Polynomially varying coordinates

6 questions | 12 marks

Equivalent correct methods earn the corresponding marks.

1. Eliminate t from $x = t + 2$, $y = t^2 - 1$. [2 marks]

$t = x - 2$.

Substitute into y.

Answer: $y = (x - 2)^2 - 1$

2. Find maximum y for $x = t$, $y = 6t - t^2$, $0 \leq t \leq 6$. [2 marks]

$y' = 6 - 2t = 0$ gives 3.

The endpoints have $y = 0$; the stationary value is 9.

Answer: 9 at $t = 3$.

3. Eliminate t from $x = t^2 - 1$, $y = 2t$. [2 marks]

Use $t = \frac{y}{2}$.

Substitute into x.

Answer: $x = \frac{y^2}{4} - 1$

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

Differentiate each coordinate once.

Differentiate again.

Answer: $(2t, 3 - 3t^2)$ and $(2, -6t)$.

5. For $(t^2, t^2 - 2t)$, find the point where vertical velocity is zero. [2 marks]

$\frac{dy}{dt} = 2t - 2$.

Substitute $t = 1$ into both coordinates.

Answer: At $t = 1$, point $(1, -1)$.

6. For $(t^2, t^3 - t)$, show $t = -1$ and 1 give the same point. [2 marks]

The squared coordinates are both 1.

Both y coordinates are 0.

Answer: Both give $(1, 0)$.