Test answers - Vectors

Year: Year 11 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. $\begin{pmatrix}4\\6\end{pmatrix} - \begin{pmatrix}-1\\5\end{pmatrix} = \begin{pmatrix}5\\1\end{pmatrix}$ (1 for $2\mathbf{a}$, 1 for the answer) Multiply each component of $\mathbf{a}$ by 2, then subtract the components of $\mathbf{b}$; subtracting -1 adds 1.

b. $\mathbf{a}+\mathbf{b} = \begin{pmatrix}1\\8\end{pmatrix}$, magnitude $\sqrt{1+64} = \sqrt{65} =$ **8.06** (1 for the vector, 1 for the answer) Add the vectors first, then square the components, add them and take the square root.

Check (a) by components: $2\times 2-(-1)=5$ and $2\times 3-5=1$.

Answer to Question 2 (4 marks)

a. $\begin{pmatrix}6\\-2\end{pmatrix} + \begin{pmatrix}-10\\5\end{pmatrix} = \begin{pmatrix}-4\\3\end{pmatrix}$ (2) The total displacement is the sum of the two legs: add the top numbers and the bottom numbers.

b. $\sqrt{16+9} =$ **5.0 km** (1 for the sum of squares, 1 for the answer) The distance is the magnitude of . The components -4 and 3 make a 3-4-5 triangle, so $PR = 5.0$ km.

A common error in (b) is to subtract the squares, $\sqrt{16-9}$.

Answer to Question 3 (4 marks)

a. $\mathbf{r} = -2\mathbf{p}$ because $-2\times 3=-6$ and $-2\times -2=4$ (2) Two vectors are parallel when one is a multiple of the other. Here every component of $\mathbf{r}$ is -2 times the matching component of $\mathbf{p}$.

b. $9 = 3\times 3$, so $k = 3\times(-2) = -6$ (1 for the multiplier, 1 for k) For $\mathbf{q}$ to be parallel to $\mathbf{p}$, it must be a multiple of $\mathbf{p}$. The top numbers show the multiplier is 3, so the bottom number must also be multiplied by 3.

Answer to Question 4 (4 marks)

a.  (1) Go from A back to O, then along $\mathbf{b}$ to B.

b. [illegible] (1), so [illegible] (1) $AN : NB = 1 : 3$ means N is a quarter of the way from A to B.

c. [illegible] (1) [illegible] because M is the midpoint of OA.

In (c), [illegible], so MN is parallel to the line joining O to the midpoint of AB.

Answer to Question 5 (4 marks)

a. $\begin{pmatrix}24\\10\end{pmatrix} + \begin{pmatrix}-8\\-16\end{pmatrix} = \begin{pmatrix}16\\-6\end{pmatrix}$ (1) The displacement from B to R is the sum of the two legs.

b. $BS = \sqrt{576 + 100} = 26$, $SR = \sqrt{64 + 256} = 17.9$, total **43.9 km** (1 for the two lengths, 1 for the total) Find the magnitude of each leg with Pythagoras and add them.

c. Direct return $= \sqrt{256 + 36} = 17.1$ km. $43.9 + 17.1 = 61.0$ km, which is more than 60 km, so **no** (1) The direct return distance is the magnitude of [illegible].