# Problem set on Dot Products MM

1. Find the value of α for which (5**i** - 2α**j** + 2**k**) is perpendicular to the vector ( **i** - **j**). (Ans. α = -5/2 )

2. Find all the numbers x for which x**i** +3**j**+**k** is perpendicular to the vector x**i** – 3x**j**+ 20**k.** (Ans. x = 5, 4 )

3. For **a**= 2**i**-**j**-2**k** and **b**=3**i**+2**j** –**k**, calculate the cosine of the angle between the two vectors. (Ans. $\sqrt{14}/28$ )

4. Find all the numbers x for which the angle between **c**= x**i** + 2**j** +2**k** and **d**= 2**i** + x**j** + 2**k** is π/3. (Ans. x = 0, 8 )

5. Find the angle between the vectors 2**i**-3**j**+**k** and -3**i**+**j**+9**k**. (Ans. π/2 )

6. Find $\text{comp}_{\mathbf{b}}\mathbf{a}$ and $\text{proj}_{\mathbf{b}}\mathbf{a}$ given that **a**= 2**i**+3**j**-**k** and **b**= 4**i**-3**j**+**k.**
(Ans. $-\frac{1}{13}\sqrt{26}, -\frac{\sqrt{26}}{13}\ (4\,\mathbf{i} - 3\mathbf{j} + \mathbf{k})$)

7. Find the unit vectors that are perpendicular to both **i**+2**j**+**k** and 3**i**-4**j**+2**k**. (Ans. $\pm\frac{1}{\sqrt{165}}(8\mathbf{i} + \mathbf{j} - 10\mathbf{k})$)

8. Find the area of the parallelogram determined by the vectors **a**= **i**+2**j**+3**k** and **b**= 4**i**-5**j**+2**k** using dot products. (Ans.$\sqrt{630}$ )
(HINT: Refer to the notes of Jan 19 )

9. Find the area of the triangle determined by the points P(1, 2, 3), Q(4, -5, 2), and R(0, 0, 0). (Ans. $\sqrt{630}$ )

10. Use scalar projections to find the distance from a point P(p, q) to the line ax + by + c = 0. (Ans. $\frac{|ap+bq+c|}{\sqrt{a^2+b^2}}$ )