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- $\text{CO}_2 \text{ (aq)} \rightleftharpoons \text{H}_2\text{CO}_3 \rightleftharpoons \text{HCO}_3^- + \text{H}^+$
- $\text{CO}_2 \text{ (aq)} + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3$
- $\text{CO}_2 \text{ (aq)} + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3 \rightleftharpoons \text{HCO}_3^- + \text{H}^+ \rightleftharpoons \text{CO}_3^{2-} + 2\text{H}^+$ (carbonic acid is a weak diprotic acid)
 $\text{CO}_2 \text{ (aq)} + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3$
 $\text{H}_2\text{CO}_3 \rightleftharpoons \text{HCO}_3^- + \text{H}^+$
 $\text{HCO}_3^- \rightleftharpoons \text{CO}_3^{2-} + \text{H}^+$

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12. $\vec{v} = 2\hat{i} + 3\hat{j} + 4\hat{k}$, $\vec{w} = 3\hat{i} + 4\hat{j} + 5\hat{k}$, $\vec{u} = 4\hat{i} + 5\hat{j} + 6\hat{k}$. Find the scalar triple product $(\vec{v}, \vec{w}, \vec{u})$.

$$(\vec{v}, \vec{w}, \vec{u}) = \begin{vmatrix} 2 & 3 & 4 \\ 3 & 4 & 5 \\ 4 & 5 & 6 \end{vmatrix}$$

$$= 2(24 - 20) - 3(18 - 20) + 4(18 - 16)$$

$$= 2(4) - 3(-2) + 4(2)$$

$$= 8 + 6 + 8$$

$$= 22$$

$$\therefore (\vec{v}, \vec{w}, \vec{u}) = 22$$

$$\vec{v} \cdot (\vec{w} \times \vec{u}) = 22$$

$$\vec{w} \cdot (\vec{u} \times \vec{v}) = 22$$

$$\vec{u} \cdot (\vec{v} \times \vec{w}) = 22 \quad (\text{Since } \vec{v} \cdot (\vec{w} \times \vec{u}) = \vec{w} \cdot (\vec{u} \times \vec{v}) = \vec{u} \cdot (\vec{v} \times \vec{w}))$$

13. Find the area of the triangle formed by the vectors $\vec{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{b} = 3\hat{i} + 4\hat{j} + 5\hat{k}$.

$$\text{Area} = \frac{1}{2} |\vec{a} \times \vec{b}| = \frac{1}{2} \sqrt{(\vec{a} \times \vec{b}) \cdot (\vec{a} \times \vec{b})}$$

$$= \frac{1}{2} \sqrt{(\vec{a} \times \vec{b}) \cdot (\vec{a} \times \vec{b})} = \frac{1}{2} \sqrt{150} = \frac{5\sqrt{6}}{2}$$

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1. $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

2. $\frac{1}{4} \times \frac{1}{5} = \frac{1}{20}$

3. $\frac{1}{6} \times \frac{1}{7} = \frac{1}{42}$

4. $\frac{1}{8} \times \frac{1}{9} = \frac{1}{72}$

5. $\frac{1}{10} \times \frac{1}{11} = \frac{1}{110}$

6. $\frac{1}{12} \times \frac{1}{13} = \frac{1}{156}$

7. $\frac{1}{14} \times \frac{1}{15} = \frac{1}{210}$

/ A B

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