

QP35

Problem 2 (4 points) - Drag Race

The time derivative of the acceleration is called “**jerk**”, i.e. $j(t) = \frac{da(t)}{dt}$.

- (a) (1 point) For motion under constant jerk j , derive equations for the acceleration $a(t)$, the velocity $v(t)$, and the position $x(t)$. Use x_0 for the initial position, v_0 for the initial velocity, and a_0 for the initial acceleration.

Two cars start a race at rest. **Car A** accelerates at constant rate a , while **car J** moves with constant jerk j and zero initial acceleration. Part way through the race, at $t = 1$ s, the cars are tied.

- (b) (1 point) In a single graph, sketch $x(t)$ for both **Car A** and **Car J**, and label the curves accordingly.
- (c) (1 point) Who was ahead at $t = 0.5$ s?
- (d) (1 point) Which car will win the race?