Vector equations of curves, lines and planes

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A sample from this topic. The complete topic collection contains three different resources and worked solutions.

Read the worked example, then show each step in the practice questions. Attempt the reasoning and exact calculations by hand. Technology may check a result but cannot replace the written argument.

What you will practise

• Vector and Cartesian equations of curves, lines and planes

Useful starting skills: Specialist and Methods Units 1–2; concurrent or completed Mathematical Methods Units 3–4.

A line through position a with direction d has vector equation r=a+td. A plane through a with independent directions u, v has r=a+su+tv. A nonzero normal n perpendicular to both directions gives n·(r-a)=0.

To compare lines or find intersections, solve their coordinate equations with separate parameters. In three dimensions, two nonparallel lines can be skew: they need not intersect. Verify any candidate point in every equation.

Worked example

Find a vector equation of the line through A=(1, 2, 0) and B=(3, 1, 4).

Subtract A from B to obtain the direction vector

adding its scalar multiples to A traces the line.

Answer: r=(1, 2, 0)+t(2, -1, 4), t real.

Try it yourself

Name: _____ Date: _____

1. Write parametric equations for r=(2, -1, 3)+t(1, 4, -2).

2. Find the plane through (1, 0, 2) with normal (2, -1, 3).

Answers and explanations

Check the method as well as the final answer. An alternative correct method is also valid.

1. $x=2+t$, $y=-1+4t$, $z=3-2t$.

Match each coordinate to the corresponding component.

2. $2x-y+3z=8$.

Use $2(x-1)-y+3(z-2)=0$.

Curriculum reference: Specialist Mathematics Units 3–4 — Vector and Cartesian equations of curves, lines and planes

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