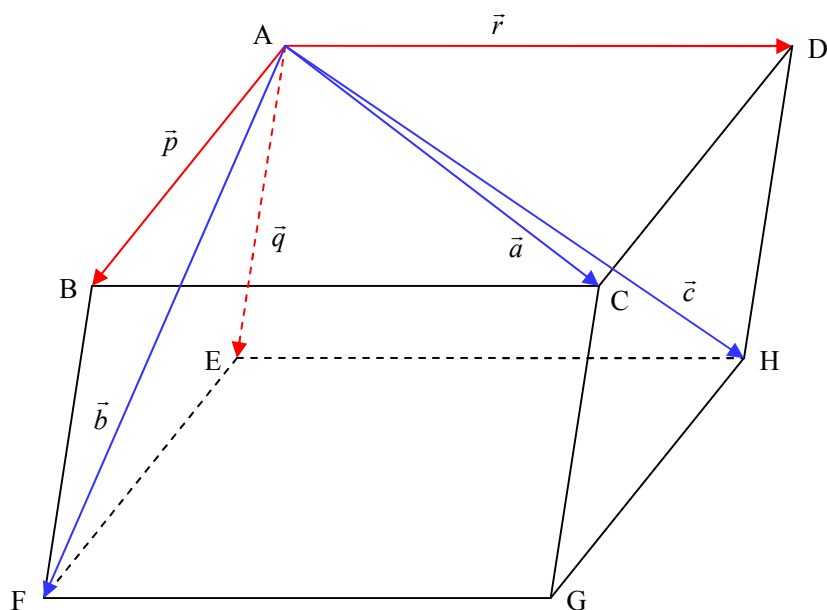


空間のベクトル2 空間のベクトル

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上図のように $\vec{p}, \vec{q}, \vec{r}$ をとると,

$$\overrightarrow{AG} = \vec{p} + \vec{q} + \vec{r} \quad \cdots \textcircled{1}$$

$$\vec{a} = \vec{p} + \vec{r} \quad \cdots \textcircled{2}$$

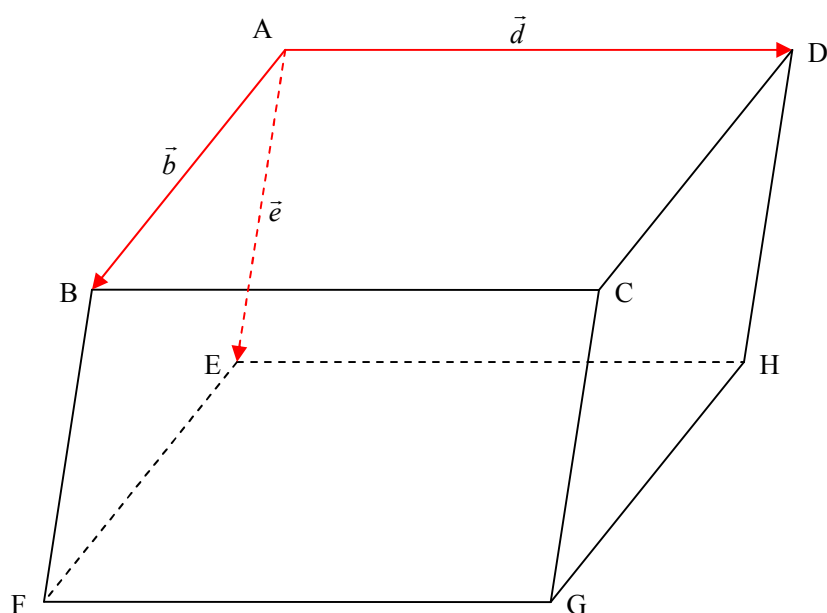
$$\vec{b} = \vec{p} + \vec{q} \quad \cdots \textcircled{3}$$

$$\vec{c} = \vec{q} + \vec{r} \quad \cdots \textcircled{4}$$

$$\textcircled{2} + \textcircled{3} + \textcircled{4} \text{ より, } \vec{a} + \vec{b} + \vec{c} = 2(\vec{p} + \vec{q} + \vec{r}) \quad \therefore \vec{p} + \vec{q} + \vec{r} = \frac{\vec{a} + \vec{b} + \vec{c}}{2}$$

$$\text{ゆえに, } \textcircled{1} \text{ より, } \overrightarrow{AG} = \frac{\vec{a} + \vec{b} + \vec{c}}{2}$$

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(1)

$$\begin{aligned}
 \overrightarrow{AG} - \overrightarrow{BH} &= \overrightarrow{AE} + \overrightarrow{EF} + \overrightarrow{FG} - (\overrightarrow{BF} + \overrightarrow{FG} + \overrightarrow{GH}) \\
 &= \overrightarrow{AE} + \overrightarrow{EF} - \overrightarrow{BF} - \overrightarrow{GH} \\
 &= \vec{e} + \vec{b} - \vec{e} - (-\vec{b}) \\
 &= 2\vec{b}
 \end{aligned}$$

$$\begin{aligned}
 \overrightarrow{DF} - \overrightarrow{CE} &= \overrightarrow{DH} + \overrightarrow{HG} + \overrightarrow{GF} - (\overrightarrow{CG} + \overrightarrow{GF} + \overrightarrow{FE}) \\
 &= \overrightarrow{DH} + \overrightarrow{HG} - \overrightarrow{CG} - \overrightarrow{FE} \\
 &= \vec{e} + \vec{b} - \vec{e} - (-\vec{b}) \\
 &= 2\vec{b}
 \end{aligned}$$

よって, $\overrightarrow{AG} - \overrightarrow{BH} = \overrightarrow{DF} - \overrightarrow{CE}$

(2)

$$\begin{aligned}
 3\overrightarrow{BH} + 2\overrightarrow{DF} &= 3(\overrightarrow{BF} + \overrightarrow{FG} + \overrightarrow{GH}) + 2(\overrightarrow{DH} + \overrightarrow{HG} + \overrightarrow{GF}) \\
 &= 3\{\vec{e} + \vec{d} + (-\vec{b})\} + 2\{\vec{e} + \vec{b} + (-\vec{d})\} \\
 &= -\vec{b} + \vec{d} + 5\vec{e}
 \end{aligned}$$

$$\begin{aligned}
 2\overrightarrow{AG} + 3\overrightarrow{CE} + 2\overrightarrow{BC} &= 2(\overrightarrow{AE} + \overrightarrow{EF} + \overrightarrow{FG}) + 3(\overrightarrow{CG} + \overrightarrow{GF} + \overrightarrow{FE}) + 2\overrightarrow{BC} \\
 &= 2(\vec{e} + \vec{b} + \vec{d}) + 3\{\vec{e} + (-\vec{d}) + (-\vec{b})\} + 2\vec{d} \\
 &= -\vec{b} + \vec{d} + 5\vec{e}
 \end{aligned}$$

よって, $3\overrightarrow{BH} + 2\overrightarrow{DF} = 2\overrightarrow{AG} + 3\overrightarrow{CE} + 2\overrightarrow{BC}$