begin{pmatrix} 12+16 \\ 18+24 \end{pmatrix}$ and got $\begin{pmatrix} 28 \\ 42 \end{pmatrix}$, and others did not insert the brackets.

Answer: $\begin{pmatrix} 12 & 16 \\ 18 & 24 \end{pmatrix}$

12 **(a)** The question was well done. Most of the candidates managed to interpret the graph and were able to write the speed of the train at 0.2 hours.

(b) The question was poorly done. Most of the candidates failed to calculate the area under the graph but instead calculated the distance using the formula $d = s \times t$ and this resulted in them getting an answer $50 \times 0.3 = 15$ km.

Answers: **(a)** 40 km / h **(b)** 7.5 km

13 It was fairly done. Candidates were able to make r the subject of the formula. Some candidates failed to divide by t on both sides of the equation.

Answer: $r = \frac{q+4t}{t}$

14 **(a)** The question was well done. Most of the candidates were able to find time difference.

(b) The question was poorly done. Most of the candidates failed to correctly apply the time difference. Instead of adding they subtracted to get 12 00 hours.

Answer: **(a)** 1 pm **(b)** 4 pm

15 **(a)** The question was well done. Candidates were able to calculate the population increase.

(b) The question was poorly done. Most candidates gave their working as $\frac{321200}{2346100} \times 100 = 13.7\%$ instead of $\frac{321200}{2024900} \times 100$.

Answers: **(a)** 321 200 **(b)** 15.9 %

Section B

16 The question was poorly done. Most of the candidates wrongly attempted to use the elimination and or the substitution method.

Answer: h = –3 and g = 2

17 The question was poorly done. Candidates failed to express the given fractions as a single fraction. They failed to find the lowest common denominator and also remove the brackets correctly.

Answer: $\frac{d^2+7d+6}{d(d+3)}$

18 **(a)** It was well done. Candidates were able to calculate the balance.

(b) It was fairly done. Some of the candidates managed to calculate 15% of the balance and then added the P180 000, while others did not add the balance.

(c) It was fairly done. Some candidates failed to divide the total balance paid by 12 months.

Answers: **(a)** P180 000 **(b)** P207 000 **(c)** P17 250

19 **(a)** It was poorly done. Most of the candidates could identify triangles but failed to apply the correct order of naming the congruent triangles.

(b) **(i)** It was fairly done. Some candidates failed to calculate the size of the interior angle of an equilateral triangle.

(ii) It was poorly done. Most of the candidates failed to use the trigonometric ratios or Pythagorean theorem correctly.

(iii) It was poorly done. Candidates failed to apply the correct method of calculating the area of a triangle. Some failed to round off their final answer to three significant figures as required.

Answers: **(a)** *FNH, FNG* **(b) (i)** 60° **(b) (ii)** 21.2 cm^2 **(iii)** 6.06 cm

20 **(a)** This part question was fairly done. Some candidates managed to convert 1:20 pm to 24-hour clock notation correctly. The common mistake was combining the 12 hour and 24 hour notations, giving their response as 13 20 pm or 13.20 pm.

(b) This part question was poorly done. Most of the candidates failed to express the time taken in hours.

(c) The part question was poorly done. Most of the candidates were dividing speed by time instead of multiplying.

Answers: **(a)** 13.20 **(b)** 0.667 **(c)** 21.3 km

21 This question was poorly done. Most of the candidates were not able to solve the quadratic equation by factorisation or by use of any other method.

Answer: $x = -8$ or $x = -1$

22 **(a)** The part question was well done. Most of the candidates were able to complete the given frequency table correctly.

(b) The part question was fairly done. Some candidates were able to use the frequency table to calculate probability.

(c) The part question was poorly done. Most of the candidates did not draw a bar chart but instead drew a histogram. Those who attempted to draw a bar chart had uneven bars and spaces in between.

Answers: **(a)** correctly drawn bar chart **(b)** 4, 6, 7, 5, 2 **(c)** $\frac{1}{5}$

23 **(a)** The part question was poorly done. Most of the candidates failed to calculate the capacity of the container instead they calculated half the capacity. The common response was 250 cm^3.

(b) This part question was also poorly done. Most of the candidates multiplied the capacity they got by 34.2 instead of dividing.

Answers: **(a)** 500 cm^3 **(b)** 14.6

24 **(a)** This part question was poorly done. Most of the candidates failed to correctly construct the triangle.

(b) The part question also was poorly done. Most of the candidates did not attempt the question.

25 **(a)** This part question was well done. A few candidates who got $x + 5$, $x = 5$ and $x = 5x$ all of which were wrong.

(b) This part question was also poorly done. Most of the candidates failed to interpret the concept of "money left" instead they wrote $5x + 23$, $23x$ or $23 – 5x$.

(c) The part question was poorly done. Most of the candidates failed to form the correct equation instead they wrote $x + 5 = 17$, $x – 23 = 17$.

(d) This part question was also poorly done. Most of the candidates failed to solve the equation.

Answers: **(a)** $5x$ **(b)** $5x – 23$ **(c)** $5x – 23 = 17$ **(d)** $x = 8$

26 **(a)** The part question was poorly done. Most of the candidates failed to accurately draw the line of best fit. One of the common mistakes was joining all the given points.

(b) The part question was also poorly done. Most of the candidates had drawn a wrong graph and were not able to fine the estimate.

27 **(a)** This question was fairly done. The common mistakes were a coordinate (0, 3) and y = 3.

(b) The part question was poorly done. Most candidates calculated the gradient by using points not on the line L.

(c) The question was poorly done since it depended on the above gradient and y intercept which candidates failed to calculate.

Answers: **(a)** 3 **(b)** 1.5 **(c)** $y = 1.5x + 3$

28 The question was well done. Most of the candidates were able to complete the given sequence.

Answer: 840

29 The question was poorly done. Most of the candidates were not able to pick a whole number that is not a sum of consecutive whole numbers but picked 12, 14,16,18. As their answers.

Answer: 16

30 The question was well done. Most of the candidates were able to interpret the pattern.

Answer: 47

31 The question was poorly done. Most of the candidates failed to pair or join the numbers to their multiples. They failed to follow the given rules.

32 The question was poorly done. Candidates failed to calculate the ratio of A:B:C:D.

Answer: 3: 6: 8: 9

33 **(a)** The question was poorly done. Most candidates gave responses such as 10,11 and 12.

(b) The part question was fairly done. Some candidates were able to name only 1 equilateral triangle and failed to give another one.

Answers: **(a)** 13 **(b)** Equilateral ΔABC and ΔAED; Isosceles triangle BDE

34 **(a)** It was poorly done. Most of the candidate's response was P15. They used all the coins listed above.

(b) The question was poorly done. Most of the candidates failed to interpret the instruction well instead they used all coins.

Answers: **(a)** P14 **(b)** First son: P5 = 2, P2 = 1, P1 = 2
Second son: P5 = 1, P2 = 2, P1 = 5

OR First son: P5 = 2, P2 = 2, P1 = 0
Second son: P5 = 1, P2 = 1, P1 = 7

35 The question was poorly done. Most candidates failed to calculate or to find the length of shaded rectangle.

Answer: 42