

Name: *Solution*

Student Number:

## Problem 1

Find the limit. Show all your work!

$$\lim_{t \rightarrow 0} \frac{e^{2t} - 1}{\sin t}$$

$$\lim_{t \rightarrow 0} e^{2t} - 1 = e^0 - 1 = 1 - 1 = 0$$

$$\lim_{t \rightarrow 0} \sin t = 0$$

} Type  $\frac{0}{0}$ 

$$\lim_{t \rightarrow 0} \frac{e^{2t} - 1}{\sin t} \stackrel{\frac{0}{0}}{=} \lim_{t \rightarrow 0} \frac{2e^{2t}}{\cos t} = \frac{2e^0}{\cos(0)} = 2$$

L'Hospital's rule

## Problem 2

Evaluate the integral

$$\int t^4 \ln t \, dt$$

$$u = \ln t$$

$$dv = t^4 \, dt$$

$$du = \frac{1}{t} \, dt$$

$$v = \frac{t^5}{5}$$

By integration by parts, we get

$$\begin{aligned} \int t^4 \ln t \, dt &= \frac{t^5}{5} \ln t - \int \frac{1}{t} \cdot \frac{t^5}{5} \, dt \\ &= \frac{t^5}{5} \ln t - \frac{1}{5} \int t^4 \, dt \\ &= \frac{t^5}{5} \ln t - \frac{1}{5} \cdot \frac{t^5}{5} + C \end{aligned}$$