

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 2021**

**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	
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2	
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9	
<b>Total</b>	

This document consists of **17** printed pages and **3** blank pages.

- 1 (a) You are given that  $W = \begin{pmatrix} 4 & 5 \\ 2 & 3 \end{pmatrix}$ ,  $X = \begin{pmatrix} -2 & 1 \end{pmatrix}$  and  $Y = \begin{pmatrix} 3 & -5 \\ -2 & 4 \end{pmatrix}$ .

Work out

(i)  $Y + W$ ,

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

(ii)  $2Y$ ,

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

(iii)  $XW$ ,

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

(iv)  $W^2$ ,

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

(b)  $\begin{pmatrix} 3 & 2 \\ -4 & 7 \end{pmatrix} - B = \begin{pmatrix} 3 & 2 \\ -4 & 7 \end{pmatrix}$

Write down matrix  $B$ .

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

(c) Given that  $\begin{pmatrix} 2 & -3 \\ 3 & 3 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 5 \\ 0 \end{pmatrix}$

(i) Form two equations in  $x$  and  $y$ .

Answer (c)(i) .....

.....[2]

(ii) Hence, solve the simultaneous equations to find the values of  $x$  and  $y$ .

Answer (c)(ii)  $x = \dots\dots\dots$  and  $y = \dots\dots\dots$ [3]

- 2 (a) The domain and range of a function are shown in the arrow diagram.

Domain	Range
4	8
5	11
6	14
7	$m$
8	20
9	$n$

- (i) Find the values of  $m$  and  $n$ .

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

$n = \dots\dots\dots$  [2]

- (ii) Describe using function notation, the function represented by the arrow diagram.

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

- (b) You are given that  $f(x) = 7x - 3$  and  $g(x) = \frac{3x+1}{2}$ .

Find

- (i)  $f(-2)$ ,

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

- (ii)  $g(w)$ ,

Answer (b)(ii)  $\dots\dots\dots$  [1]

(iii)  $x$ , if  $f(x) = 3$ .

Express your answer to 2 significant figures.

*Answer (b)(iii)  $x = \dots\dots\dots$* [2]

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3 (a) You are given that  $R = (3a - b)^2$ .

(i) Find the value  $R$  when  $a = \frac{7}{3}$  and  $b = 2$ .

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

(ii) Express  $a$  in terms of  $R$  and  $b$ .

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

(b) Remove brackets and simplify.

(i)  $3(5n - 2) - 2(1 + 3n)$

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

(ii)  $(3p - q)^2$

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

(c) Solve the inequality

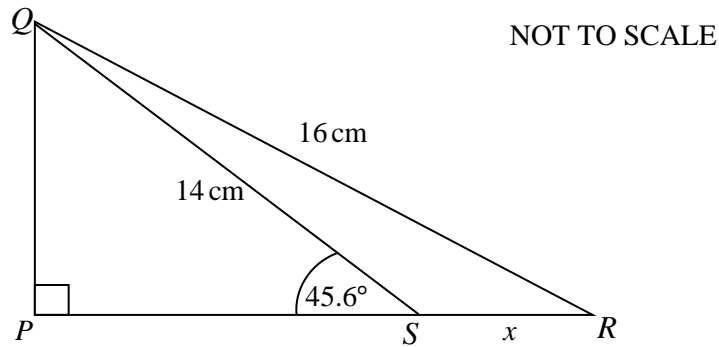
$$3 - 7x \geq x - 5$$

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

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- 4 (a)  $PQR$  is a right-angled triangle.

$QR = 16$  cm,  $QS = 14$  cm,  $RS = x$  and angle  $PSQ = 45.6^\circ$ .



- (i) Find  $PQ$ .

Answer (a)(i)  $PQ = \dots\dots\dots$  cm [2]

- (ii) Calculate angle  $PQS$ .

Answer (a)(ii)  $\dots\dots\dots^\circ$  [1]

- (iii) Calculate angle  $SQR$ .

Answer (a)(iii)  $\dots\dots\dots^\circ$  [3]



(iv) Find the value of  $x$ .

