Velocity, acceleration and speed

6 questions | 12 marks

Equivalent correct methods earn the corresponding marks.

1. Find speed for $(3t, 4t)$ m. [2 marks]

Velocity is (3, 4).

Its magnitude is 5.

Answer: 5 m/s.

2. Find velocity and acceleration at 2 for (t^2, t^3). [2 marks]

Velocity is $(2t, 3t^2)$.

Acceleration is (2, 6 t); substitute 2.

Answer: $(4, 12)$ and (2, 12).

3. When is $(t^2 - 2t, t^3 - 3t)$ momentarily at rest? [2 marks]

The first velocity component $2t - 2$ vanishes only at 1.

The second $3t^2 - 3$ also vanishes there.

Answer: t=1.

4. Given velocity (2, 1) and acceleration (-1, 0), find the speed rate. [2 marks]

The dot product is-2.

Divide by speed $\sqrt{5}$; the particle slows down.

Answer: $-2/\sqrt{5}$

5. Find speed for $(\cos 2t, \sin 2t, 3t)$. [2 marks]

Velocity is $(-2\sin 2t, 2\cos 2t, 3)$.

The squared speed is 4+9.

Answer: $\sqrt{13}$

6. Give an example of nonzero constant speed with zero acceleration. [2 marks]

Velocity is the constant vector (3, 4).

Its derivative is zero.

Answer: $(3t, 4t)$ has speed 5 and zero acceleration.