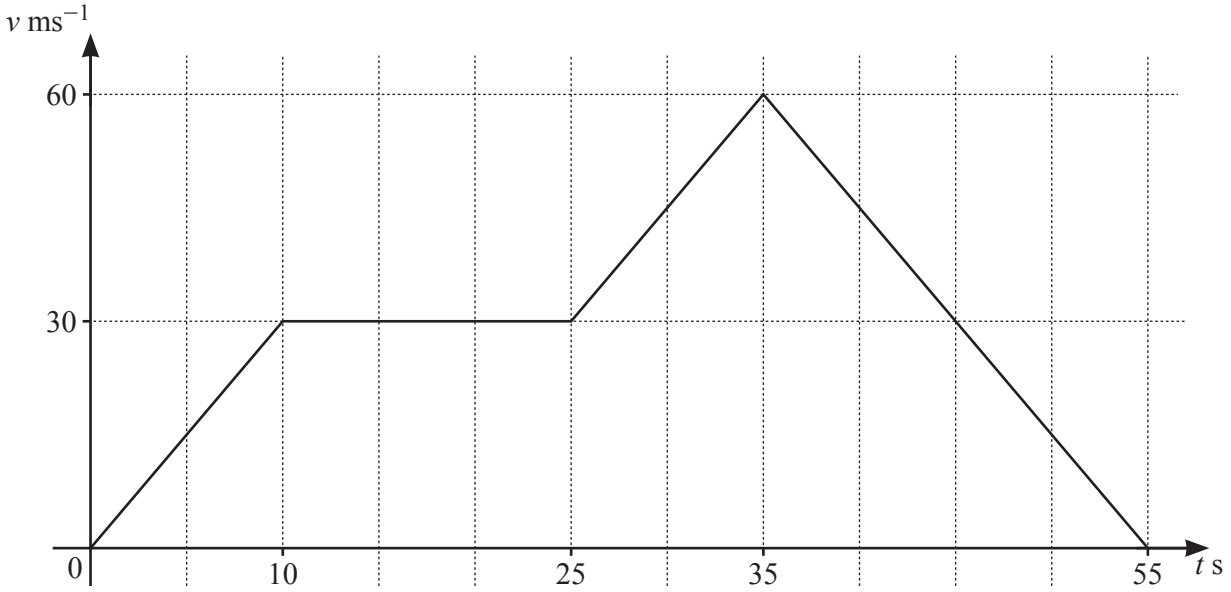
11 (a)



The diagram shows the velocity–time graph for a particle P, travelling in a straight line with velocity $v\,\text{ms}^{-1}$ at a time t seconds. P accelerates at a constant rate for the first 10 s of its motion, and then travels at constant velocity, $30\,\text{ms}^{-1}$, for another 15 s. P then accelerates at a constant rate for a further 10 s and reaches a velocity of $60\,\text{ms}^{-1}$. P then decelerates at a constant rate and comes to rest when $t = 55$.

(i) Find the acceleration when $t = 12$. [1]

(ii) Find the acceleration when $t = 50$. [1]

(iii) Find the total distance travelled by the particle P. [2]

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(b) A particle Q travels in a straight line such that its velocity, $v\,\text{ms}^{-1}$, at time t s after passing through a fixed point O is given by $v = 4\cos 3t - 4$.

(i) Find the speed of Q when $t = \frac{5\pi}{9}$. [2]

(ii) Find the smallest positive value of t for which the acceleration of Q is zero. [3]

(iii) Find an expression for the displacement of Q from O at time t. [2]

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