

Question 7 (12 marks) Use the Question 7 Writing Booklet.

- (a) The acceleration of a particle is given by

$$\ddot{x} = 4 \cos 2t$$

where x is displacement in metres and t is time in seconds.

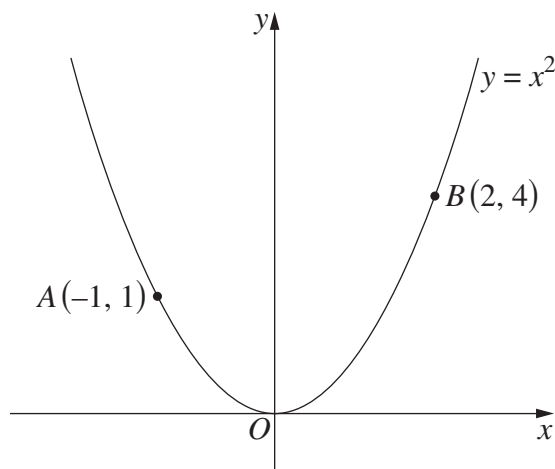
Initially the particle is at the origin with a velocity of 1 m s^{-1} .

- (i) Show that the velocity of the particle is given by 2

$$\dot{x} = 2 \sin 2t + 1.$$

- (ii) Find the time when the particle first comes to rest. 2
- (iii) Find the displacement, x , of the particle in terms of t . 2

- (b) The parabola shown in the diagram is the graph $y = x^2$. The points $A(-1, 1)$ and $B(2, 4)$ are on the parabola.



- (i) Find the equation of the tangent to the parabola at A . 2
- (ii) Let M be the midpoint of AB . 2
 There is a point C on the parabola such that the tangent at C is parallel to AB .
 Show that the line MC is vertical.
- (iii) The tangent at A meets the line MC at T . 2
 Show that the line BT is a tangent to the parabola.