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 $(2, 6t)$; 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: $t = 1$.

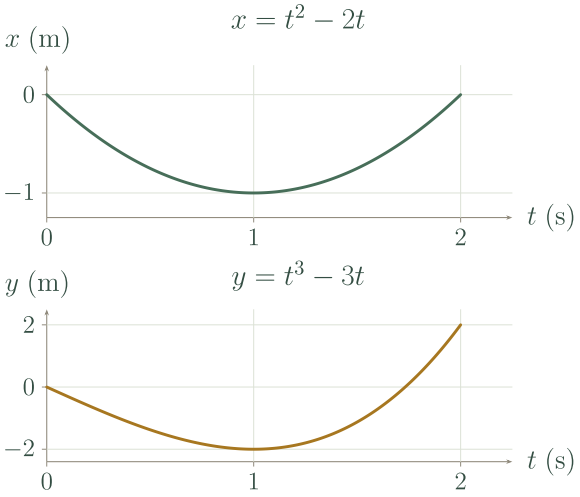


Illustration only: $0 \le t \le 2$.

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: $-\frac{2}{\sqrt{5}}$

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: $\sqrt{13}$

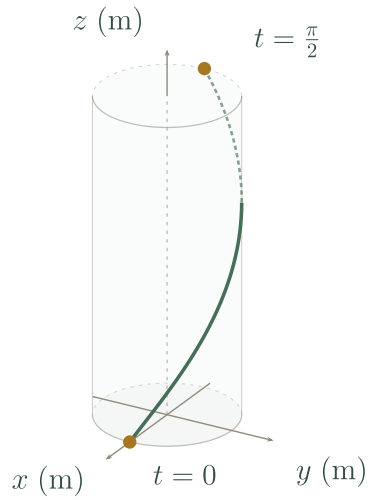


Illustration only: $0 \le t \le \frac{\pi}{2}$.

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.