



6. Let  $q = -\frac{\sqrt{3}}{2} + \frac{1}{2}\mathbf{u}$  be a quaternion, and where  $\mathbf{u}$  is the imaginary unit quaternion  $\mathbf{u} = \frac{\sqrt{2}}{2}(i - k)$ . Find  $q^2$ .

- a)  $\mathbf{u}$                       b)  $-\frac{1}{2} + \frac{1}{2}\mathbf{u}$                       c) 1                      d)  $\frac{1}{2} - \frac{\sqrt{3}}{2}\mathbf{u}$                       e)  $-\frac{1}{2} + \frac{\sqrt{3}}{2}i$

Correct Answer:  $\frac{1}{2} - \frac{\sqrt{3}}{2}\mathbf{u}$

7. Same  $q$  and  $\mathbf{u}$  as in the previous question. Find  $q^3$ .

- a)  $\mathbf{u}$                       b)  $-\frac{1}{2} + \frac{1}{2}\mathbf{u}$                       c) 1                      d)  $-\frac{1}{2} + \frac{\sqrt{3}}{2}\mathbf{u}$                       e)  $-\frac{1}{2} - \frac{\sqrt{3}}{2}i$

Correct Answer:  $\mathbf{u}$

8. Same  $q$  and  $\mathbf{u}$  as in the previous question. Find the quaternion product  $\mathbf{u} \cdot i$ .

- a)  $-\frac{\sqrt{2}}{2}(1 + j)$                       b)  $-\frac{\sqrt{2}}{2}(1 - j)$                       c)  $-\frac{\sqrt{2}}{2}(i - j)$                       d)  $\frac{\sqrt{2}}{2}(i + j)$                       e)  $\frac{\sqrt{2}}{2}(i - k)$

Correct Answer:  $-\frac{\sqrt{2}}{2}(1 + j)$

9. Same  $\mathbf{u}$  as in the previous question. Find  $\mathbf{u} \cdot i + i \cdot \mathbf{u}$ .

- a) 1                      b)  $-\frac{1}{2} + \frac{1}{2}\mathbf{u}$                       c)  $-\sqrt{2}$                       d)  $\sqrt{2}$                       e)  $\sqrt{2}i$

Correct Answer:  $-\sqrt{2}$

10. Let  $V$  be the cross product algebra. Which of the following properties fail in  $V$ ?

- i) Associativity                      ii) Commutativity                      iii) Existence of Multiplicative Identity  
 a) i) and ii) only                      b) i) and iii) only                      c) all of them                      d) ii) and iii) only                      e) i) only

Correct Answer: all of them