



EXAMINATIONS COUNCIL OF ESWATINI  
Junior Certificate Examination

CANDIDATE  
NAME

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CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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**ADDITIONAL MATHEMATICS**

**519**

**October/November 2023**

**2 hours 30 minutes**

Candidates answer on the Question Paper.  
Additional Materials: Geometrical instruments

**READ THESE INSTRUCTIONS FIRST**

Write your centre number, candidate number and name on the spaces provided.  
Write in dark blue or black pen in the spaces provided on the Question Paper.  
You may use an HB pencil for any diagrams or graphs or rough working.  
Do **not** use staples, paperclips, highlighters, and glue or correction fluid.

Answer **all** questions.

All working should be clearly shown below that question.  
The number of marks is given in brackets [ ] at the end of each question or part question.

Scientific calculators should be used.  
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures.  
Give answers in degrees to one decimal place.  
For  $\pi$ , use 3.14 or the value given in the specific question.  
The total of marks the marks for this paper is 100.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
<b>Total</b>	

1 (a) Work out.

(i)  $-2 \begin{pmatrix} -1 & 2 \\ -2 & 3 \end{pmatrix}$

Answer (a)(i) [1]

(ii)  $\begin{pmatrix} -3 & -2 \\ 4 & 3 \end{pmatrix} + \begin{pmatrix} 1 & 2 \\ -2 & 1 \end{pmatrix}$

Answer (a)(ii) [2]

(b)  $\begin{pmatrix} 1 & -2 \\ 0 & 1 \\ 5 & 6 \end{pmatrix} \begin{pmatrix} 3 & 4 & 8 & 7 \\ 1 & 1 & 3 & 3 \end{pmatrix}$

The answer to this matrix multiplication is of order  $a \times b$ .

Find the values of  $a$  and  $b$ .

Answer (b)  $a = \dots\dots\dots$

$b = \dots\dots\dots$  [2]

(c) It is given that

$$\begin{pmatrix} 2 & x \\ 4 & y \end{pmatrix} \begin{pmatrix} -4 \\ 5 \end{pmatrix} = \begin{pmatrix} -3 \\ -x \end{pmatrix}$$

Find the values of  $x$  and  $y$ .

Answer (c)  $x = \dots\dots\dots$

$y = \dots\dots\dots$  [3]

(d) Given that  $A = \begin{pmatrix} 4 & 5 \\ -2 & 1 \end{pmatrix}$  and  $B = \begin{pmatrix} 3 & 2 \\ -1 & 2 \end{pmatrix}$ .

Work out

(i)  $AB$

Answer (d)(i)

[2]

(ii)  $BA$

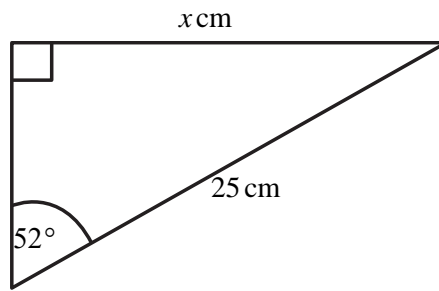
Answer (d)(ii)

[2]

(iii) From the solutions to (d)(i) and (d)(ii), we can conclude that  $AB$  and  $BA$  are

..... [1]

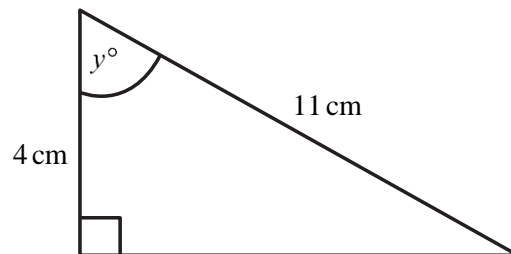
2 (a) (i)



NOT TO SCALE

Find the value of  $x$ .Answer (a)(i)  $x = \dots\dots\dots$  cm [3]

