Additional Assessment Materials

Summer 2021

Pearson Edexcel GCE in Mathematics

9MA0 (Public release version)

Resource Set 1: Topic 10

Vectors

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an optional part of the range of evidence teachers may use when deciding on a candidate’s grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

1. Relative to a fixed origin O,

the point A has position vector $(2\mathbf{i} + 3\mathbf{j} - 4\mathbf{k})$,

the point B has position vector $(4\mathbf{i} - 2\mathbf{j} + 3\mathbf{k})$,

and the point C has position vector $(a\mathbf{i} + 5\mathbf{j} - 2\mathbf{k})$, where a is a constant and $a < 0$.

D is the point such that $\overrightarrow{AB} = \overrightarrow{BD}$.

(a) Find the position vector of D.

(2)

Given $|\overrightarrow{AC}| = 4$,

(b) find the value of a.

(3)

(Total for Question 1 is 5 marks)

---

2. Relative to a fixed origin O

- point A has position vector $2\mathbf{i} + 5\mathbf{j} - 6\mathbf{k}$
- point B has position vector $3\mathbf{i} - 3\mathbf{j} - 4\mathbf{k}$
- point C has position vector $2\mathbf{i} - 16\mathbf{j} + 4\mathbf{k}$

(a) Find $\overrightarrow{AB}$

(2)

(b) Show that quadrilateral $OABC$ is a trapezium, giving reasons for your answer.

(2)

(Total for Question 2 is 4 marks)

---

3. Relative to a fixed origin O, the points A and B are such that

$$\overrightarrow{OA} = \begin{pmatrix} -3 \\ 2 \\ 7 \end{pmatrix} \text{ and } \overrightarrow{OB} = \begin{pmatrix} 3 \\ -1 \\ p \end{pmatrix}, \text{ where } p \text{ is a constant,}$$

and the points C and D are such that

$$\overrightarrow{BC} = \begin{pmatrix} 0 \\ 6 \\ -7 \end{pmatrix} \text{ and } \overrightarrow{AD} = \begin{pmatrix} 2 \\ 5 \\ -4 \end{pmatrix}.$$

(a) Find the position vector of the point D.

(1)

Given that $ABCD$ is a trapezium,

(b) find the value of p.

(4)

(Total for Question 3 is 5 marks)

---

4. Relative to a fixed origin, points P, Q and R have position vectors $\mathbf{p}$, $\mathbf{q}$ and $\mathbf{r}$ respectively. Given that

- P, Q and R lie on a straight line
- Q lies one third of the way from P to R

show that

$$\mathbf{q} = \frac{1}{3}(\mathbf{r} + 2\mathbf{p})$$

(3)

(Total for Question 4 is 3 marks)

5.

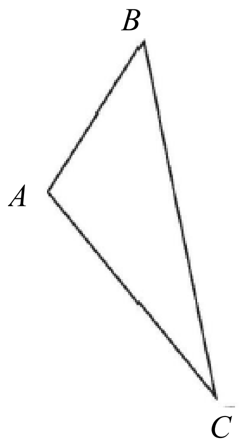

Figure 2

Figure 2 Figure 2 shows a sketch of a triangle ABC.

Given $\overrightarrow{AB} = 2\mathbf{i} + 3\mathbf{j} + \mathbf{k}$ and $\overrightarrow{BC} = \mathbf{i} - 9\mathbf{j} + 3\mathbf{k}$,

show that $\angle BAC = 105.9°$ to one decimal place.

(5)

(Total for Question 5 is 5 marks)

---

6. Relative to a fixed origin O,

- the point A has position vector $-2\mathbf{i} + 3\mathbf{j}$,
- the point B has position vector $3\mathbf{i} + p\mathbf{j}$, where p is constant,
- the point C has position vector $q\mathbf{i} + 7\mathbf{j}$, where q is constant.

Given that $\left|\overrightarrow{AB}\right| = 5\sqrt{2}$,

(a) find the possible values for p.

(3)

Given that the angle between $\overrightarrow{AC}$ and the unit vector $\mathbf{i}$ is $\frac{\pi}{3}$ radians,

(b) find the exact value of q.

(3)

(Total for Question 6 is 6 marks)

7.

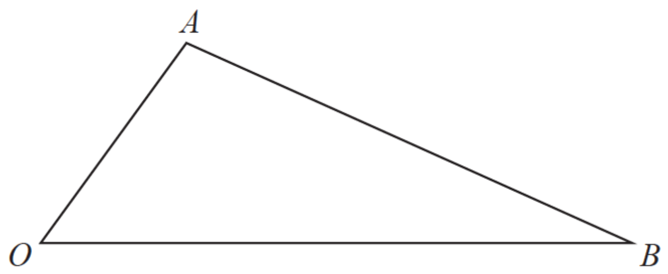

Figure 7

Figure 7 shows a sketch of triangle *OAB*.

The point *C* is such that $\overrightarrow{OC} = 2\,\overrightarrow{OA}$.

The point *M* is the midpoint of *AB*.

The straight line through *C* and *M* cuts *OB* at the point *N*.

Given $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$

(*a*) Find $\overrightarrow{CM}$ in terms of **a** and **b**.

(2)

(*b*) Show that $\overrightarrow{ON} = \left(2 - \frac{3}{2}\lambda\right)\mathbf{a} + \frac{1}{2}\lambda\mathbf{b}$, where λ is a scalar constant.

(2)

(*c*) Hence prove that $ON : NB = 2 : 1$

(2)

(Total for Question 7 is 6 marks)