Question 2   (7 marks)

Figure 1 shows the graph of $y = f(x)$ where $f(x) = 2xe^{-x^2}$ for $x \geq 0$.

Figure 1

The function $f(x)$ is a probability density function, and hence the area of the region between the graph of $y = f(x)$ and the x-axis for $x \geq 0$ is equal to 1.

(a) State *one* other condition that $f(x)$ must satisfy, given that it is a probability density function.

(1 mark)

(b) Calculate $\Pr(0 \leq X \leq 1)$.

(1 mark)

(c) Find $f'(x)$.

(2 marks)

(d) The 'mode' of the probability density function $f(x)$ is the x-coordinate at which $f(x)$ is at its maximum value.

Using an algebraic approach, find the *exact* value of the mode of $f(x)$.

(3 marks)

PLEASE TURN OVER