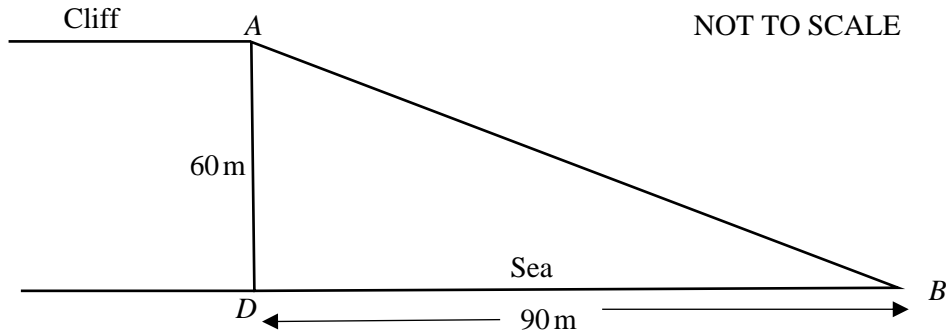
(ii)



NOT TO SCALE

Calculate the size of angle  $y$ .Answer (a)(ii)  $y = \dots\dots\dots$  cm [3]

(b)



The above diagram shows a vertical cliff  $AD$  which is  $60\text{ m}$  above sea level. A big bird at position  $A$  on the cliff sees a small fish at  $B$  on the surface of the sea.  $B$  is  $90\text{ m}$  from the foot of the cliff  $D$ .

(i) Calculate the direct distance from the bird to the fish.

Write your answer correct to 1 decimal place.

Answer (b)(i) ..... m [3]

(ii) Calculate the angle of depression of the fish from the bird.

Answer (b)(ii) ..... [3]

3 You are given the words SPACES and PLACES.

(a) Find the probability of finding the letter S from

(i) the word SPACES

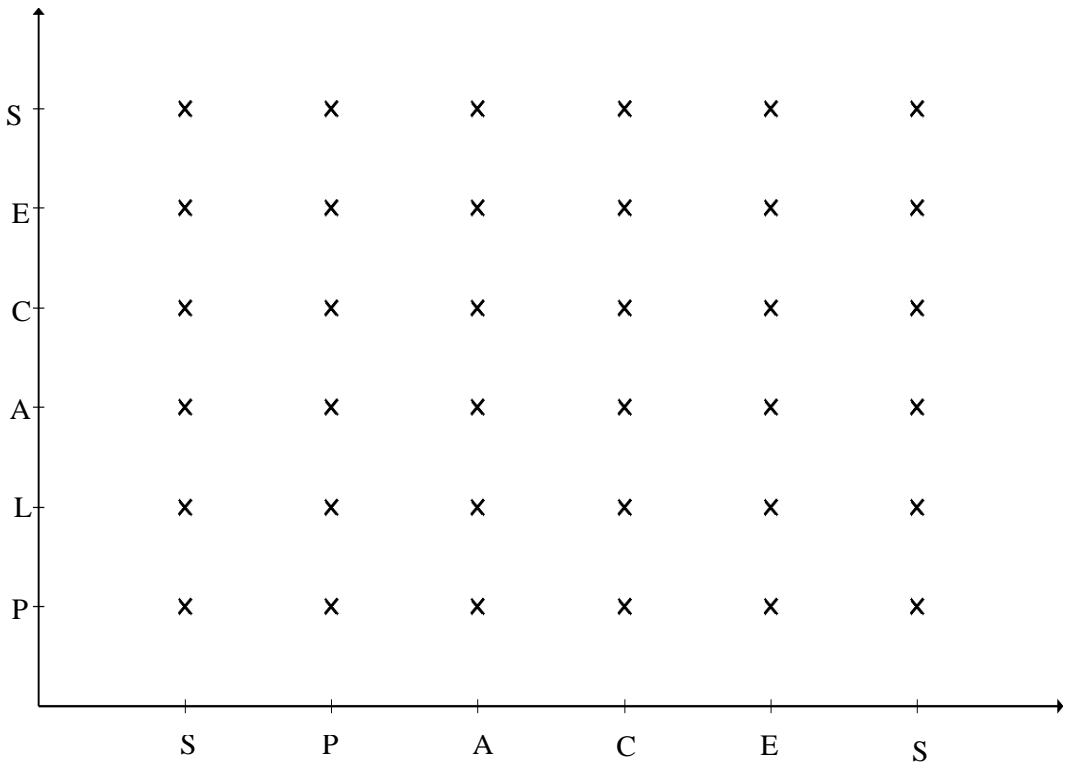
Answer (a)(i) ..... [1]

(ii) the word PLACES

Answer (a)(ii) ..... [1]

Two letters are chosen, one from each of the words SPACES and PLACES.

