

2003 Form B AB4

A.

$$a(t) = v'(t) = -e^{1-t}$$

$$a(3) = -e^{-2}$$

B.

$$a(3) < 0$$

$$v(3) = -1 + e^{-2} < 0$$

Since $a(3) < 0$ and $v(3) < 0$ speed is increasing.

C.

$$v(t) = 0$$

$$1 - e^{1-t} = 0$$

$$1 = e^{1-t}$$

$$t = 1$$

$v(t) > 0$ for $t < 1$ and $v(t) < 0$ for $t > 1$

Therefore the particle changes directions at $t = 1$.

D.

$$\begin{aligned} \text{Distance} &= \int_0^3 |v(t)| dt \\ &= \int_0^1 (-1 + e^{1-t}) dt + \int_1^3 (1 - e^{1-t}) dt \\ &= (-t - e^{1-t}) \Big|_0^1 + (t + e^{1-t}) \Big|_1^3 \\ &= (-1 - 1 + e) + (3 + e^{-2} - 1 - 1) \\ &= e + e^{-2} - 1 \end{aligned}$$