Exercise 2

Paper 1 style · No calculator

2 6 marks SL 5.9 ●●○ Typical

A particle moves along a line so that its displacement from O is $s(t) = t^3 - 3t^2$ metres, for $0 \leq t \leq 3$, where t is in seconds.

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

(b) Find the total distance travelled by the particle for $0 \leq t \leq 3$. **[3]**

(c) Find the values of t for which the particle is slowing down. **[1]**

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)

$v(t) = 3t^2 - 6t = 3t(t-2) = 0$ **M1**

$t = 0$ and $t = 2$ **A1**

Total 2 marks

MARKSCHEME (b)

$s(0) = 0,\ s(2) = -4,\ s(3) = 0$ **(M1)**

$|-4 - 0| + |0 - (-4)|$ **M1**

8 m **A1**

Total 3 marks

Note The displacement over the three seconds is 0: it is not the distance.

MARKSCHEME (c)

$1 < t < 2$ **A1**

Total 1 mark

Note $a(t) = 6t - 6$: on $1 < t < 2$, $v < 0$ and $a > 0$, opposite signs.