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5. The vector $\mathbf{a} = 5\mathbf{i} + 12\mathbf{j}$.

The magnitude of this vector is given by $|\mathbf{a}|=\sqrt{5^2 + 12^2}=\sqrt{25 + 144} = 13$.

The unit vector in the direction of $\mathbf{a}$ is $\hat{\mathbf{a}}$ where $\hat{\mathbf{a}} = \frac{\mathbf{a}}{|\mathbf{a}|} = \frac{1}{13}\mathbf{a}$

Find the unit vector for each of the following:

a) $\mathbf{a} = 3\mathbf{i} + 4\mathbf{j}$.

b) $\mathbf{b} = \mathbf{i} + \mathbf{j}$.

c) $\mathbf{c} = -\mathbf{i} + \sqrt{3}\mathbf{j}$.

d) $\mathbf{d} = 4\sqrt{5}\mathbf{i} + 8\mathbf{j}$.

Answers:

1) a) 20, b) 22, c) -22, d) -35 e) -2, f) -5

2) a) $\mathbf{p} \cdot \mathbf{q} = 10$

2) b) $cos\theta = \frac{-4}{\sqrt{65}}$

3) $\mu = \frac{119}{24}$

4) a) $\theta = \frac{\pi}{2}$ b) $\theta = \pi$

5) a) $\hat{\mathbf{a}} = \frac{1}{5}(\mathbf{i} + 4\mathbf{j})$

b) $\hat{\mathbf{b}} = \frac{1}{\sqrt{2}}(\mathbf{i} + \mathbf{j})$

b) $\hat{\mathbf{c}} = \frac{1}{2}(-\mathbf{i} + \sqrt{3}\mathbf{j})$

b) $\hat{\mathbf{d}} = \frac{\sqrt{5}}{3}\mathbf{i} + \frac{2}{3}\mathbf{j}$