Scalar Product

(Dot Product)
2D & 3D Vectors

Answers *can be found at the end of Exercise 1 (online notes). To get there, either click here: RadfordMathematics.com or, if you've printed this worksheet out, by scanning the* ***QR Code*** *in the upper right hand corner of the page.*

Exercise 1

Calculate the scalar product (or dot product) of each of the following pairs of vectors:

1. $\overrightarrow{a} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$ and $\overrightarrow{b} = \begin{pmatrix} 3 \\ 7 \end{pmatrix}$
2. $\overrightarrow{u} = 3\vec{i} - 2\vec{j} + \overrightarrow{k}$ and $\overrightarrow{v} = -\vec{i} + 4\vec{j} + 2\overrightarrow{k}$
3. $\overrightarrow{c} = \begin{pmatrix} 2 \\ 0 \\ -5 \end{pmatrix}$ and $\overrightarrow{d} = \begin{pmatrix} 1 \\ -3 \\ 4 \end{pmatrix}$

Exercise 2

Given the vectors $\overrightarrow{a} = \begin{pmatrix} 2 \\ -3 \\ 4 \end{pmatrix}$ and $\overrightarrow{b} = \begin{pmatrix} 1 \\ -2 \\ p \end{pmatrix}$, find the value of p for which $\overrightarrow{a}$ and $\overrightarrow{b}$ are perpendicular.

Exercise 3

Given the vectors $\overrightarrow{u} = \begin{pmatrix} 0 \\ 5 \\ q \end{pmatrix}$ and $\overrightarrow{v} = \begin{pmatrix} 0 \\ 10 \\ 14 \end{pmatrix}$, find the values of q for which $\overrightarrow{u}$ and $\overrightarrow{v}$ are:

1. parallel
2. perpendicular

Exercise 4

Show that triangle ABC, where the vertices A, B and C have coordinates $A\,(0, -3, 9)$, $B\,(5, -10, 10)$ and $C\,(2, -4, 6)$ is right angled at C.

Exercise 5

Given $\overrightarrow{u} = \begin{pmatrix} 2k \\ -1 \\ 1 \end{pmatrix}$ and $\overrightarrow{v} = \begin{pmatrix} k \\ k \\ -1 \end{pmatrix}$ are perpendicular and $k > 0$, find the value of k.