Vectors practice

Perform the calculations below.
EXAMPLE:
Question: Vector $\vec{a}$ has magnitude (length) of 5 and direction of $45°$, vector $\vec{b}$ has magnitude of 10 and direction of $30°$. Find components of vectos $\vec{a}$ and $\vec{b}$, calculate $\vec{c} = \vec{a} + \vec{b}$, $\vec{a} \cdot \vec{b}$, the length $c = |\vec{c}|$, and the direction ϕ_c of vector $\vec{c}$. (Use calculator.)
Answer:

1. Components of vector $\vec{a}$ are $\vec{a} = (a\cos 45°, a\sin 45°) = (5\cos 45°, 5\cos 45°) = (3.5, 3.5)$.

2. $\vec{b} = (b\cos 30°, b\sin 30°) = (10\cos 30°, 10\sin 30°) = (8.6, 5)$.

3. $\vec{c} = (3.5, 3.5) + (8.6, 5) = (13.1, 8.5)$.

4. $\vec{a} \cdot \vec{b} = (3.5, 3.5) \cdot (8.6, 5) = 8.6 * 3.5 + 5 * 3.5 = 46.6$

5. $c = |\vec{c}| = \sqrt{13.1^2 + 8.5^2} = 15.62$

6. $\tan \phi_c = c_y/c_x = 8.5/13.1 = 0.65$ (finding $\tan \phi_c$ is enough!).

ASSIGNMENT:
A. Find components of vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}, \vec{e}$.

1. Vector $\vec{a}$ has magnitude of 5 and direction of $60°$.

2. Vector $\vec{b}$ has magnitude of 2.5 and direction of $135°$.

3. Vector $\vec{c}$ has magnitude of 15 and direction of $-45°$.

4. Vector $\vec{d}$ has magnitude of 1 and direction of $120°$.

5. Vector $\vec{e}$ has magnitude of 10 and direction of $-30°$.

B. Using above $\vec{a}, \vec{b}, \vec{c}, \vec{d}, \vec{e}$, find

1. $\vec{a} + \vec{b}, |\vec{a} + \vec{b}|$ (length of $\vec{a} + \vec{b}$), and direction of $\vec{a} + \vec{b}$, ϕ_{a+b}.

2. $\vec{a} + 2\vec{b}, |\vec{a} + 2\vec{b}|$, and direction.

3. $\vec{b} + \vec{c}, |\vec{b} + \vec{c}|$, and direction.

4. $3\vec{a} - 4\vec{e}, |3\vec{a} - 4\vec{e}|$, and direction.

5. $\vec{a} + 2\vec{c} - \vec{e}, |\vec{a} + 2\vec{c} - \vec{e}|$, and direction.

6. $1.5\vec{a} + \vec{c} - \vec{d} - \vec{e}, |1.5\vec{a} + \vec{c} - \vec{d} = \vec{e}|$, and direction.

7. $\vec{c} + \vec{d} + 0.5\vec{a} + 1.5\vec{b}, |\vec{c} + \vec{d} + 0.5\vec{a} + 1.5\vec{b}|$, and direction.

8. $\vec{c} + \vec{d} - (\vec{a} + \vec{b}) + \vec{e}, |\vec{c} + \vec{d} - (\vec{a} + \vec{b}) + \vec{e}|$, and direction.

9. $\vec{c} + 2(\vec{d} - \vec{b}) + (\vec{a} + \vec{e}), |\vec{c} + 2(\vec{d} - \vec{b}) + (\vec{a} + \vec{e})|$, and direction.

C. Using above $\vec{a}, \vec{b}, \vec{c}, \vec{d}, \vec{e}$ find $\vec{a} \cdot \vec{b}, \vec{a} \cdot \vec{c}, \vec{b} \cdot \vec{d}, \vec{a} \cdot \vec{e}, \vec{a} \cdot (\vec{b} + \vec{e}), \vec{a} \cdot (2\vec{c} + 3\vec{e}), \vec{a} \cdot (2\vec{e}), (2\vec{a} + \vec{d}) \cdot \vec{b}$.