



# 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](https://www.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.  $\vec{a} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$  and  $\vec{b} = \begin{pmatrix} 3 \\ 7 \end{pmatrix}$
2.  $\vec{u} = 3\vec{i} - 2\vec{j} + \vec{k}$  and  $\vec{v} = -\vec{i} + 4\vec{j} + 2\vec{k}$
3.  $\vec{c} = \begin{pmatrix} 2 \\ 0 \\ -5 \end{pmatrix}$  and  $\vec{d} = \begin{pmatrix} 1 \\ -3 \\ 4 \end{pmatrix}$

## Exercise 2

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



### Exercise 3

Given the vectors  $\vec{u} = \begin{pmatrix} 0 \\ 5 \\ q \end{pmatrix}$  and  $\vec{v} = \begin{pmatrix} 0 \\ 10 \\ 14 \end{pmatrix}$ , find the values of  $q$  for which  $\vec{u}$  and  $\vec{v}$  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  $\vec{u} = \begin{pmatrix} 2k \\ -1 \\ 1 \end{pmatrix}$  and  $\vec{v} = \begin{pmatrix} k \\ k \\ -1 \end{pmatrix}$  are perpendicular and  $k > 0$ , find the value of  $k$ .