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5. A car travels at a constant speed of $40\,m\,s^{-1}$ in a straight line along a horizontal racetrack. At time $t = 0$, the car passes a motorcyclist who is at rest. The motorcyclist immediately sets off to catch up with the car.

The motorcyclist accelerates at $4\,m\,s^{-2}$ for 15 s and then accelerates at $1\,m\,s^{-2}$ for a further T seconds until he catches up with the car.

(a) Sketch, on the same axes, the speed-time graph for the motion of the car and the speed-time graph for the motion of the motorcyclist, from time $t = 0$ to the instant when the motorcyclist catches up with the car.

(2)

At the instant when $t = t_1$ seconds, the car and the motorcyclist are moving at the same speed.

(b) Find the value of t_1

(2)

(c) Show that $T^2 + kT - 300 = 0$, where k is a constant to be found.

(6)

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