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

- (b) Sam is riding vertically in a hot air balloon, directly over a point  $O$  on the ground. The balloon rises 50 m above the ground. Sam spots a parked car on the ground at an angle of depression of  $35^\circ$ .

Calculate the distance between the car and point  $O$ .

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

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5 (a) Solve the equations.

(i)  $5 = \frac{2x}{3}$

Answer (a)(i)  $x = \dots\dots\dots$  [2]

(ii)  $160 - p^2 = 0$

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

(b) Express as a single fraction.

$$\frac{4}{y+2} + \frac{2}{y-3}$$

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

(c) Factorise.

(i)  $4x - 28$

Answer (c)(i)  $\dots\dots\dots$  [1]

(ii)  $x^2 - 7x + 12$

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

- 6 (a) The point  $R$  has co-ordinates  $(4, -3)$  and the point  $S$  has co-ordinates  $(-3, 5)$ .

$$\overrightarrow{ST} = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$$

Find

(i)  $\overrightarrow{RS}$ ,

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

- (ii) The co-ordinates of point  $T$ .

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

(b) Given that  $\mathbf{a} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$  and  $\mathbf{b} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$ ,

Work out.

(i)  $\mathbf{a} + \mathbf{b}$

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

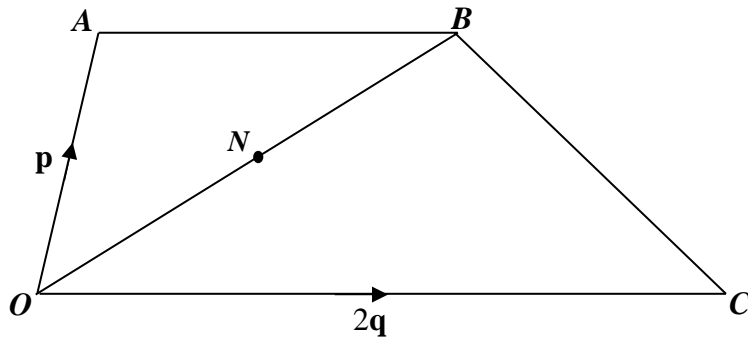
(ii)  $\mathbf{a} - 2\mathbf{b}$

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

(iii)  $|\mathbf{b}|$

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

- (c)  $OABC$  is a trapezium.  
 $N$  is the midpoint of  $OB$ .  
 $\vec{OA} = \mathbf{p}$  and  $\vec{OC} = 2\mathbf{q}$ .  
 $OC = 2AB$ .



Find, in terms of  $\mathbf{p}$  and/or  $\mathbf{q}$

- (i)  $\vec{AB}$ ,

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

- (ii)  $\vec{ON}$ ,

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

- (iii)  $\vec{NC}$ .

Answer (c)(iii) .....[3]

7 A red die and a white die are thrown at the same time.

(a) On the grid, draw a possibility space diagram to show all possible outcomes.


[3]

(b) Find the probability of obtaining:

(i) 2 and 5,

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

(ii) a prime number on the red die and an even number on the white die,

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

(iii) two numbers with a product bigger than 20.

