EXAMINATIONS COUNCIL OF ESWATINI

JC

EXAMINATION REPORT

FOR

ADDITIONAL MATHEMATICS

YEAR

2023

Paper 519

General Comments

The overall performance of candidates was generally fairly good. There were many excellent scripts with a significant number of candidates demonstrating an extensive understanding of all topics while there was also many candidates who were unable to cope with the demand of this paper. Marks ranged from Zero to 100. There was no evidence that candidates were short of time, as almost all attempted the last few questions. Non-response was most common in **Questions 2, 3(b), and 4(b).**

Candidates showed particular success in the fundamental skills assessed in **Questions 1(a), 3(a) and 8(a).** Many candidates got these questions correct. The most challenging questions were **Questions 1(d), 2(b), 3(b), 4(b), 6(a) and 9(a)**. Candidates were very good this year at showing their working. It was rare to see stages in the working omitted and so in the majority of cases it was possible to award method marks when answers were not correct or inaccurate. Some candidates lost marks due to truncating or rounding off prematurely within their working, or giving answers to less than the required three significant figures. This was particularly evident in **Questions 2 and 4(a)(ii).**

COMMENTS ON SPECIFIC QUESTIONS

1. **(a) (i)** This was answered well by most candidates. Many candidates were able to multiply the matrix by the negative scalar. There were just a few who failed to work out directed numbers. Common incorrect answer: $\begin{pmatrix} -2 & 4 \\ -4 & 6 \end{pmatrix}$

    Correct answer: $\begin{pmatrix} \mathbf{2} & \mathbf{-4} \\ \mathbf{4} & \mathbf{-6} \end{pmatrix}$

    (ii) This was fairly well done. A large number of candidates got this correct, but there was also a large number of candidates who got it wrong. Adding directed numbers seemed to be a challenge with candidates in this part question. Common incorrect answers: $\begin{pmatrix} -4 & -4 \\ -6 & 4 \end{pmatrix}, \begin{pmatrix} 4 & 4 \\ 6 & 4 \end{pmatrix}$.

    Correct answer: $\begin{pmatrix} \mathbf{-2} & \mathbf{0} \\ \mathbf{2} & \mathbf{4} \end{pmatrix}$

    (b) This was poorly well done. Most candidates failed to give the order of the product matrix. They multiplied out the two given matrices while others gave the order of the two individual matrices. Others wrote the order as column by rows instead of rows by column. Common incorrect answers: a = 4 and b = 3;

    a = 3 by 2 and b = 2 by 4.

    Correct answer: a = 3

    b = 4

(c) This question was fairly well done. Some candidates were unable to formulate the two equations from the matrices. Others would formulate them but fail to solve the equations. Working out directed numbers seemed to be a challenge for candidates in this part question. Some candidates changed the negative number to positives number in the matrices before working it out. Common incorrect answer: x = -1 and y = -3

Correct answer: x = 1

y = 3

(d) (i) and **(ii)**

These were very poorly done questions. Many candidates found these questions challenging and it was rare to award full credit. They incorrectly multiplied entries that are in the same position. Common incorrect answers: $\begin{pmatrix} 12 & 10 \\ 2 & 2 \end{pmatrix}, \begin{pmatrix} 7 & 7 \\ -3 & 3 \end{pmatrix}$.

Correct answer: (i) $\begin{pmatrix} 7 & 18 \\ -7 & -2 \end{pmatrix}$

(ii) $\begin{pmatrix} 8 & 17 \\ -8 & -3 \end{pmatrix}$

(iii) This was poorly done. Incorrectly multiplying entries in the same position in **(i)** and **(ii)** resulted in getting the same answers. This led to a majority of candidates incorrectly concluding that AB and BA are the same or equal. Most of the good candidates got this one wrong. Common incorrect answers: parallel, not associative, congruent.

Correct answer: not commutative / not equal

2. **(i)** This question was fairly well done. Most candidates were able to use the correct trigonometric ratio but lost the accuracy mark due to incorrectly rounding off or truncating. There was also quite a large number of candidates who used cosine ratio instead of the sine ratio. There were also those who wrote the sine ratio incorrectly. Common incorrect answers: 20, 19

Correct answer: 19.7

(ii) Most candidates answered this part correctly. Many candidates did not get the accuracy mark because of truncating their answer or incorrectly rounding off. Some used the tangent ratio instead of the cosine ratio. Others correctly wrote the cosine ratio but failed to get the cosine of an angle yº. Common incorrect answers: 68º, 69º.

