

## Kinematic relationships

2014 Revised AH

Marks

1. The acceleration of a particle moving in a straight line is described by the expression

$$a = 1.2t.$$

At time,  $t = 0$  s the displacement of the particle is 0 m and its velocity is  $1.4 \text{ m s}^{-1}$ .

- (a) Show that the velocity of the particle at time  $t$  is given by the expression

$$v = 0.6t^2 + 1.4.$$

2

- (b) Calculate the displacement of the particle when its velocity is  $3.8 \text{ m s}^{-1}$ .

3

(5)

2016 CfE AH Physics

A car on a long straight track accelerates from rest. The car's run begins at time  $t = 0$ .

Its velocity  $v$  at time  $t$  is given by the equation

$$v = 0.135t^2 + 1.26t$$

where  $v$  is measured in  $\text{m s}^{-1}$  and  $t$  is measured in s.

Using calculus methods:

- (a) determine the acceleration of the car at  $t = 15.0$  s;

3

*Space for working and answer*

- (b) determine the displacement of the car from its original position at this time.

3

*Space for working and answer*

1. An athlete competes in a one hundred metre race on a flat track, as shown in Figure 1A.



Figure 1A

Starting from rest, the athlete's speed for the first 3.10 seconds of the race can be modelled using the relationship

$$v = 0.4t^2 + 2t$$

where the symbols have their usual meaning.

According to this model:

- (a) determine the speed of the athlete at  $t = 3.10$  s;

2

*Space for working and answer*

- (b) determine, using **calculus** methods, the distance travelled by the athlete in this time.

3

*Space for working and answer*

SQA Exemplar paper

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4

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