國立臺灣海洋大學商船系 1B 普通物理 98(1)作業 1 解答　(970929/1006)

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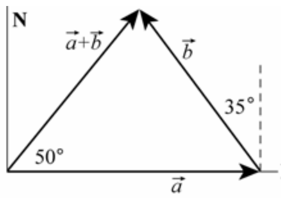
**_Ex_.1-1, _Prob_.3-35** (HRW,8e)　***Sol.***

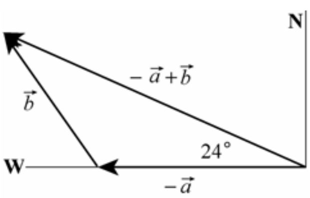
We apply Eqs.3-30 and 3-23. If a vector-capable calculator is used, this makes a good exercise for getting familiar with those features. Here we briefly sketch the method.

(**a**) We note that $\mathbf{b}\times\mathbf{c} = -8.0\,\mathbf{i} + 5.0\,\mathbf{j} + 6.0\,\mathbf{k}$. Thus, $\mathbf{a}\cdot\mathbf{b}\times\mathbf{c} = (3.0)(-8.0) + (3.0)(5.0) + (-2.0)(6.0) = -21$.

(**b**) We note that $\mathbf{b}+\mathbf{c} = 1.0\,\mathbf{i} - 2.0\,\mathbf{j} + 3.0\,\mathbf{k}$. Thus, $\mathbf{a}\cdot(\mathbf{b}+\mathbf{c}) = (3.0)(1.0) + (3.0)(-2.0) + (-2.0)(3.0) = -9.0$.

(**c**) Finally, $\mathbf{a}\times(\mathbf{b}+\mathbf{c}) = [(3.0)(3.0) - (-2.0)(-2.0)]\,\mathbf{i} + [(-2.0)(1.0) - (3.0)(3.0)]\,\mathbf{j} + [(3.0)(-2.0) - (1.0)(3.0)]\,\mathbf{k} = 5.0\,\mathbf{i} - 11\,\mathbf{j} - 9.0\,\mathbf{k}$.




**_Ex_.1-2, _Prob_.3-48** (HRW,8e)　***Sol.***

The vectors are shown on the diagram. The $x$ axis runs from west to east and the $y$ axis runs from south to north. Then $a_x = 5.0$ m, $a_y = 0$, $b_x = -(4.0\text{ m})\sin 35° = -2.29$ m, and $b_y = (4.0\text{ m})\cos 35° = 3.28$ m.

(**a**) Let $\mathbf{c} = \mathbf{a} + \mathbf{b}$. Then $c_x = a_x + b_x = 5.00 - 2.29 = 2.71$ (m) and $c_y = a_y + b_y = 3.28$ (m). The magnitude of $c$ is

$$c = \sqrt{c_x^2 + c_y^2} = \sqrt{2.71^2 + 3.28^2} = 4.25 \approx 4.2 \text{ (m)}$$

(**b**) The angle $\theta$ that $\mathbf{c} = \mathbf{a} + \mathbf{b}$ makes with the $+x$ axis is $\theta = \tan^{-1}(\frac{c_y}{c_x}) = \tan^{-1}(\frac{3.28}{2.71}) = 50.4° \approx 50°$.

(**c**) The vector $\mathbf{b} - \mathbf{a}$ is found by adding $-\mathbf{a}$ to $\mathbf{b}$. The result is shown on the diagram to the right. Let $\mathbf{d} = \mathbf{b} - \mathbf{a}$. The components are $d_x = b_x - a_x = -2.29 - 5.00 = -7.29$ (m) and $d_y = b_y - a_y = 3.28$ m. The magnitude of $\mathbf{d}$ is $d = \sqrt{d_x^2 + d_y^2} = 7.99\text{ m} \approx 8.0\text{ m}$.

(**d**) The tangent of the angle $\theta$ that $\mathbf{d}$ makes with the $+x$ axis (east) is $\tan\theta = \frac{d_y}{d_x} = \frac{3.28}{-7.29} = -0.449$.

There are two solutions: $-24.2°$ and $155.8° \approx 156°$. As the diagram shows, the second solution is correct. The vector $\mathbf{d} = \mathbf{b} - \mathbf{a}$ is 24° north of west.