The possibility space diagram below shows the possible outcomes.



(b) Find the probability that the chosen letters are

(i) both vowels,

Answer (b)(i) ..... [2]

(ii) both consonants,

Answer (b)(ii) ..... [2]

(iii) different,

Answer (b)(iii) ..... [2]

(iv) the same vowels.

Answer (b)(iv) ..... [2]

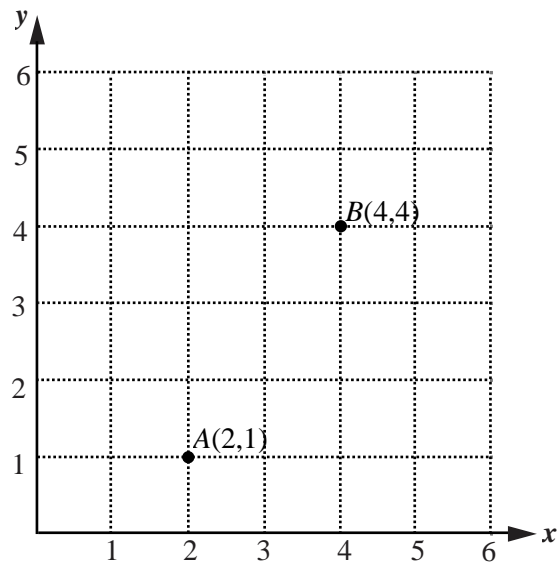
(c) The probability that Sizwe is late for school on any day is 0.0375.

Find the probability that Sizwe is not late for school.

Answer (c) ..... [1]

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4 (a)



- (i) Write down  $\overrightarrow{AB}$  as a column vector.

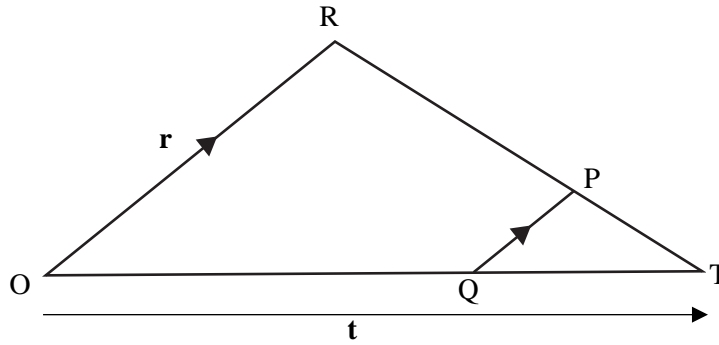
Answer (a)(i)  $\overrightarrow{AB} =$  [1]

- (ii) Work out the magnitude of  $\overrightarrow{AB}$ .

Answer (a)(ii)  $|\overrightarrow{AB}| = \dots\dots\dots$  [2]



(b)



Triangle QPT is an enlargement of triangle ORT, scale factor  $\frac{1}{3}$ .

$\vec{OR} = \mathbf{r}$  and  $\vec{OT} = \mathbf{t}$ .

Write the following in terms of  $\mathbf{r}$  and / or  $\mathbf{t}$ . Simplify your answers where possible.

(i)  $\vec{QT}$ .

Answer (b)(i) ..... [1]

(ii)  $\vec{TP}$ .

Answer (b)(ii) ..... [2]

(iii)  $\vec{QP}$ .

Answer (b)(iii) ..... [1]

5 (a) (i) Make  $p$  the subject of the formula.

$$np = \frac{3m - p}{4}$$

Answer (a)(i)  $p =$  ..... [3]

- (ii) Find the value of  $p$  when  $m = 5$  and  $n = 4$ .  
Give your answer as a fraction.

Answer (a)(ii)  $p = \dots\dots\dots$  [2]

- (b) Simplify.

(i)  $2(k+10) - (3 - k)$

Answer (b)(i)  $\dots\dots\dots$  [2]

(ii)  $\frac{2}{2y-5} - \frac{1}{y+1}$

Answer (b)(ii)  $\dots\dots\dots$  [3]

- (c) Expand and simplify  $(x - 7)^2$ .

