42. We apply Eq. 3-30 and Eq. 3-23.

(a) $\vec{a} \times \vec{b} = (a_x b_y - a_y b_x)\,\hat{\text{k}}$ since all other terms vanish, due to the fact that neither $\vec{a}$ nor $\vec{b}$ have any z components. Consequently, we obtain $((3.0)(4.0) - (5.0)(2.0))\,\hat{\text{k}} = 2.0\,\hat{\text{k}}$.

(b) $\vec{a} \cdot \vec{b} = a_x b_x + a_y b_y$ yields $(3)(2) + (5)(4) = 26$.

(c) $\vec{a} + \vec{b} = (3+2)\,\hat{\text{i}} + (5+4)\,\hat{\text{j}}$, so that $\left(\vec{a} + \vec{b}\right) \cdot \vec{b} = (5)(2) + (9)(4) = 46$.

(d) Several approaches are available. In this solution, we will construct a $\hat{b}$ unit-vector and "dot" it (take the scalar product of it) with $\vec{a}$. In this case, we make the desired unit-vector by

$$\hat{b} = \frac{\vec{b}}{|\vec{b}|} = \frac{2\,\hat{\text{i}} + 4\,\hat{\text{j}}}{\sqrt{2^2 + 4^2}} \ .$$

We therefore obtain

$$a_b = \vec{a} \cdot \hat{b} = \frac{(3)(2) + (5)(4)}{\sqrt{2^2 + 4^2}} = 5.8 \ .$$