Correct answer: 68.7º

(b) (i) This was well done. A lot of candidates were able to use the Pythagoras theorem to get the correct answer. There were a few candidates who lost the accuracy mark because they did not write their answer correct to 1 decimal place as instructed in this part question.

Correct answer: 108.2

(ii) This was poorly well done. Most candidates calculated the angle of depression at A from the vertical cliff AD which led to $\tan^{-1}(\frac{90}{60})$ instead of $\tan^{-1}(\frac{60}{90})$ from the imaginary horizontal line from A. Common incorrect answer: 56.3^0, 34^0.

Correct answer: 33.7^0

3 (a) (i) and **(ii)**

These questions were well answered. Many candidates were able to find the probability of finding the letter S from the given words.

Correct answer: (i) $\frac{2}{6}$ oe

(ii) $\frac{1}{6}$ oe

(b) (i) This was poorly well done. Most candidates showed no understanding of a possibility space diagram, vowels or consonants. They incorrectly used 6 or 12 as their total number of possible outcomes. Some probabilities were incorrectly given as whole numbers. Others were just listing the letters which were asked. Common incorrect answer: $\frac{4}{6}$, $\frac{1}{6}$, 4.

Correct answer: (i) $\frac{4}{36}$ oe

(ii) This was poorly well done. Common incorrect answer: $\frac{32}{36}, \frac{8}{9}$

Correct answer: (ii) $\frac{16}{36}$ oe

(iii) This was poorly well done. Common incorrect answer: $\frac{3}{12}, \frac{32}{36}$

Correct answer: (iii) $\frac{30}{36}$ oe

(iv) This was poorly well done. Common incorrect answer: $\frac{4}{12}$

Correct answer: (iv) $\frac{2}{36}$ oe

(c) This was fairly done. Some candidates got it correct although there were also a number of them who got it wrong.

Correct answer: 0.9625

4. **(a) (i)** This was a well attempted question, with the majority of candidates gaining full marks. Some expected the examiner to select the correct answer by providing a choice of answers like $\binom{3}{2}$ or $\binom{2}{3}$. Others expressed the column vector as a coordinate and scored no mark. Common Incorrect answers: $\binom{3}{2}$, $\binom{2}{3}$, $\frac{2}{3}$, (3, 2)

Correct answer: $\binom{2}{3}$

  (ii) This was well done. Most candidates were able to work out the magnitude of the vector. There was quite a number of candidates who lost the accuracy mark for truncating or incorrect rounding off the answer to the nearest whole number. Common incorrect answers: 3.6, 3.60, 4.

Correct answer: 3.61

  (b) Using the sum and difference of two vectors to express given vectors in terms of two coplanar vectors and simplifying vector expressions continued to prove to be a challenge for candidates year after year. Most candidates did not answer this part question. Some simple wrote the routes using capital letters such as
$\overrightarrow{QT} = \frac{1}{3}\overrightarrow{OT}$. Others were able to write their answers in terms of **r** and/or **t**. Relating vectors with enlargement, scale factor $\frac{1}{3}$ was also a challenge for candidates.

  (i) This question was very poorly done. Common incorrect answers were $\frac{1}{3}\overrightarrow{OT}$, t, $\frac{1}{3}$.

Correct answer: $\frac{1}{3}t$

  (ii) This was very poorly done. Common incorrect answers were t + r, r − t, $\frac{-1}{3}$r - $\frac{1}{3}$t

Correct answer: $\frac{-t}{3} + \frac{r}{3}$ or $\frac{1}{3}(-t + r)$

  (iii) This was very poorly done. Common incorrect answers was $\frac{1}{3}$r + $\frac{1}{3}$t

Correct answer: $\frac{1}{3}r$

5. **(a) (i)** This question was fairly well done. Most candidates were able to make p the subject of the formula, but there were also many candidates who did not put brackets to the two term numerator, hence getting incorrect answer.
    Common incorrect answers: $\frac{3m}{4n}$, $\frac{3m}{4n-1}$, -p = -3m − 4pn

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Correct answer: $\frac{3m}{4n+1}$

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(ii) While there were a considerable number of candidates who could find the value of p correctly, many candidates only got one mark for correct substitution and could not workout to get the accuracy mark.

