

**QP35**

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?