

YEAR 11 MATHEMATICS SPECIALIST**TEST 2, 2018***(Vectors and Geometric proofs)***CALCULATOR-ASSUMED****Student's Name:** _____

Total Marks: 42

Time Allowed: 50 mins

MATERIAL REQUIRED/RECOMMENDED FOR THIS TEST*Standard Items:* Pens, pencils, eraser, ruler*Special Items:* Up to three approved calculators
One page (unfolded A4 sheet) front and back of Notes
WACE Formula Sheet**INSTRUCTIONS TO STUDENTS**

Do not open this paper until instructed to do so.

You are required to answer ALL questions.

Write answers in the spaces provided beneath each question.

Marks are shown with the questions.

Show all working clearly, in sufficient detail to allow your answers to be checked and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks.It is recommended that students **do not use pencil**, except in diagrams.

Question 1

[11 marks = 1, 2, 2, 3, 3]

If $\mathbf{a} = 5\mathbf{i} + 12\mathbf{j}$, $\mathbf{b} = 3\mathbf{i} - 4\mathbf{j}$ and $\mathbf{c} = x\mathbf{i} - \mathbf{j}$ find:

- a) a vector in the same direction as \mathbf{a} but twice the magnitude of \mathbf{a} .
- b) a unit vector in the same direction as \mathbf{b} .
- c) a vector in the same direction as \mathbf{b} but the same magnitude as \mathbf{a} .
- d) if $|\mathbf{c}| = |\mathbf{a}|$, find the possible values of x
- e) If $\mathbf{a} + \mathbf{b} - \mathbf{c} = -3\mathbf{i} + y\mathbf{j}$, find the values for x and y .

Question 2 [5 marks]

Three forces are applied to a body. One has magnitude 300 N and acts due south. Another has magnitude 250 N and acts on a bearing of 050° . If all three forces are in equilibrium, determine the magnitude and direction of the third force.

Question 3 [8 marks = 4, 4]

(a) A triangle PQR has vertices $P(1, 1)$, $Q(5, 3)$ and $R(3, 7)$.

Determine the vector \overrightarrow{QM} where M is the midpoint of side PR .

(b) ABC is a triangle with point D on side \overrightarrow{AC} such that $\overrightarrow{AD} = \frac{3}{4}\overrightarrow{AC}$.
If $\overrightarrow{BA} = \mathbf{a}$ and $\overrightarrow{BD} = \mathbf{d}$, show that $\overrightarrow{BC} = \frac{1}{3}(4\mathbf{d} - \mathbf{a})$.

¹⁰
Question 4 [8 marks = 1, 5, 2, 1]

A helicopter capable of flying at a speed of 39km/hr in still air, takes off from airport A to airport B such that $\vec{AB} = 300\mathbf{i} + 100\mathbf{j}$. Throughout the journey, the helicopter encounters a wind blowing with velocity of $9\mathbf{i}$ km/hr.

(a) Draw vector diagram to represent the situation.

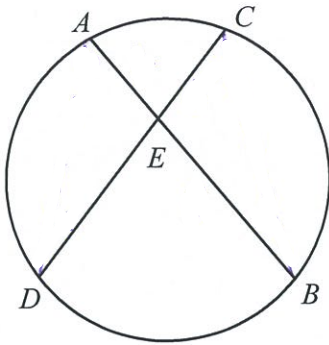
(b) Find the velocity vector, in the form $a\mathbf{i} + b\mathbf{j}$, the pilot should set so that the helicopter flies directly to airport B.

(d) Calculate the resultant speed of the Helicopter.

(e) Find, ~~to the nearest minute~~, the time taken for the journey.

Question 5 [5 marks]

In the circle shown below, not to scale, AB and CD are chords that intersect at E . If $AE = 4$ cm, $BE = 8$ cm and $CE = 6$ cm, determine the length of DE . Justify your answer.



Question 6 [5 marks]

A, B, C and D are points on the circumference of a circle centre O.

GF is a tangent to the circle at C.

DE and GF intersect at C.

Angles DAB and BDC are 135° and 27° respectively.

Prove $\angle GCE = 72^\circ$.

