



Further Math with Ali Hashir

Vectors

Further Pure Mathematics 1 – Chapter 6 • Answers

Final answers only. Full step-by-step working, including every vector product, is in the companion *Worked Solutions* booklet.

QUESTIONS 1–7 • Vector products, lines and planes

- 1 (a) $-7\mathbf{i} + 5\mathbf{j} + 13\mathbf{k}$ (b) both scalar products are 0 (c) $\frac{1}{9\sqrt{3}}(-7\mathbf{i} + 5\mathbf{j} + 13\mathbf{k})$
- 2 (a) $3\mathbf{i} - 5\mathbf{j} - 4\mathbf{k}$ (b) $\frac{5}{2}\sqrt{2}$ (c) $\frac{5\sqrt{2}}{3}$
- 3 (a) $\mathbf{r} = 2\mathbf{i} - \mathbf{j} + 3\mathbf{k} + t(3\mathbf{i} + 2\mathbf{j} - 4\mathbf{k})$ (b) yes, at $t = 2$ (c) 56.1°
- 4 (a) $\mathbf{r} \cdot (2\mathbf{i} - \mathbf{j} + 3\mathbf{k}) = 3$; $2x - y + 3z = 3$ (b) $\mathbf{r} = \mathbf{i} + 2\mathbf{j} + \mathbf{k} + \lambda(\mathbf{i} + 2\mathbf{j}) + \mu(3\mathbf{j} + \mathbf{k})$
(c) $x - 3y - 2z = -3$
- 5 (a) $x + z = 3$ (b) $4 + (-1) = 3$ (c) $\frac{5\sqrt{2}}{2}$
- 6 (a) $\mathbf{n} \cdot \mathbf{d} = 0$ and $(1, 2, -1)$ is not in Π ; distance $\frac{6}{\sqrt{19}}$ (b) $(6, 7, 8)$ (c) 9.6°
- 7 (a) 63.6° (b) $\frac{2}{3}$ (c) $(\frac{40}{9}, \frac{7}{9}, -\frac{14}{9})$

QUESTIONS 8–14 • Distances, intersections and angles

- 8 (a) $\sqrt{13}$ (b) $(\frac{5}{3}, \frac{4}{3}, \frac{4}{3})$
- 9 (a) not parallel, and the three equations are inconsistent (b) 80.4° (c) $\frac{6}{\sqrt{35}}$
- 10 (a) $2x - y = 5$ (b) $\frac{7}{\sqrt{5}}$ (c) 75.0°
- 11 (a) 60° (b) $\mathbf{r} = 3\mathbf{i} + \mathbf{j} + t(\mathbf{i} + \mathbf{j} - \mathbf{k})$ (c) $x - y = 2$
- 12 (a) 3 (b) $(3, 1, 0)$ (c) $(2, -1, -2)$ (d) the direction is perpendicular to $\mathbf{n}$ and $(1, 1, 1)$ satisfies the equation
- 13 (a) $a = 4$ (b) $3\mathbf{i} + \mathbf{j} + 2\mathbf{k}$ (c) 74.2° (d) $3x - 4y - 5z = -5$

- 14 (a) not parallel and no intersection (b) $x - y - z = 2$ (c) $2\sqrt{3}$ (d) 54.7°

QUESTIONS 15–20 • Examination-standard problems

- 15 (a) $x + 3y - z = 2$ (b) $\frac{9}{\sqrt{11}}$ (c) 70.1° (d) $\frac{9}{\sqrt{77}}$
- 16 (a) shown (b) $t = 3$ or $t = -3$ (c) $x + y - 2z = 3$ (d) 45°
- 17 (a) $x - 3y - 5z = -2$ (b) $\frac{14}{\sqrt{35}}$ (c) $\frac{12}{5}\mathbf{i} - \frac{1}{5}\mathbf{j} + \mathbf{k}$
- 18 (a) $\sqrt{3}$ (b) $\overrightarrow{OP} = \mathbf{i} + 2\mathbf{j}$, $\overrightarrow{OQ} = 2\mathbf{i} + \mathbf{j} - \mathbf{k}$ (c) $\mathbf{r} = \mathbf{i} + 2\mathbf{j} + t(\mathbf{i} - \mathbf{j} - \mathbf{k})$ (d) $|\overrightarrow{PQ}| = \sqrt{3}$
- 19 (a) $2x - y - z = 3$ (b) $\mathbf{r} = 3\mathbf{i} + 3\mathbf{j} + t(\mathbf{i} + 5\mathbf{j} - 3\mathbf{k})$ (c) $\frac{2}{\sqrt{6}}$ (d) $\frac{4}{\sqrt{6}}$
- 20 (a) $-4\mathbf{i} - 3\mathbf{j} + 5\mathbf{k}$; area $\frac{5}{2}\sqrt{2}$ (b) $4x + 3y - 5z = 5$ (c) $\frac{11\sqrt{2}}{5}$ (d) $\frac{11}{3}$ (e) 75.4°

Step-by-step working for every question is in the companion Worked Solutions booklet.



Instagram: @vectorspacepk

Website: www.vectorspace.pk