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Correct answer: $\frac{15}{17}$

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(b) (i) This was well done. Many candidates got this question correct. Although there were few who were able to remove brackets correctly but failed to simplify the expression. Others did not change the subtraction sign in the second factor resulting in an incorrect answer. Common incorrect answer: k + 17

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Correct answer: 3k + 17

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(ii) This was poorly done. Quite a number of candidates failed to get the correct answer. Candidates continue to incorrectly cross multiplie by the denominators which led to the denominators eliminated in the next step of simplifying the algebraic expression. Others failed to correctly remove brackets in the numerator since there was a minus sign before the brackets. Common incorrect answers: $7, \frac{7}{2y-5-y+1}, \frac{y+7}{(2y-5)(y+1)}$

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Correct answer: $\frac{7}{(2y-5)(y+1)}$

</div>

(c) This was poorly done. Many candidates failed to simplify the expression after correctly removing the brackets. Directed numbers proved to be a challenge when simplifying the expression. Common incorrect answers: $x^2 + 49$, $x^2 - 7x + 7x - 49$, $x^2 - 7x - 7x - 49$

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Correct answer: $x^2 - 14x + 49$

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6. (a) (i) This was very poorly well done. This question was one of the most challenging questions for candidates. Most candidates were able to factor out $3x^2$ but failed to write the correct terms inside the brackets. Common incorrect answers: $3x(x^7 - 2x^5 + 4x^2)$,

<div align="right">

Correct answer: $3x^2(x^5 - 2x^3 + 4)$

</div>

(ii) This was a well answered question. A lot of candidates were able to factorise the expression correctly. Common incorrect answer: $(x + 3)(x - 6)$.

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Correct answer: (x + 3)(x + 6)

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(b) (i) This was fairly well done. This was a discriminating question. Even the good candidates did not write the negative value for d, which was d = -3. They only wrote the positive value for d and were just awarded one mark instead of two.

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Correct answer: d = -3 or d = 3

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(ii) This question was fairly well done. While there was a good response to this question, many candidates lost marks for failing to correctly clear the fractions. They only multiplied the left hand side of the equation by the LCM instead of both sides. Some would correctly remove the brackets but failed to isolate term containing x. Common incorrect answer: $\frac{23}{3}$

Correct answer: $\frac{56}{3}$ **oe**

(c) This question proved challenging for the majority of candidates but a reasonable number of fully correct solutions were seen.

Correct answer: x = -2

y = 3

(d) There were some excellent responses to this question that were fully correct and well presented. However, a lot of candidates that were able to remove brackets and collect like terms to reach -7x < 4 did not reverse or change the inequality sign since they were now dividing by a negative. Many candidates changed the inequality sign to an equal sign (=) and this made them to loss marks.
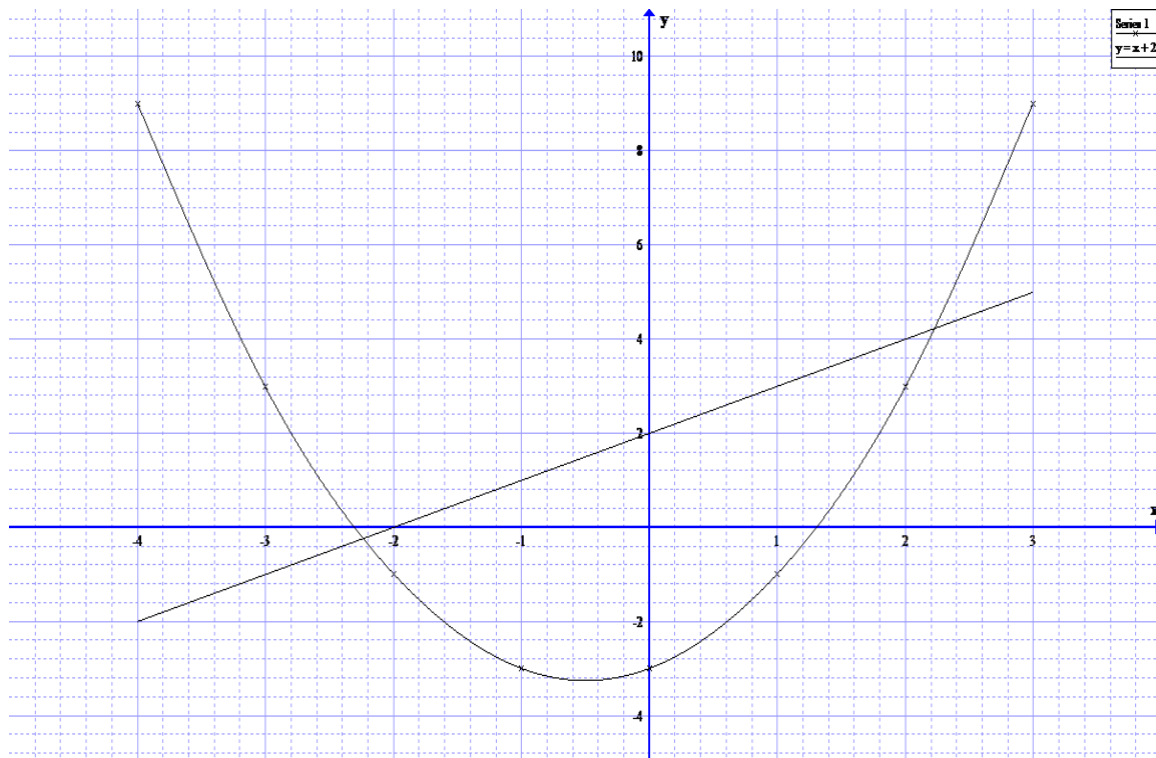
Correct answer: x $> \frac{-4}{7}$

