

8MA0 Unit Test

Mechanics – Variable Acceleration

Time allowed: 45 minutes

Centre:

Name:

Teacher:

Question	Points	Score
1	10	
2	7	
3	7	
4	8	
5	5	
6	13	
Total:	50	

How I can achieve better:

-
-
-
-
-
-



1. A body moves in a straight line such that its velocity, $v \text{ ms}^{-1}$, at time $t \text{ s}$ is given by

$$v = -\frac{1}{3}(2t^2 - 9t - 18), \quad t \geq 0.$$

- (a) Find the initial velocity of the body. [2]
- (b) Find the value of t when the body is instantaneously at rest. [3]
- (c) Find the greatest speed of the body in the first seven seconds of motion. [5]

Total: 10



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

$$s = \frac{1}{6} (8t^3 - 105t^2 + 144t + 540).$$

Find the distance between the points at which the particle is instantaneously at rest.

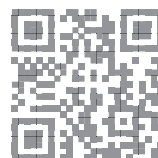


3. A particle P moves along a straight line. Initially, P is at rest at a point O on the line. At time t s, the velocity of P is v ms⁻¹, where

$$v = \frac{1}{20}t(5 - t)^2, \quad 0 \leq t \leq 8.$$

- (a) Sketch a velocity-time graph for the motion of P . [2]
- (b) Find the values of t and the corresponding values of v when the acceleration of P is instantaneously zero. [5]

Total: 7



4. A particle P travels in a straight line.

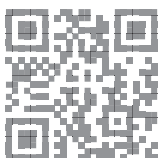
[8]

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 $(12t - 4)$ ms^{-2} .

When $t = 1$, $s = 2$ and when $t = 3$, $s = 30$.

Find the displacement when $t = 2$.



5. A sled is moving down a steep hill in a straight line.

[5]

At time t s, the acceleration of the sled is a ms⁻² where

$$a = \frac{1}{500} (20t^2 - t^3), \quad 0 \leq t \leq 20.$$

When $t = 0$ the sled is at rest at the top of the hill.

Find the distance the sled travels in the first 10s of its motion.



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

$$s = 30t - 0.4t^2, \quad 0 \leq t \leq 25.$$

The car reaches the point B when $t = 25$.

- (a) Find the distance AB . [2]
- (b) Show that the car travels with a constant acceleration and state the value of this acceleration. [3]

A runner passes through B when $t = 0$ with an initial velocity of 2 ms^{-1} running directly towards A . The runner has a constant acceleration of 0.1 ms^{-2} .

- (c) Find the distance from A at which the runner and the car pass one another. [8]

Total: 13

