



Christ Church
Grammar School

2016
UNIT TEST 3

MATHEMATICS SPECIALIST Year 12

Section One:
Calculator-free

Student name _____

Teacher name _____

Time and marks available for this section

Reading time before commencing work: 2 minutes
Working time for this section: 15 minutes
Marks available: 15 marks

Materials required/recommended for this section

To be provided by the supervisor

This Question/Answer Booklet
Formula Sheet

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener,
correction fluid/tape, eraser, ruler, highlighters

Special items: nil

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Instructions to candidates

1. Write your answers in this Question/Answer Booklet.
2. Answer all questions.
3. **Show all your working clearly.** Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks. If you repeat an answer to any question, ensure that you cancel the answer you do not wish to have marked.
4. It is recommended that **you do not use pencil**, except in diagrams.

Question 1

(4 marks)

Point A has position vector $\begin{pmatrix} 3 \\ -3 \\ -12 \end{pmatrix}$ and point B has position vector $\begin{pmatrix} 11 \\ 1 \\ 4 \end{pmatrix}$.

Determine the position vector of the point P that divides AB internally in the ratio 3:5.

Question 2

(6 marks)

Consider the three points $P(1,3,0)$, $Q(3,4,-3)$ and $R(3,6,2)$.
The three points are on the plane Π .

Determine the cartesian equation of the plane Π .

Question 3**(5 marks)**

As part of a product recall, a shop removed all sizes of a variety of soup from its shelves. The soup was sold in 300 mL, 500 mL and 800 mL sizes for \$4.50, \$6.00 and \$7.50 respectively. The total volume of soup in all 42 cans removed was 25 L and the value of these cans was to \$267.

If x 300 mL cans, y 500 mL cans and z 800 mL cans were removed, then some of the above information can be expressed by the equations $3x + 4y + 5z = 178$ and $x + y + z = 42$.

Write down a third equation from the information and use it to find how many of each size of can were removed.



Christ Church
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UNIT TEST 3

MATHEMATICS SPECIALIST Year 12

Section Two:

Calculator-assumed

Student name _____

Teacher name _____

Time and marks available for this section

Reading time before commencing work: 3 minutes
Working time for this section: 30 minutes
Marks available: 30 marks

Materials required/recommended for this section

To be provided by the supervisor

This Question/Answer Booklet
Formula Sheet (retained from Section One)

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: drawing instruments, templates, and up to three calculators approved for use in the WACE examinations

Important note to candidates

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Instructions to candidates

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Question 4

(8 marks)

Let Π be the plane given by the cartesian equation $4x - 3y + z = 42$.

- (a) Determine a vector equation for the plane in the form $\mathbf{r} = \mathbf{a} + \lambda\mathbf{b} + \mu\mathbf{c}$ (5 marks)

Let L be the line given by $\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} + \lambda \begin{pmatrix} -1 \\ 2 \\ 5 \end{pmatrix}$.

- (b) Determine the acute angle between the plane Π and the line L . (3 marks)

Question 5

(6 marks)

Let S be the sphere defined by the equation $(x - 4)^2 + (y + 4)^2 + (z - 3)^2 = 4$.

Let Π be the plane defined by the equation $2x - 2y + 5z = -8$.

The distance between a sphere and a plane that do not intersect is defined as the shortest distance between the two objects.

Determine the distance between S and Π .

Question 6

(5 marks)

Two gravity-defying drones, Drone A and Drone B, travel in space along straight lines.

Drone A starts at the point represented by the position vector $\begin{pmatrix} 2 \\ 1 \\ -3 \end{pmatrix}$ km.

Drone B starts at the point represented by the position vector $\begin{pmatrix} 5 \\ 28 \\ -6 \end{pmatrix}$ km.

Drone A has a velocity of $\begin{pmatrix} 7 \\ 10 \\ -3 \end{pmatrix}$ km/h and Drone B has a velocity of $\begin{pmatrix} 6 \\ 1 \\ -2 \end{pmatrix}$ km/h.

(a) Show that the two drones will collide. (3 marks)

(b) Determine the distance travelled by Drone A until they collide. (2 marks)

Question 7

(6 marks)

Consider the following system of equations:

$$x + y + z = 2$$

$$x - y + 2z = 7$$

$$3x - 3y + pz = q$$

Determine the possible values of p and q such that the system of equations has

- (i) a unique solution,
- (ii) no solution,
- (iii) an infinite number of solutions.

Question 8

(5 marks)

Find the equation of the line of intersection of the two planes whose equations are

$$r \cdot \begin{pmatrix} 1 \\ 1 \\ -3 \end{pmatrix} = 6 \text{ and } r \cdot \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix} = 4 \text{ respectively.}$$

End of questions