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

8 The variables  $x$  and  $y$  are connected by the equation  $y = 3 - x^2 + 2x$  for  $-2 \leq x \leq 4$ .

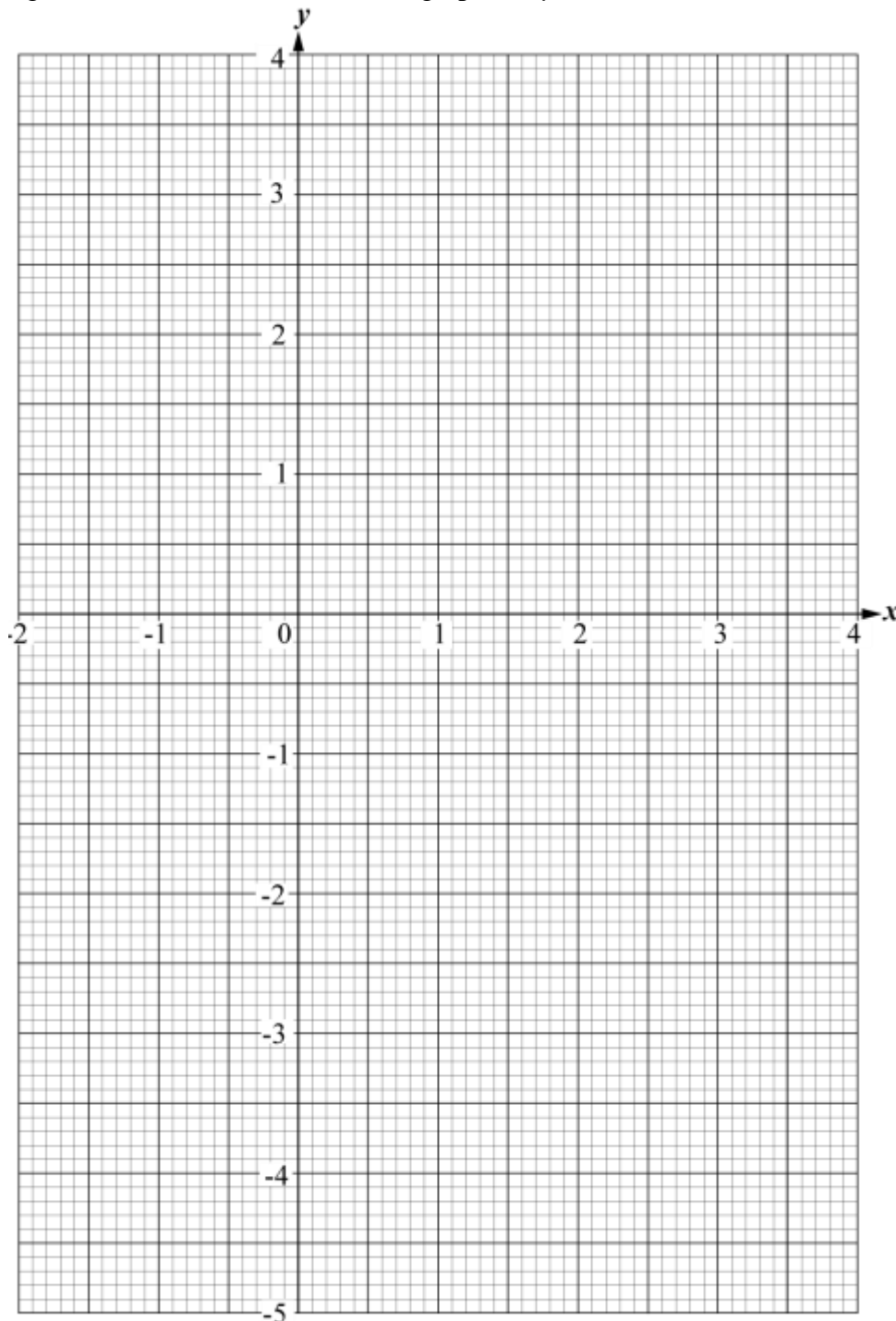
$x$	-2	-1	0	1	2	3	4
$y = 3 - x^2 + 2x$	-5	$p$	3	4	3	0	$q$

(a) Find the values of  $p$  and  $q$ .

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

$q = \dots\dots\dots$  [2]

(b) Using the set of axes below, draw the graph of  $y = 3 - x^2 + 2x$  for  $-2 \leq x \leq 4$ .



[3]

- (c) Write down the maximum value,  $y$  can take for this function.

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

- (d) Use your graph to solve the equation  $3 - x^2 + 2x = 3$ .

