**1** A body moves in a straight line such that its velocity, *v* m s−1, at time *t* s is given by , *t* ⩾ 0.

**a** Find the initial velocity of the body. **(2 marks)**

**b** Find the value of *t* when the body is instantaneously at rest. **(3 marks)**

**c** Find the greatest speed of the body in the first seven seconds of motion. **(5 marks)**

**2** A particle *P* moves in a straight line. At time *t* s the displacement *s* cm from a fixed point *O* is given by 

Find the distance between the points at which the particle is instantaneously at rest. **(7 marks)**

**3** A particle *P* moves along a straight line. Initially, *P* is at rest at a point *O* on the line. At time *t* s, the velocity of *P* is *v* m s−1, where , 0 ⩽ *t* ⩽ 8.

**a** Sketch a velocity–time graph for the motion of *P*. **(2 marks)**

**b** Find the values of *t* and the corresponding values of *v* when the acceleration of *P* is instantaneously zero. **(5 marks)**

**4** A particle *P* travels in a straight line.

At time *t* s, the displacement of *P* from a point *O* on the line is *s* m. At time *t* s, the acceleration of *P* is (12*t* – 4) m s−2. When *t* = 1, *s* = 2 and when *t* = 3, *s* = 30.

Find the displacement when *t* = 2. **(8 marks)**

**5** A sled is moving down a steep hill in a straight line. At time *t* s, the acceleration of the sled is *a* m s−2 where , 0 ⩽ *t* ⩽ 20. When *t* = 0 the sled is at rest at the top of the hill. Find the distance the sled travels in the first 10 s of its motion. **(5 marks)**

**6** A car starts from the point *A*. At time *t* s after leaving *A*, the distance of the car from *A* is*s*m, where, 0 ⩽ *t* ⩽ 25. The car reaches the point *B* when *t* = 25.

**a** Find the distance *AB*. **(2 mark)**

**b** Show that the car travels with a constant acceleration and state the value of this acceleration. **(3 marks)**

A runner passes through *B* when *t* = 0 with an initial velocity of 2 m s−1 running directly towards *A*. The runner has a constant acceleration of 0.1 m s−2.

**c** Find the distance from *A* at which the runner and the car pass one another. **(8 marks)**