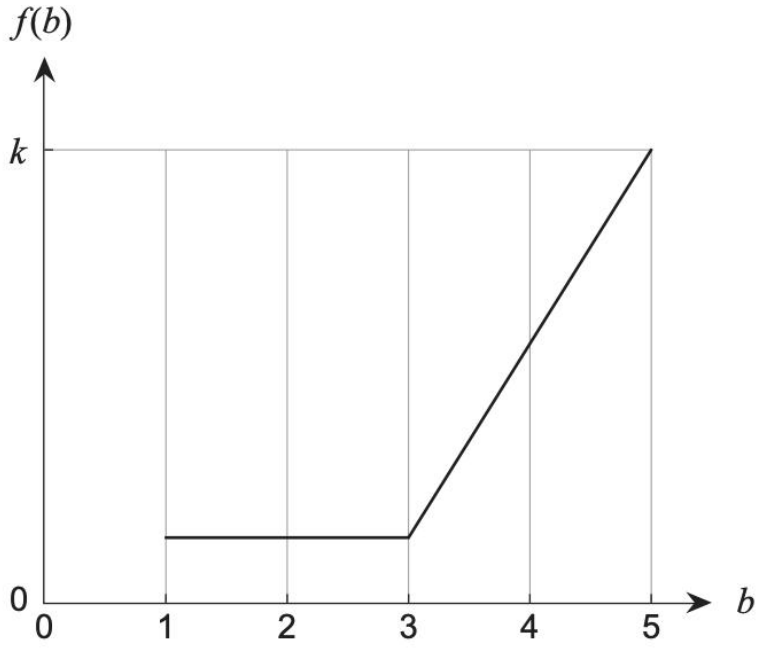
Question 11 **(13 marks)**

Mrs Euler is having her car serviced at BIMDAS Mechanics. She drops her vehicle off at 8 am and is told that her car will be ready for collection at some time between 1 pm and 5 pm that day.

Let the random variable B denote the time after noon (12 pm) at which a vehicle is ready for collection at BIMDAS Mechanics. The probability density function for B is shown in the graph below.



The probability of a vehicle being ready for collection between 2 pm and 3 pm is 0.1.

(a) Determine the value of k. (2 marks)

(b) An incomplete expression for the probability density function of B is given below. Fill in the boxes to complete the missing parts of the expression. (2 marks)

$$f(b) = \begin{cases} 0.1, & \square \\ \square, & 3 \leq b \leq 5 \\ 0, & \text{otherwise} \end{cases}$$

(c) Determine the expected time that Mrs Euler's vehicle will be ready for collection at BIMDAS Mechanics. (3 marks)

Mr Euler is also having his car serviced, but by Addition Autos. He drops his vehicle off at 8 am and is told that his car will be ready for collection at some time between 1 pm and 5 pm that day.

Let the random variable A denote the time after noon (12 pm) that a vehicle is ready for collection at Addition Autos. The cumulative distribution function for A is given by

$$P(A \leq a) = \begin{cases} 0, & a < 1 \\ \dfrac{10a - a^2 - 9}{16}, & 1 \leq a \leq 5 \\ 1, & a > 5 \end{cases}$$

(d) Determine the probability that Mr Euler's vehicle will be ready to collect

(i) by 3 pm. (1 mark)

(ii) between 3 pm and 4 pm. (2 marks)

(e) Determine the expected time at which Mr Euler's vehicle will be ready for collection at Addition Autos. (3 marks)