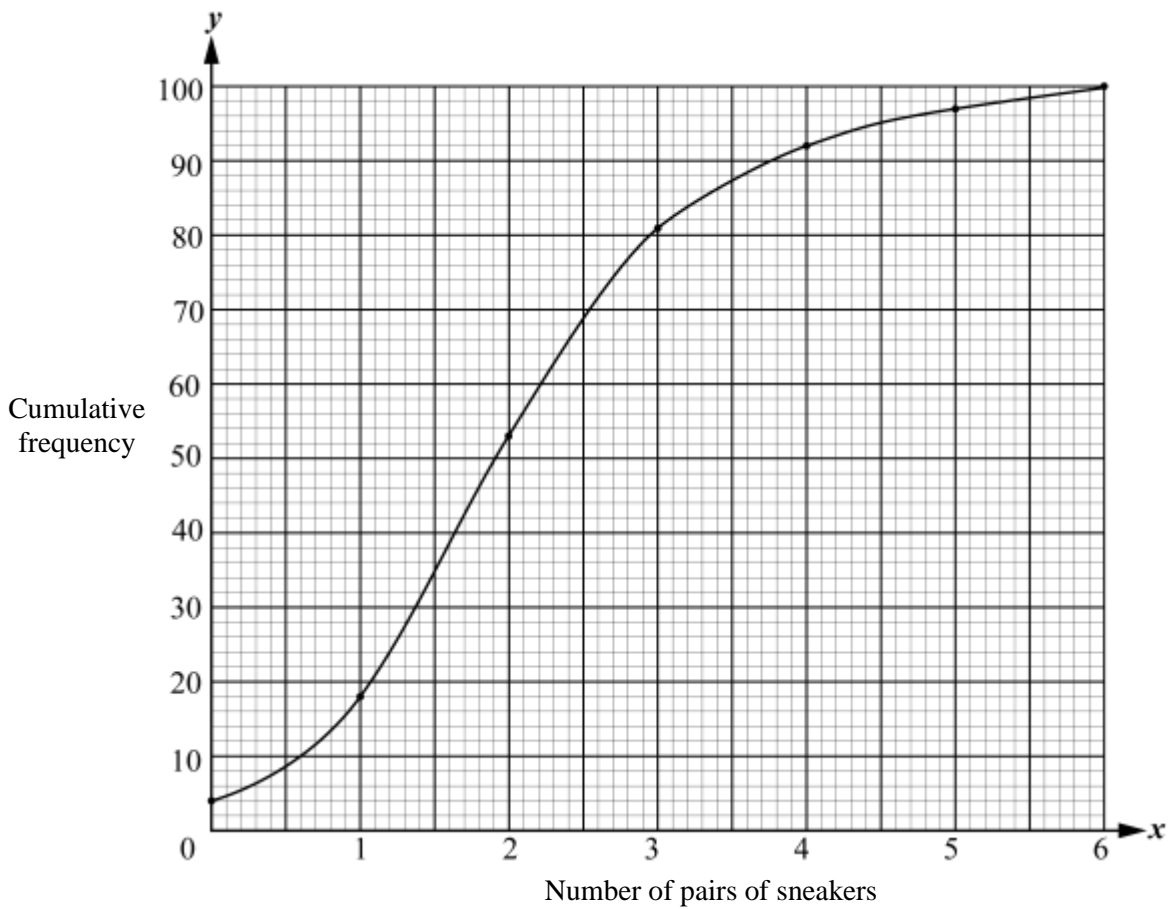
*Answer (d)*  $x =$  ..... or  $x =$  .....[3]

- (e) Write down the equation of the line of symmetry of the graph.

*Answer (e)* .....[1]

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- 9 The cumulative frequency curve shows the number of pairs of sneakers that a group of 100 students owned.



(a) Use the curve to find:

- (i) the number of students that did not have even a single pair of sneakers,

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

- (ii) the number of students that had 3 or more pairs of sneakers,

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

- (iii) the median number of pairs of sneakers.

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



- (b) (i) Use the graph to complete the cumulative frequency table.

Number of pairs of sneakers	Number of students (frequency)	Cumulative frequency
0		
1	14	18
2	35	
3		81
4	11	92
5	5	
6	3	100

[2]

- (ii) Write down the modal number of pairs of sneakers.

*Answer (b)(ii) .....*[1]

- (c) A student is chosen at random from the distribution.

Find the probability that the student has more than 4 pairs of sneakers.

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





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