Exercise 1 Calc. : ✓

Part 1

Yoghurts are often considered part of a healthy diet. Unfortunately, not all yoghurts are healthy, because flavouring may have harmful additives.
A wholesaler buys yoghurts from two suppliers: 80% from supplier A and 20% from supplier B. 10% of yoghurts from supplier A have flavouring and 20% of those from supplier B also have flavouring.
For the following parts a), b) and c), a yoghurt is chosen at random from the wholesaler's stock.

a) **Determine** the probability that the yoghurt comes from supplier B and has flavouring. — 2 marks

b) **Show** that the probability that the yoghurt has no flavouring is 0.88. — 3 marks

c) Given that the yoghurt has flavouring, **determine** the probability that it comes from supplier B. — 2 marks

d) The wholesaler has a large stock and sells packages of 10 yoghurts selected at random.
Determine the probability that all 10 yoghurts in a package chosen at random have no flavouring. — 3 marks

Part 2

Milk is important for our health because it provides us with nutrients such as protein. A cow produces milk for approximately 10 months after giving birth. Milk production in litres per day from a cow of a certain breed is modelled by the function f defined by:

$$f(t) = -0.00068t^2 + 0.1831t + 24, \quad 0 \leq t \leq 300,$$

where t is the time in days after the cow gives birth.

e) **Determine** $f'(200)$. **Interpret** its meaning in context. — 3 marks

f) **Examine** whether milk production of 40 litres per day is possible for this cow. — 2 marks

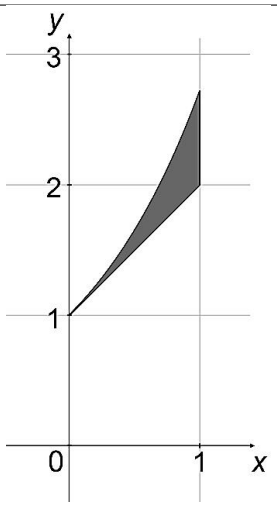
g) **Determine** for how many days milk production exceeds 30 litres per day for this cow. — 4 marks

Part 3

A yoghurt production company has a symbol designed by enclosing a region, shaded in the diagram, between the graphs of the functions g and h and the line $x = 1$, where:

$$g(x) = e^x$$

$$h(x) = x + 1.$$



h) **Show** that the graphs of the functions g and h intersect on the y-axis. 1 mark

One unit on the graph represents 1 metre.

i) **Calculate** in metres the perimeter of the region shaded in the diagram. 3 marks

Give your answer correct to 2 decimal places.

You may use the formula for the arc length L along a graph of f from $x = a$ to $x = b$:

$$L = \int_a^b \sqrt{1 + (f'(x))^2}\, dx.$$

j) **Determine** the area of the region shaded in the diagram in square metres. **Give** your answer correct to 2 decimal places. 2 marks