7. (a) Most candidates were successful in this question, with the majority of candidates showing good understanding.

Correct answer: 3   -1   -1   9

(b) This part was answered reasonably well by many candidates. All points were plotted correctly and a smooth curve was drawn through all plotted points of which 7 are correct. There were also many candidates who failed to interpret correctly the value of each small division on the y-axis. Hence, points were incorrectly plotted even though a smooth curve was drawn.

Correct answer:

(c) (i) This was fairly well done. Many candidates got it correct. Some could not write the correct spelling for parabola. Common incorrect answers; quadratic graph, ogive, polygon.

Correct answer: Parabola

(ii) This part was generally well attempted with many candidates correctly writing down the equation of the line of symmetry. Incorrect responses included x = 0.5,   y = - 0.5, 0.5

Correct answer: x = - 0.5

(d) (i) This question was often left blank by candidates but conversely, there were some very good answers as well. Some lines passed next to the points instead of through the points. Others drew a short line that did not pass at (-2,0) and (0,2)

Correct answer: Correct line through (-2,0) and (0,2)

(ii) Many candidates were unable to give the correct answer to this question. Instead of using the curve, others solved for x algebraically and failed to find the values for x.

Correct answer: x = -2.2 to -2.4

Or x = 2.2 to 2.4

8. (a) This question proved to be straightforward for most candidates. This was a well attempted question, with the majority of candidates gaining full marks. Some would correctly find and write down the values of a, b and c on the table but wrongly transfer their answers on to the answer space. Common incorrect answers: a = 5, b =13 c = 28
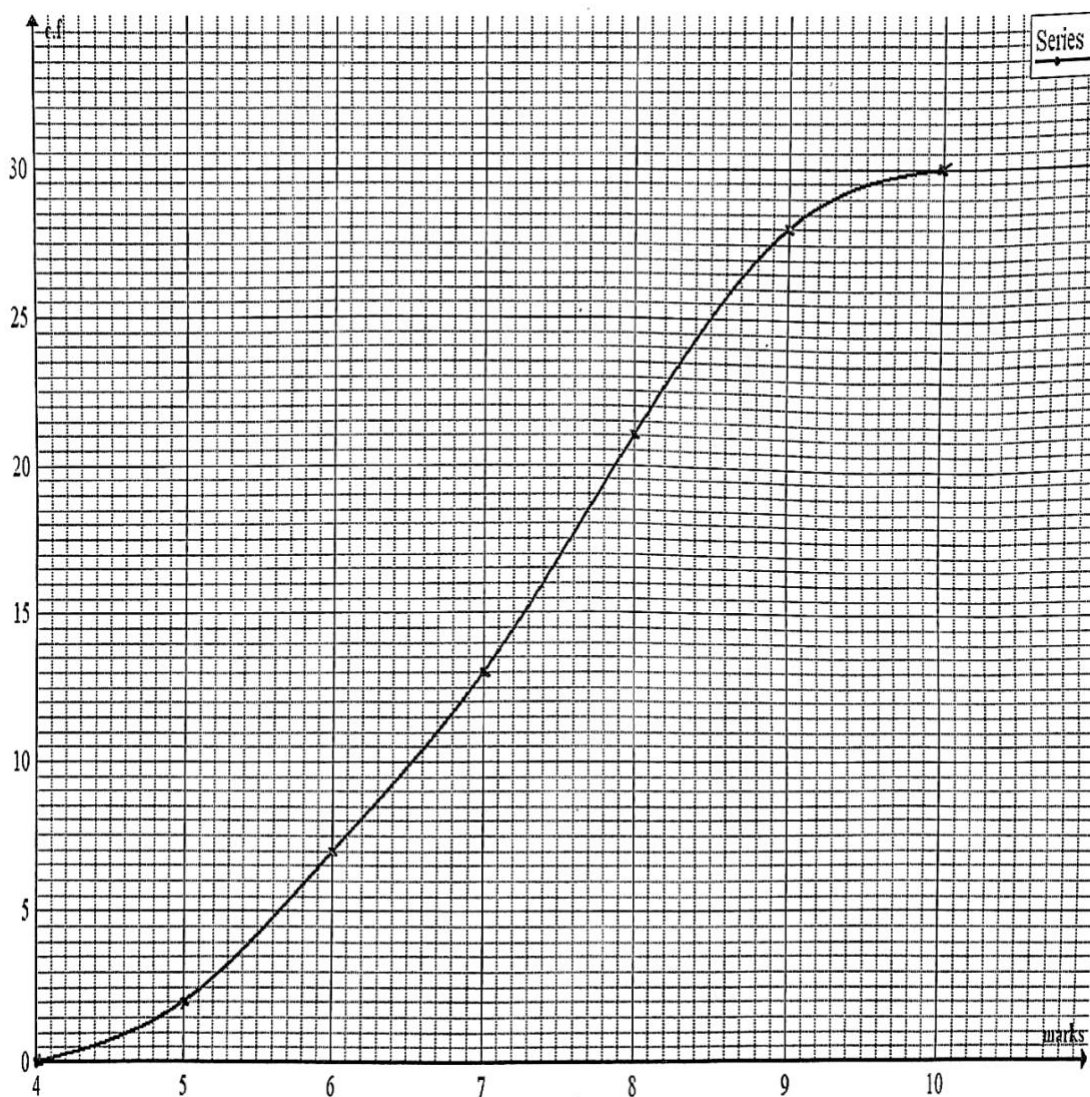
Correct answer: a = 13

