

**PERTH MODERN SCHOOL**

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Independent Public School

Mathematics Specialist

Year 11

Student name: _____ Teacher name: _____

Date: Friday 14 May 2021

Task type:	Response
Time allowed:	40 minutes
Number of questions:	8
Materials required:	Calculator with CAS capability (to be provided by the student)
Standard items:	Pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters
Special items:	Drawing instruments, templates, notes on two unfolded sheet of A4 paper, and up to three calculators approved for use in the WACE examinations
Marks available:	40 marks
Task weighting:	10%
Formula sheet provided:	Yes

Note: All part questions worth more than 2 marks require working to obtain full marks.

Question 1

Let p and q be positive integers. Prove by contradiction that

$$\frac{p}{q} + \frac{q}{p} \geq 2$$

A high school student council has 7 boys and 6 girls. A yearbook committee of 7 people is to be appointed from the student council.

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Question 3

Anna, Belinda and Charles belong to a team of 8 students.

- a) How many selections of 4 students would include both Anna and Belinda but not Charles?

A team photo is about to be taken with all eight students standing next to each other.

- b) Determine the number of arrangements in which;

- a. Anna is standing at one end and Belinda and Charles are standing next to each other

- b. Anna and Belinda are standing next to each other and Charles is standing next to them

Question 4

- a) Seven teams play 23 volleyball games. Prove that there is some pair of teams that play each other more than once. (2 marks)

- b) How many of the integers from 1 to 220 inclusive are divisible by 2, 5 or 11? (5 marks)

Question 5

Let $a=3i-j$, $b=2i+j$ and $c=4i+yj$

a) Find a unit vector in the same direction as b (1 mark)

b) A vector in the same direction as b but equal in magnitude to a (2 marks)

c) Solve for y if a and c are perpendicular (2 marks)

Solve for y if a and c are parallel (3 marks)

- d) Solve for y if the angle between a and c is 45° . Make sure you clearly show the use of the scalar product (3 marks)

Question 6

Let A and B be the points defined by the position vectors $a = 4i + j$ and $b = i - j$ respectively. Find;

- a) The component of a that is parallel to b (2 marks)

- b) The component of a that is perpendicular to b (2 marks)

Question 7 (4 marks)

A helicopter can maintain a speed of 200 km/h in still air. What bearing should the pilot set if they wish to fly 380 km in a direction of 040° ? The instrument readout shows that the wind is blowing at 60 km/h from 100° .

(Additional working space)