



NOTE #1 (VECTORS, DOT PRODUCT.)

[Vectors]

(1) Find a vector  $\overrightarrow{AB}$ .

(a)  $A(-3, 4), B(1, -2)$

(b)  $A(0, 0), B(1, 1)$

(c)  $A(-2, 2), B(-1, 3)$



(2) If  $\mathbf{a} = \langle -1, 2 \rangle$  and  $\mathbf{b} = \langle 5, 3 \rangle$ , find  $|\mathbf{a}|$ ,  $\mathbf{a} + \mathbf{b}$ ,  $\mathbf{a} - \mathbf{b}$ , and  $-3\mathbf{a} + 4\mathbf{b}$ .

(3) If  $|\mathbf{r}| = 2$ , and  $\mathbf{r}$  makes an angle of  $210^\circ$  with the positive  $x$ -axis, find the component of the vector  $\mathbf{r}$ .

(4) If  $\mathbf{a} = \langle 3, -4 \rangle$ , find a vector with length 10 in the direction of  $\mathbf{a}$ .



**[Dot product]**

(5) Find  $\mathbf{a} \cdot \mathbf{b}$ .

(a)  $|\mathbf{a}| = 4$ ,  $|\mathbf{b}| = 5$ , the angle between  $\mathbf{a}$  and  $\mathbf{b}$  is  $\frac{\pi}{3}$

(b)  $\mathbf{a} = \langle -2, -8 \rangle$ ,  $\mathbf{b} = \langle 6, -4 \rangle$

(c)  $\mathbf{a} = \mathbf{i} + \mathbf{j}$ ,  $\mathbf{b} = \mathbf{i} - 2\mathbf{j}$



(6) Find the angle between the vectors.

(a)  $\mathbf{a} = \langle 6, 0 \rangle$ ,  $\mathbf{b} = \langle 5, 3 \rangle$

(b)  $\mathbf{a} = \langle 3, 1 \rangle$ ,  $\mathbf{b} = \langle 2, 4 \rangle$



(7) Find the values of  $x$  such that the given vectors are orthogonal.

(a)  $\langle 4, x \rangle, \langle x, 1 \rangle$

(b)  $\langle x, x \rangle, \langle 1, x \rangle$



- (8) A force  $\mathbf{F} = \langle -3, 4 \rangle$  is used to move an object from the point  $(0, 2)$  to the point  $(-3, 3)$ . How much work is done by the force if distance is measured in meters and force is measured in Newtons?



- (9) A boat heads in the direction  $N30^\circ E$  with a speed of  $40\text{mph}$ . The water current is flowing  $S45^\circ E$  with a speed of  $6\text{mph}$ . Find the true speed and direction of the boat.