Answer (c)  $\dots\dots\dots$  [2]

6 (a) Factorise

(i)  $3x^7 - 6x^5 + 12x^2$ ,

Answer (a)(i) ..... [3]

(ii)  $x^2 + 9x + 18$ .

Answer (a)(ii) ..... [2]

(b) Solve

(i)  $d^2 + 5 = 14$ .

Answer (b)(i) ..... [2]

(ii)  $\frac{x-4}{4} - \frac{2}{3} = 3$ .

Answer (b)(ii)  $x =$  ..... [3]

(c) Solve the simultaneous equations

$$\begin{aligned} 3x + 5y &= 9 \\ x + 2y &= 4. \end{aligned}$$

Answer (c)  $x = \dots\dots\dots$

$y = \dots\dots\dots$  [3]

(d) Solve  $4 - 5x < 2(x + 4)$ .

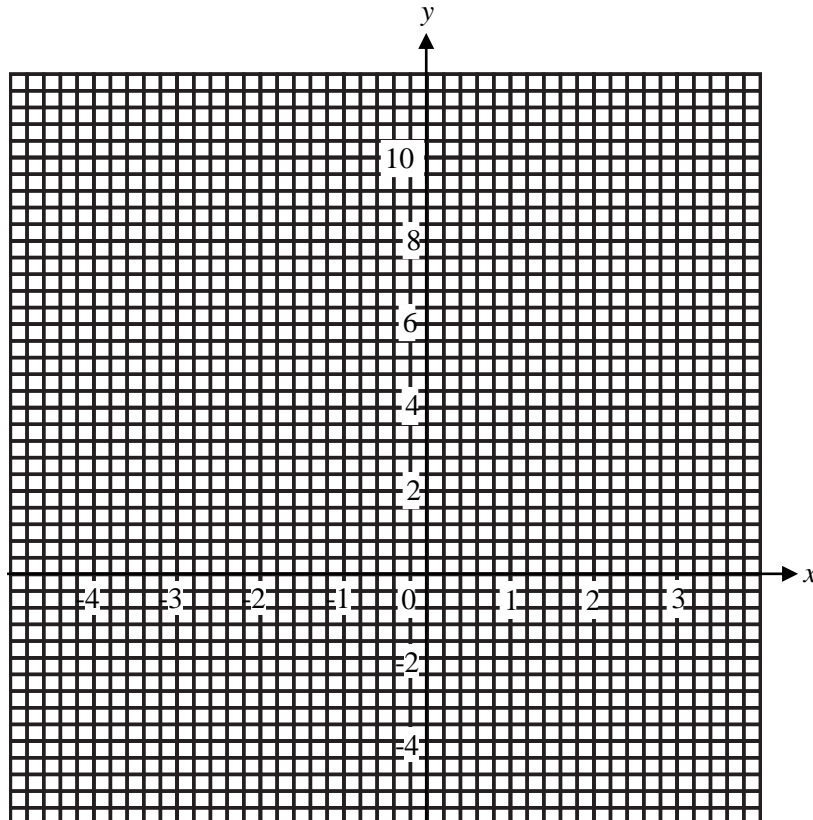
Answer (d)  $\dots\dots\dots$  [3]

7 (a) Complete the table of values for  $y = x^2 + x - 3$ .

$x$	-4	-3	-2	-1	0	1	2	3
$y$	9			-3	-3		3	

[3]

(b) On the grid, draw the graph of  $y = x^2 + x - 3$  for  $-4 \leq x \leq 3$ .



[4]

(c) (i) Write down the special name for this kind of graph.

Answer (c)(i) ..... [1]

(ii) Write down the equation of the line of symmetry of your graph.

Answer (c)(ii) ..... [1]

(d) (i) On the grid, draw the graph of  $y = x + 2$ . [2]

(ii) Hence solve the equation  $x^2 + x - 3 = x + 2$ .

Answer (d)(ii)  $x =$  ..... or  $x =$  ..... [2]

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- 8 The table below shows the number of marks gained by 30 students in a test.

<i>Mark</i>	<i>Frequency</i>	<i>Cumulative frequency</i>
5	2	2
6	$c$	7
7	6	$a$
8	8	21
9	7	$b$
10	2	30

- (a) Find the values of  $a$ ,  $b$  and  $c$ .

