

Springburn Academy : Mathematics Department

Higher Mathematics : Lesson Starters

Block 1 (Vectors)

Without using a calculator :

Task 1

1 Find the resultant vector $3\mathbf{u} - \mathbf{v}$ when $\mathbf{u} = \begin{pmatrix} -3 \\ 4 \\ 2 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} 1 \\ 0 \\ -5 \end{pmatrix}$

2 What is the gradient of the line $3y - 5x = 6$?

3 If $C = (5, 3, 2)$ and $D = (7, -4, -1)$. Calculate the components of the vector \overrightarrow{CD} .

4 Find the magnitude of the vector $\overrightarrow{AB} = \begin{pmatrix} 2 \\ -1 \\ 6 \end{pmatrix}$

Task 2

1 Simplify $\sqrt{240}$

2 If $\mathbf{f} = 3\mathbf{i} + 2\mathbf{k}$ and $\mathbf{g} = 2\mathbf{i} + 4\mathbf{j} + 3\mathbf{k}$, find $|\mathbf{f} + \mathbf{g}|$.

3 Find the equation of the horizontal line which passes through the point $(3, 4)$.

4 Given that $\mathbf{p} = \begin{pmatrix} 2 \\ 5 \\ -7 \end{pmatrix}$, $\mathbf{q} = \begin{pmatrix} 1 \\ 0 \\ -1 \end{pmatrix}$ and $\mathbf{r} = \begin{pmatrix} -4 \\ 2 \\ 0 \end{pmatrix}$, express $2\mathbf{p} - \mathbf{q} - \frac{1}{2}\mathbf{r}$ in component form.

Task 3

1 Given that $|\mathbf{a}| = 3$, $|\mathbf{b}| = 2$ and $\mathbf{a} \cdot \mathbf{b} = 5$, what is the value of $\mathbf{a} \cdot (\mathbf{a} + \mathbf{b})$?

2 Calculate the gradient of the line perpendicular to the line $3y - 8x = 13$.

3 A line makes an angle of 30° with the positive direction of the x -axis. What is the gradient of the line?

4 The vectors $x\mathbf{i} + 5\mathbf{j} + 7\mathbf{k}$ and $-3\mathbf{i} + 2\mathbf{j} - \mathbf{k}$ are perpendicular. What is the value of x ?

Task 4

1. Show that the points $A(-7, -8, 1)$, $T(3, 2, 5)$ and $B(18, 17, 11)$ are collinear. Find the ratio in which T divides AB .
2. If $x^2 - 6x + 14$ is written in the form $(x - p)^2 + q$, what is the value of q ?
3. The roots of the equation $kx^2 - 3x + 2 = 0$ are equal. What is the value of k ?

4. The vector \mathbf{u} has components $\begin{pmatrix} -3 \\ 0 \\ 4 \end{pmatrix}$. Create a unit vector parallel to \mathbf{u} .

Task 5

DOABC is a square based pyramid as shown in the diagram below.

O is the origin, D is the point $(2, 2, 6)$ and $OA = 4$ units.

M is the mid-point of OA.

- (a) State the coordinates of B.
- (b) Express \overrightarrow{DB} and \overrightarrow{DM} in component form.
- (c) Find the size of angle BDM.

(Calculator may be used here.)

