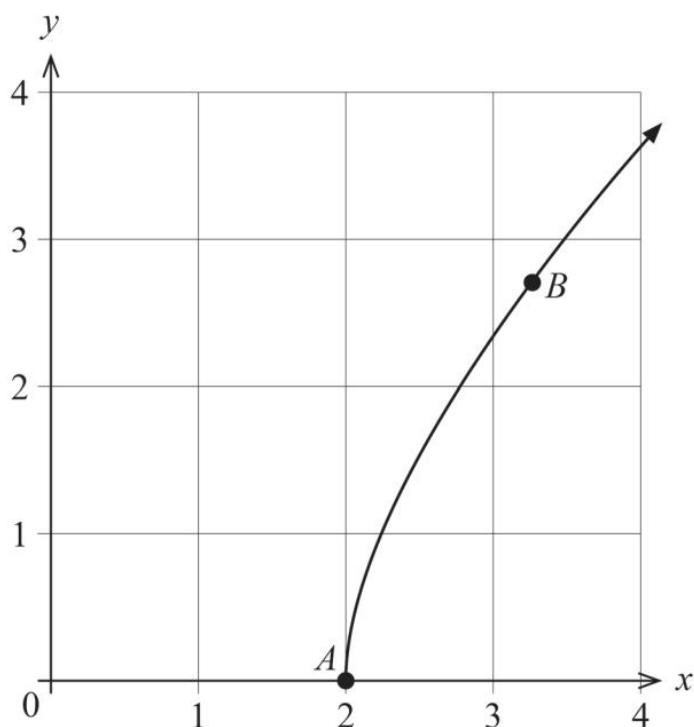


### Question 18

(12 marks)

A drone's position vector is given by  $\underline{r}(t) = \begin{pmatrix} e^t + e^{-t} \\ e^t - e^{-t} \end{pmatrix}$  metres where  $t$  is measured in seconds for  $0 \leq t \leq 5$ . A plot of the path of the drone is shown below.



The drone starts its motion at point  $A$  and is at point  $B$  when  $t = \ln 3$ .

(a) Determine the position vector for point  $B$  exactly. (2 marks)

(b) Determine the velocity vector  $\underline{v}(t)$ . (2 marks)

- (c) Calculate the distance travelled from point  $A$  to point  $B$ , correct to 0.001 metres. (3 marks)
- (d) After 2 seconds of motion, calculate correct to 0.1 degrees, the direction in which the drone is travelling. (2 marks)

(e) Determine the Cartesian equation for the path of the drone.

(3 marks)