# RVHS H2 Mathematics Remedial Programme

# Topic: Vectors I, II

**<u>Basic Mastery Questions</u>**

1. **ACJC Promo 9758/2021/Q10(i)**
Referred to the origin *O*, the points *A*, *B* and *C* have position vectors $4\mathbf{i}-2\mathbf{j}$, $\alpha\mathbf{i}-\mathbf{j}+2\mathbf{k}$ and $-\mathbf{i}-7\mathbf{j}+\beta\mathbf{k}$ respectively, where $\alpha$ and $\beta$ are constants.

Given that *A*, *B* and *C* are collinear, show that $\alpha$ =5, and find the value of $\beta$. [3]

**Answer:** $\beta=-10$

2. **JPJC Prelim 9758/2021/01/Q2**
Referred to the origin *O*, the points *A* and *B* have position vectors **a** and **b** such that

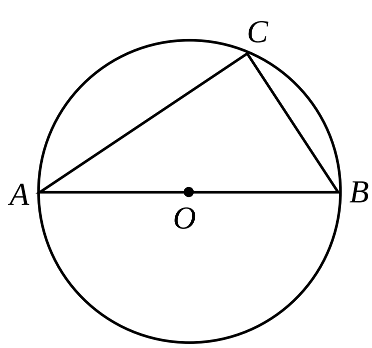
$$\mathbf{a}=\mathbf{i}+\mathbf{j}+\mathbf{k} \quad \text{and} \quad \mathbf{b}=\mathbf{i}+2\mathbf{j}+2\mathbf{k}.$$

**(i)** Find the size of angle *OAB*. [2]

The point *C* has position vector **c** given by $\mathbf{c}=\lambda\mathbf{a}+\mu\mathbf{b}$, where $\lambda$ and $\mu$ are positive constants. Given that the area of triangle *OAC* is twice that of triangle *OBC*,
**(ii)** find $\mu$ in terms of $\lambda$, [3]
**(iii)** hence, if *OC* = $\sqrt{118}$, find the position vector **c**. [4]

**Answer: (i)** 144.7° **(ii)** $\mu=2\lambda$ **(iii)** $\underset{\sim}{c}=\begin{pmatrix}3\sqrt{2}\\5\sqrt{2}\\5\sqrt{2}\end{pmatrix}$

3. **RI Prelim 9758/2021/02/Q4(a)(i)**




Referred to the origin *O*, points *A*, *B* and *C* have position vectors **a**, **b** and **c** respectively. The three points lie on a circle with centre *O* and diameter *AB* (see diagram).
Using a suitable scalar product, show that the angle *ACB* is $90°$. [4]

**Standard Questions**

1. **MI Promo 9758/2021/PU2/02/Q4**

Referred to the origin $O$, the points $A$ and $B$ are such that $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. The mid-point of $OA$ is $P$ and the point $M$ on $PB$ is such that $PM : MB = 2:3$.

By finding $\overrightarrow{OM}$, show that the area of triangle $OMP$ can be written as $k|\mathbf{a} \times \mathbf{b}|$ where $k$ is a constant to be found. [5]

Given that $|\mathbf{a}| = 2$, $|\mathbf{b}| = \sqrt{2}$ and the angle $AOB$ is $\frac{\pi}{4}$ radians, show that $PM$ is perpendicular to $OA$. [4]

**Answer:** $k = \frac{1}{10}$

2. **MI Promo 9758/2020/PU2/P1/Q7**

In the parallelogram $OABC$, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$. The point $M$ on $OA$ is such that $OM : MA = 2 : 1$ and the point $N$ on $AB$ is such that $AN : NB = 1 : 2$. It is given that the lines $CM$ and $ON$ intersect at point $R$.

**(i)** Find $\overrightarrow{OM}$ and $\overrightarrow{ON}$, giving your answers in terms of $\mathbf{a}$ and $\mathbf{c}$. [2]

**(ii)** Show that $\overrightarrow{OR} = \frac{6}{11}\mathbf{a} + \frac{2}{11}\mathbf{c}$. [4]

**(iii)** Hence find the ratio $CR : RM$. [1]

**(iv)** State, with a reason, whether the points $O$, $B$ and $R$ are collinear. [2]

**Answer: (i)** $\overrightarrow{OM} = \frac{2}{3}\mathbf{a}$, $\overrightarrow{ON} = \mathbf{a} + \frac{1}{3}\mathbf{c}$ **(iii)** $9:2$