b = 28

c = 5

(b) This question was fairly well done. Candidates should be encouraged to use correct scale on both axes, plot all points and join the points using free hand instead of straight lines. Curve must be dawn through all points.

Correct answer: correct scale on both axes

6 correct points plotted

Correct curve through all points

(c) This was poorly well done. Most candidates only calculated the median position and gave it as their answer.

Correct Answer: 7.2 to 7.4

9. (a) This part was not generally answered well. The majority of candidates understood the operations carried out on the arrow diagram but failed to use function notation. Common incorrect answers: f: x = $\frac{x+1}{2}$, $\frac{x+1}{2}$, f(x) = x + $\frac{1}{2}$, f(x) = x + 1 ÷ 2 , f(x)→ $\frac{x+1}{2}$

Correct Answer: f(x) = $\frac{x+1}{2}$

Or f: x→ $\frac{x+1}{2}$

(b) (i) This question was generally well answered with a good number of candidates able to evaluate the function.

Correct answer: - 3

(ii) This part proved more challenging with very few candidates able to form the equation to find x. Some candidates incorrectly substituted x with -2 in function f.

Correct answer: 9

RECOMMENDATIONS

Candidates are reminded of the need to read the questions carefully, focusing on instructions and key words.

Many candidates lost marks due to lack of showing necessary working. Candidates should show full working with their answers to ensure that method marks are considered.

Attention should be made to the degree of accuracy required. Candidates should be encouraged to avoid truncation of numbers and premature rounding in workings as this often leads to an inaccurate answer and the loss of the accuracy mark.

It is important that candidates are also encouraged to use a scientific calculator when dealing with directed numbers and must have their calculator set in degrees mode.