

## Dot product problems

1. a) Compute  $\langle 1, 2, -4 \rangle \cdot \langle 2, 3, 5 \rangle$ .

b) Is the angle between these two vectors acute, obtuse or right?

**Answer:** a)  $\langle 1, 2, -4 \rangle \cdot \langle 2, 3, 5 \rangle = 1 \cdot 2 + 2 \cdot 3 - 4 \cdot 5 = -12$ .

b) Let  $\theta$  be the angle between the vectors. Since the dot product is negative we have  $\cos \theta < 0$ , which means  $\theta > \pi/2$ . The angle is obtuse.

2. Suppose  $\mathbf{B} = \langle 2, 2, 1 \rangle$ . Suppose also that  $\mathbf{B}$  makes an angle of  $30^\circ$  with  $\mathbf{A}$  and  $\mathbf{A} \cdot \mathbf{B} = 6$ . Find  $|\mathbf{A}|$ .

**Answer:** Since  $30^\circ = \pi/6$  radians and  $|\mathbf{B}| = 3$  we get

$$6 = \mathbf{A} \cdot \mathbf{B} = |\mathbf{A}||\mathbf{B}| \cos(\pi/6) = |\mathbf{A}| \cdot 3 \cdot \frac{\sqrt{3}}{2} \Rightarrow |\mathbf{A}| = \frac{4}{\sqrt{3}}.$$

3. If  $\mathbf{A} \cdot \mathbf{B} = 0$  what is the angle between  $\mathbf{A}$  and  $\mathbf{B}$ ?

**Answer:**  $\pi/2$ .

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