CONTOUREDUCATION

VCE Specialist Mathematics ½
Vectors I [6.1]
Test Solutions

20.5 Marks. 1 Minute Reading. 16 Minutes Writing.

Results:

Test Questions	_____ / 20.5

Section A: Test Questions (20.5 Marks)

Question 1 (3.5 marks)

Tick whether the following statements are **true** or **false**.

Statement	True	False
a. Scalar quantity has a direction component whereas a vector quantity does not.		✓
b. If $\overrightarrow{OA} = \boldsymbol{a}, \overrightarrow{OB} = \boldsymbol{b}$, $\overrightarrow{CA} = \boldsymbol{u}$ and $\overrightarrow{CB} = \boldsymbol{v}$, then $\boldsymbol{b} - \boldsymbol{a} = \boldsymbol{v} - \boldsymbol{u}$.	✓	
c. The resultant vector is a sum of any number of vectors added together.	✓	
d. Subtraction of a vector can be thought of adding a negative vector.	✓	
e. Scalar multiplication does not change the direction of the vector.		✓
f. If the point A has coordinates $(1, 4)$ and the point B has coordinates $(3, 5)$ then the position vector of A is $2\boldsymbol{i} + \boldsymbol{j}$.		✓
g. The angle between two vectors is measured by joining one's head with another vector's tail.		✓

False: It can go the other direction.

False: It's either both heads or both tails.

Space for Personal Notes

Question 2 (4 marks)

The point A has coordinates $(2, 1, -3)$ and point B is such that $\overrightarrow{AB} = 3\boldsymbol{i} - \boldsymbol{j} + 5\boldsymbol{k}$.
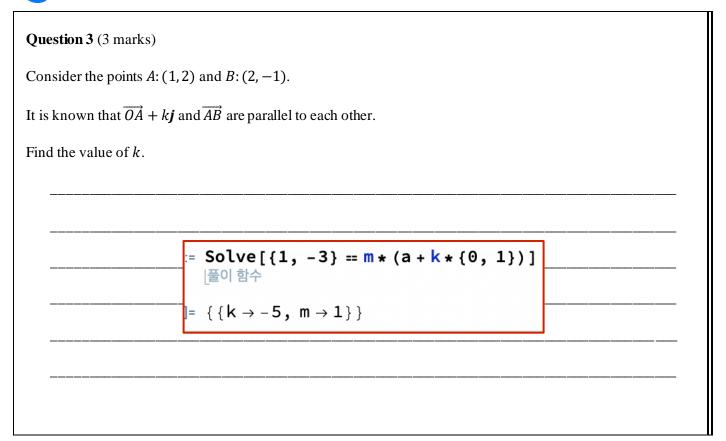
a. Find the position vector of B. (2 marks)

$$\Longrightarrow \overrightarrow{OB} = \overrightarrow{OA} + \overrightarrow{AB}$$
$$\Longrightarrow \underline{b} = (2, 1, -3) + (3, -1, 5)$$
$$\Longrightarrow \underline{b} = (5, 0, 2)$$

b. Hence, find the distance of B from O. (2 marks)

$$\Longrightarrow |\overrightarrow{OB}| = |5, 0, 2|$$
$$\Longrightarrow |\underline{b}| = \sqrt{5^2 + 0^2 + 2^2}$$
$$\Longrightarrow |\underline{b}| = \sqrt{29} \approx 5.39$$

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Question 3 (3 marks)

Consider the points $A: (1, 2)$ and $B: (2, -1)$.

It is known that $\overrightarrow{OA} + k\boldsymbol{j}$ and $\overrightarrow{AB}$ are parallel to each other.

Find the value of k.

_____

_____

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:= Solve[{1, -3} == m * (a + k * {0, 1})]
  |풀이 함수

|= {{k → -5, m → 1}}
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_____

_____

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Question 4 (4 marks)

The following information is given for two points which lie on the same plane.

$$\overline{OA} = i + 4j \text{ and } \overline{OB} = 5i + 5j$$

a. Find the vector $\overline{AB}$ and hence, state its length. (2 marks)

$$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB} = -(\underline{i} + 4\underline{j}) + (5\underline{i} + 5\underline{j}) = 4\underline{i} + \underline{j}$$

$$|\overrightarrow{AB}| = |4\underline{i} + \underline{j}| = \sqrt{4^2 + 1^2} = \sqrt{17}$$

b. Find $\cos(\theta)$, where θ is the angle AOB. (2 marks)

$$\cos(\theta) = \frac{5}{\sqrt{34}}$$

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Question 5 (6 marks)

Given the vectors:

$$a = i - j + 3k$$

$$b = 2i - j + k$$

a. Evaluate $a - b$. (1 mark)

$$-i + 2k$$

b. Calculate the dot product of a and b. (1 mark)

$$6$$

c. Find a unit vector in the direction of $-a$. (1 mark)

$$-\frac{1}{\sqrt{11}}(i - j + 3k)$$

d. Find $\sin(\theta)$, where θ is the angle between a and the z-axis. (3 marks)

$$\cos(\theta) = \frac{3}{\sqrt{11}}$$

$\sin(\theta) = \frac{\sqrt{2}}{\sqrt{11}}$ via identity $(\sin^2 + \cos^2 = 1)$

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