1. Find the unit vector in the direction of $-\mathbf{i}+2\mathbf{j}$. Ans. $-\frac{1}{\sqrt{5}}\mathbf{i}+\frac{2}{\sqrt{5}}\mathbf{j}$	2. Find the unit vector in the direction of $3\mathbf{i}-4\mathbf{j}+12\mathbf{k}$. Ans. $\frac{3}{13}\mathbf{i}-\frac{4}{13}\mathbf{j}+\frac{12}{13}\mathbf{k}$
3. Find the vector with length = 3 and in the same direction as $-\mathbf{i}+2\mathbf{j}$. Ans. $-\frac{3}{\sqrt{5}}\mathbf{i}+\frac{6}{\sqrt{5}}\mathbf{j}$	4. Find the vector with length = 13 which is parallel to $3\mathbf{i}-4\mathbf{j}+12\mathbf{k}$. Ans. $\pm(3\mathbf{i}-4\mathbf{j}+12\mathbf{k})$
5. Let $\mathbf{a}=3\mathbf{i}+4\mathbf{j}$, $\mathbf{b}=-\mathbf{i}+2\mathbf{j}$. Find $\mathbf{a}\cdot\mathbf{b}$. Ans. 5	6. Let $\mathbf{a}=3\mathbf{i}-4\mathbf{j}+12\mathbf{k}$, $\mathbf{b}=2\mathbf{i}+2\mathbf{j}-\mathbf{k}$. Find $\mathbf{a}\cdot\mathbf{b}$. Ans. –14
7. Let $\mathbf{a}=3\mathbf{i}+4\mathbf{j}$, $\mathbf{b}=-\mathbf{i}+2\mathbf{j}$ and θ is the angle between $\mathbf{a}$ and $\mathbf{b}$. Find θ . Ans. 63.4°	8. Let $\mathbf{a}=3\mathbf{i}-4\mathbf{j}+12\mathbf{k}$, $\mathbf{b}=2\mathbf{i}+2\mathbf{j}-\mathbf{k}$ and θ is the angle between $\mathbf{a}$ and $\mathbf{b}$. Find θ . Ans. 111°
9. Let $\mathbf{a}=3\mathbf{i}+4\mathbf{j}$, $\mathbf{b}=-\mathbf{i}+2\mathbf{j}$. Find the length of projection of $\mathbf{b}$ on $\mathbf{a}$. Ans. 1	10. Let $\mathbf{a}=3\mathbf{i}-4\mathbf{j}+12\mathbf{k}$, $\mathbf{b}=2\mathbf{i}+2\mathbf{j}-\mathbf{k}$. Find the length of projection of $\mathbf{b}$ on $\mathbf{a}$. Ans. $\frac{14}{13}$

11. Let $\mathbf{a} = 3\mathbf{i} + 4\mathbf{j}$, $\mathbf{b} = -\mathbf{i} + 2\mathbf{j}$.
Find the projection vector of $\mathbf{b}$ on $\mathbf{a}$.

Ans. $\frac{3}{5}\mathbf{i} + \frac{4}{5}\mathbf{j}$

12. Let $\mathbf{a} = 3\mathbf{i} - 4\mathbf{j} + 12\mathbf{k}$, $\mathbf{b} = 2\mathbf{i} + 2\mathbf{j} - \mathbf{k}$.
Find the projection vector of $\mathbf{a}$ on $\mathbf{b}$.

Ans. $-\frac{28}{9}\mathbf{i} - \frac{28}{9}\mathbf{j} + \frac{14}{9}\mathbf{k}$

13. Let A = (3, 4), B = (–1, 2) .
Let E be a point on OA such that $BE \perp OA$.
Find the vector $\overrightarrow{EB}$.

Ans. $-\frac{8}{5}\mathbf{i} + \frac{6}{5}\mathbf{j}$

14. Let $A = (3, -4, 12)$, $B = (2, 2, -1)$.
Let F be a point on OB such that $AF \perp OB$.
Find the vector $\overrightarrow{AF}$.

Ans. $-\frac{55}{9}\mathbf{i} + \frac{8}{9}\mathbf{j} - \frac{94}{9}\mathbf{k}$

15. Determine whether the following points are collinear. If they are not collinear, determine the shortest distance from C to the line determined by AB. Find the point D on the line AB which is nearest to C.
(a) $A(1, -2, 4)$, $B(5, -8, 6)$, $C(-1, 1, 3)$.
(b) $A(1, -2, 4)$, $B(5, -8, 6)$, $C(0, 1, 3)$.

(a) A, B, C are collinear.

(b) Not collinear, the shortest distance $= \frac{1}{7}\sqrt{35}$, $-\frac{5}{7}\mathbf{i} + \frac{4}{7}\mathbf{j} + \frac{22}{7}\mathbf{k}$