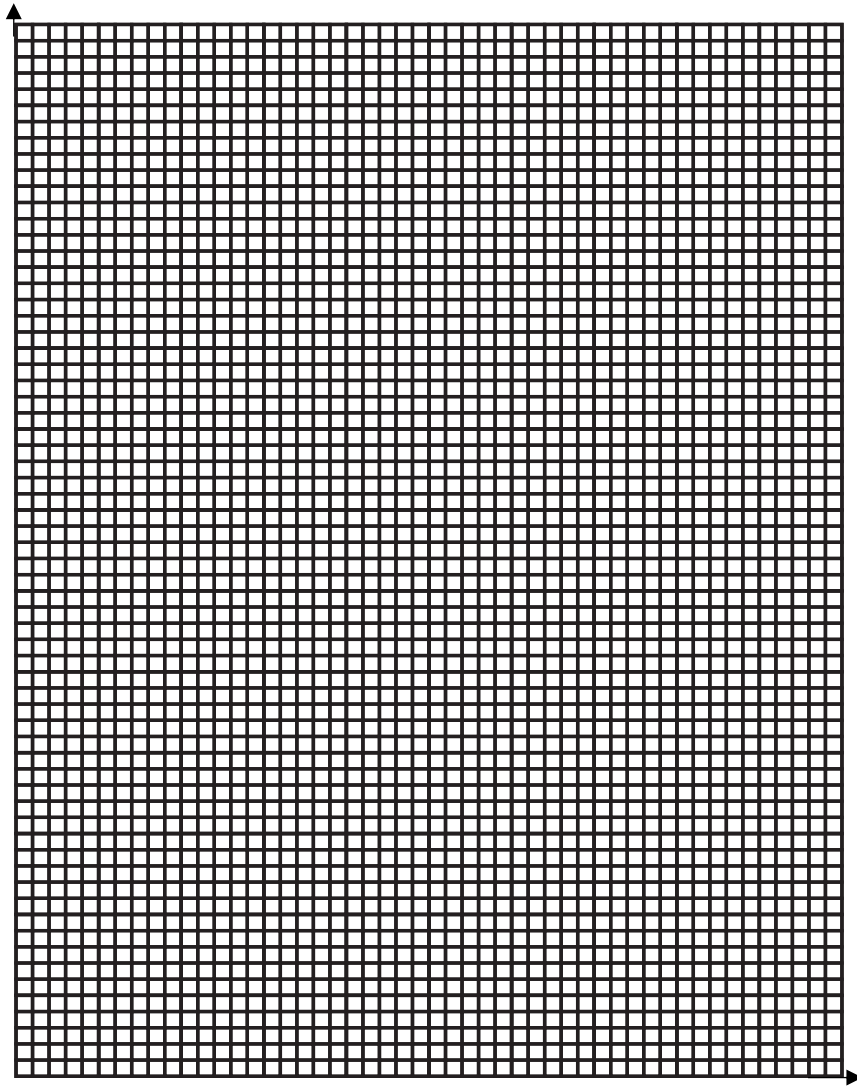
Answer (a)  $a = \dots\dots\dots$

$b = \dots\dots\dots$

$c = \dots\dots\dots$  [3]

(b) On the grid below, draw the cumulative frequency curve.

Use a scale of 2 cm to represent 1 mark on the horizontal axis and 2 cm to represent 5 students on the vertical axis.

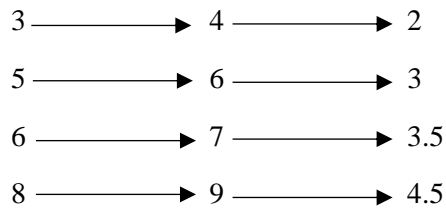


[4]

(c) Use your curve to find the median mark.

Answer (c) ..... [2]

- 9 (a) Use function notation to describe the function represented by the following arrow diagram.



Answer (a) ..... [3]

- (b) You are given the function  $f(x) = \frac{x}{3} - 5$ .

(i) Evaluate  $f(6)$ .

Answer (b)(i) ..... [1]

(ii) Find the value of  $x$  if  $f(x) = -2$ .

Answer (b)(ii) ..... [3]