

Vector Worksheet — Worked Solutions

Vector Representations

For a vector from P to Q ,

$$\overrightarrow{PQ} = \begin{pmatrix} x_Q - x_P \\ y_Q - y_P \end{pmatrix}.$$

For $\mathbf{v}$, the column vector is already given as $\begin{pmatrix} 5 \\ 3 \end{pmatrix}$, so

$$Q = P + \begin{pmatrix} 5 \\ 3 \end{pmatrix} = (2, 3) + (5, 3) = (7, 6).$$

For $\mathbf{w}$,

$$\overrightarrow{CD} = D - C = \begin{pmatrix} 1 - (-3) \\ 5 - 2 \end{pmatrix} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}.$$

For the own example $\mathbf{t}$, choose

$$Y = (8, 3).$$

Then

$$\overrightarrow{XY} = \begin{pmatrix} 8 - 5 \\ 3 - 0 \end{pmatrix} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}.$$

	$\mathbf{u}$	$\mathbf{v}$	$\mathbf{w}$	$\mathbf{t}$ (own)	
Points	$A = (0, 0),$ $B = (3, -1)$	$P = (2, 3),$ $Q = (7, 6)$	$C = (-3, 2),$ $D = (1, 5)$	$X = (5, 0),$ $Y = (8, 3)$	
Directed path	$\overrightarrow{AB}$	$\overrightarrow{PQ}$	$\overrightarrow{CD}$	$\overrightarrow{XY}$	
Column vector	$\begin{pmatrix} 3 \\ -1 \end{pmatrix}$	$\begin{pmatrix} 5 \\ 3 \end{pmatrix}$	$\begin{pmatrix} 4 \\ 3 \end{pmatrix}$	$\begin{pmatrix} 3 \\ 3 \end{pmatrix}$	

Adding Vectors

Many routes are possible. One valid route through the grey track is shown below.

Start at

$$R = (-9, -3).$$

Apply the vector

$$\mathbf{g} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}.$$

Then the endpoint is

$$S = R + \mathbf{g} = (-9, -3) + (1, 3) = (-8, 0).$$

The route crosses the Start/Finish line when $y = -1$. Since

$$R + t\mathbf{g} = (-9, -3) + t(1, 3),$$

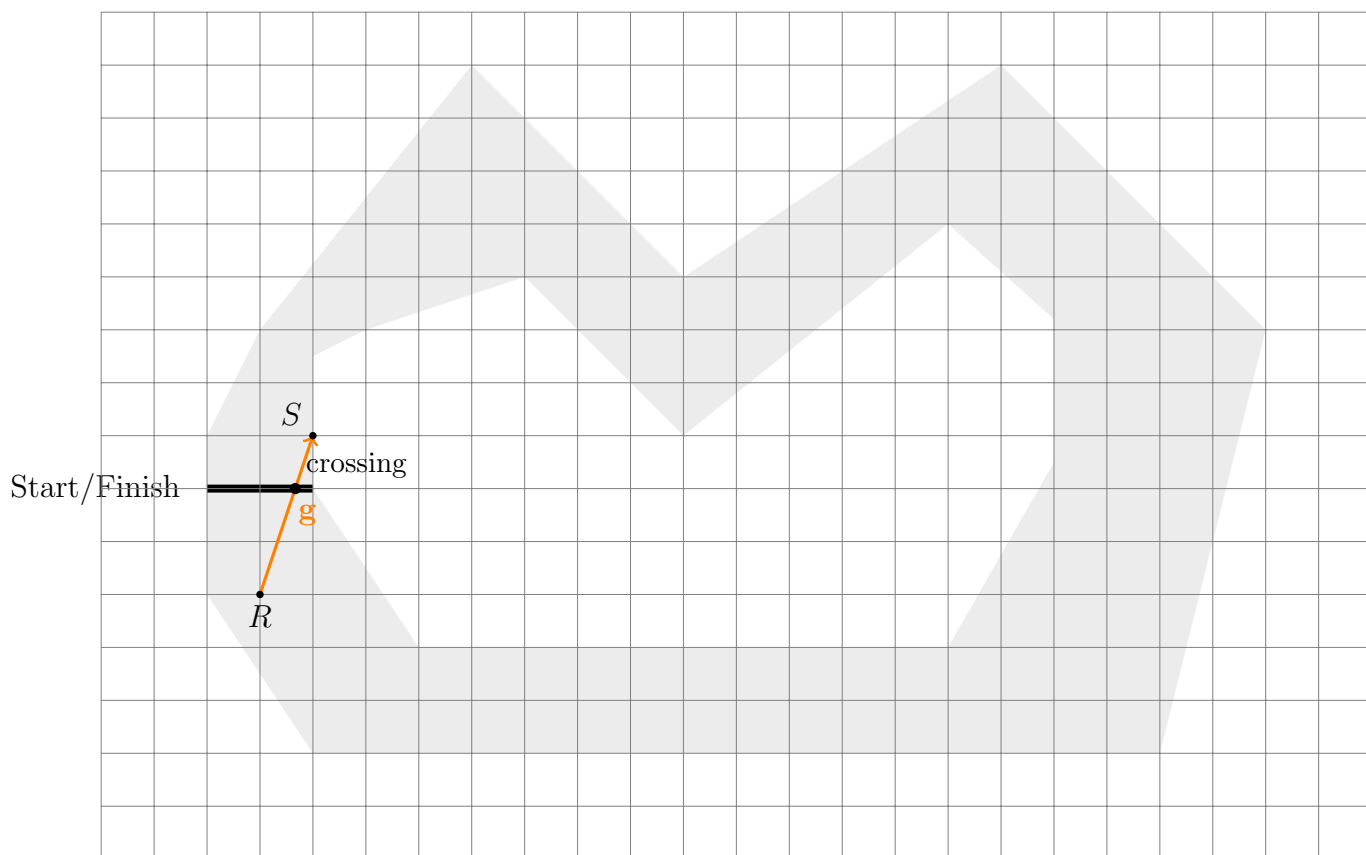
we solve

$$-3 + 3t = -1 \implies t = \frac{2}{3}.$$

At that point,

$$x = -9 + \frac{2}{3} = -\frac{25}{3} \approx -8.33,$$

which lies on the Start/Finish line segment between $(-10, -1)$ and $(-8, -1)$. The whole segment stays inside the grey track; the endpoint $(-8, 0)$ touches the inner edge, which is allowed.



1. Write your path in the form $g + a + \dots$

$\mathbf{g}$

2. Collect the like terms in your expression.

Since only $\mathbf{g}$ is used, there are no like terms to collect. The expression is already simplified:

$$\mathbf{g}.$$

3. Thus evaluate the expression from 1. as a column vector. What do you notice?

$$\mathbf{g} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}.$$

The resultant column vector is the total displacement from R to S . It is exactly the column vector for $\mathbf{g}$, because the route consists of a single application of $\mathbf{g}$.