Exercise 1

Paper 1 style · No calculator

1 7 marks SL 5.9 ●○○ Routine

A particle moves along a straight line. Its displacement from a fixed point O, s metres, at time t seconds is $s(t) = 2t^3 - 9t^2 + 12t - 3$, for $t \geq 0$.

(a) Write down the initial displacement of the particle, and find its initial velocity. **[2]**

(b) Find the times at which the particle is at rest. **[2]**

(c) Write down the values of t for which the particle moves in the negative direction. **[1]**

(d) Find the acceleration of the particle when $t = 2$. **[2]**

The markscheme is on the next page: try the question first. Written and verified by a practising IB mathematics teacher, produced with AI assistance; solved twice and recomputed by software. Not affiliated with or endorsed by the International Baccalaureate Organization.
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MARKSCHEME (a)

$s(0) = -3$ m — **A1**

$v(t) = 6t^2 - 18t + 12$, $v(0) = 12\ \text{m s}^{-1}$ — **A1**

Total 2 marks

MARKSCHEME (b)

$6(t-1)(t-2) = 0$ — **M1**

$t = 1$ and $t = 2$ — **A1**

Total 2 marks

MARKSCHEME (c)

$1 < t < 2$ — **A1**

Total 1 mark

Note Where $v(t) < 0$: between the roots of an upward parabola.

MARKSCHEME (d)

$a(t) = 12t - 18$ — **A1**

$a(2) = 6\ \text{m s}^{-2}$ — **A1**

Total 2 marks