



Advanced Placement Physics

Ch 03A : Solutions to Summer Assignment

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H&R 8e 03-013

Because the point of this problem is algebraic manipulation, diagrams are not necessary.

$$(a) \quad \vec{a} + \vec{b} = (4\hat{i} - 3\hat{j} + \hat{k}) + (-\hat{i} + \hat{j} + 4\hat{k}) = (4-1)\hat{i} + (-3+1)\hat{j} + (1+4)\hat{k}$$
$$\vec{a} + \vec{b} = 3\hat{i} - 2\hat{j} + 5\hat{k}$$

$$(b) \quad \vec{a} - \vec{b} = (4\hat{i} - 3\hat{j} + \hat{k}) - (-\hat{i} + \hat{j} + 4\hat{k}) = (4+1)\hat{i} + (-3-1)\hat{j} + (1-4)\hat{k}$$
$$\vec{a} - \vec{b} = 5\hat{i} - 4\hat{j} - 3\hat{k}$$

(c) Given that $\vec{a} - \vec{b} + \vec{c} = 0$, we see that

$$\vec{c} = \vec{b} - \vec{a} = -(-\vec{b} + \vec{a}) = -(\vec{a} - \vec{b}) = -(5\hat{i} - 4\hat{j} - 3\hat{k}) = \boxed{-5\hat{i} + 4\hat{j} + 3\hat{k}}$$

H&R 8e #03-029

$$\vec{d}_1 + \vec{d}_2 = 5\vec{d}_3 \quad (29.1)$$

$$\vec{d}_1 - \vec{d}_2 = 3\vec{d}_3 \quad (29.2)$$

(a) First, add (29.1) to (29.2) to find

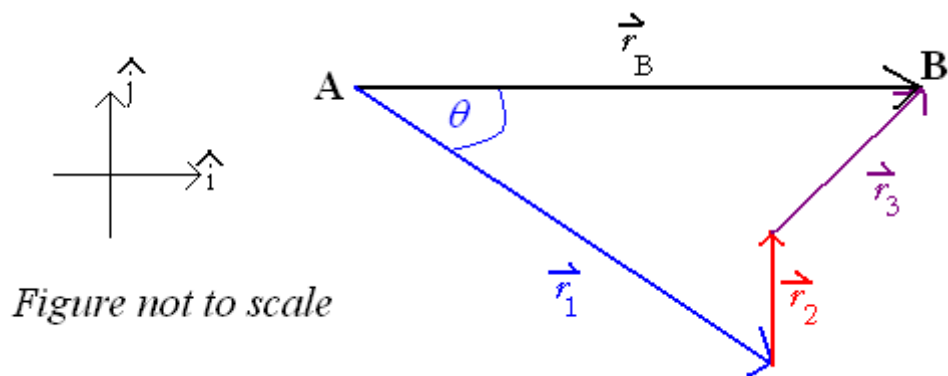
$$2\vec{d}_1 = 8\vec{d}_3$$

$$\text{So... } \vec{d}_1 = 4\vec{d}_3 = 4(2\hat{i} + 4\hat{j}) = 8\hat{i} + 16\hat{j}$$

(b) Likewise, subtract (29.2) from (29.1) to find

$$2\vec{d}_2 = 2\vec{d}_3$$

$$\text{So... } \vec{d}_2 = \vec{d}_3 = 2\hat{i} + 4\hat{j}$$



From the set up of the problem, we have $\vec{r}_B = \vec{r}_1 + \vec{r}_2 + \vec{r}_3$ and the distance we want is $|\vec{r}_3|$. Since they end up at the same point, the paths are (vectorially) equal:

$$\vec{r}_1 + \vec{r}_2 + \vec{r}_3 = \vec{r}_B$$

which can be manipulated to

$$\vec{r}_3 = \vec{r}_B - \vec{r}_1 - \vec{r}_2$$

But the vectors are reasonably easy to get:

$$\vec{r}_B = 25 \text{ km } \hat{i}$$

$$\vec{r}_2 = 8 \text{ km } \hat{j}$$

$$\vec{r}_1 = r_1 (\cos \theta) \hat{i} + r_1 (\sin \theta) (-\hat{j}) = 23.2 \text{ km } \hat{i} - 6.2 \text{ km } \hat{j}$$

Putting it together,

$$\begin{aligned} \vec{r}_3 &= 25 \text{ km } \hat{i} - (23.2 \text{ km } \hat{i} - 6.2 \text{ km } \hat{j}) - 8 \text{ km } \hat{j} = (25 \text{ km} - 23.2 \text{ km}) \hat{i} + (6.2 \text{ km} - 8 \text{ km}) \hat{j} \\ &= 1.8 \text{ km } \hat{i} - 1.8 \text{ km } \hat{j} \end{aligned}$$

(Note that this implies that the drawing is incorrect, as the third vector should be headed in a downward direction. The error turns out to be irrelevant.)

$$r_3 = |\vec{r}_3| = \sqrt{r_{3x}^2 + r_{3y}^2} = \sqrt{(1.8 \text{ km})^2 + (-1.8 \text{ km})^2} = \boxed{2.5 \text{ km}}$$

A “correct” diagram would have looked like the following (but changed nothing):

