IB SL MATHEMATICS

KINEMATICS

NAME: _____ **DATE: _____**

1. The velocity, $\boldsymbol{v}$, in m s^{-1} of a particle moving in a straight line is given by $v = e^{3t-2}$, where t is the time in seconds.

(a) Find the acceleration of the particle at $t = 1$.

(b) At what value of t does the particle have a velocity of 22.3 m s^{-1}?

(c) Find the distance travelled in the first second.

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(Total 6 marks)

2. The velocity v of a particle at time t is given by $v = e^{-2t} + 12t$. The displacement of the particle at time t is s. Given that $s = 2$ when $t = 0$, express s in terms of t.

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(Total 6 marks)

3. The velocity v m s^{-1} of a moving body at time t seconds is given by $v = 50 - 10t$.

(a) Find its acceleration in m s^{-2}.

(b) The initial displacement s is 40 metres. Find an expression for s in terms of t.

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(Total 6 marks)

4. The displacement s metres of a car, t seconds after leaving a fixed point A, is given by

$$s = 10t - 0.5t^2.$$

(a) Calculate the velocity when $t = 0$.

(b) Calculate the value of t when the velocity is zero.

(c) Calculate the displacement of the car from A when the velocity is zero.

(Total 6 marks)

5. A car starts by moving from a fixed point A. Its velocity, v m s^{-1} after t seconds is given by $v = 4t + 5 - 5e^{-t}$. Let d be the displacement from A when $t = 4$.

(a) Write down an integral which represents d.

(b) Calculate the value of d.

(Total 6 marks)

6. In this question, s represents displacement in metres, and t represents time in seconds.

(a) The velocity v m s^{-1} of a moving body may be written as $v = \frac{ds}{dt} = 30 - at$, where a is a constant. Given that $s = 0$ when $t = 0$, find an expression for s in terms of a and t.

(5)

Trains approaching a station start to slow down when they pass a signal which is 200 m from the station.

(b) The velocity of Train 1 t seconds after passing the signal is given by $v = 30 - 5t$.

(i) Write down its velocity as it passes the signal.

(ii) Show that it will stop before reaching the station.

(5)

(c) Train 2 slows down so that it stops at the station. Its velocity is given by $v = \frac{ds}{dt} = 30 - at$, where a is a constant.

(i) Find, in terms of a, the time taken to stop.

(ii) Use your solutions to parts (a) and (c)(i) to find the value of a.

(5)
(Total 15 marks)