Question 18 **(17 marks)**

A person climbs a ladder and holds a can of paint as shown in the photograph below.

Position A

The ladder is 2.78 m long from the ground to the roof gutter of the house and rests on the gutter 2.40 m above the ground. The woman stands with her feet 0.500 m above the ground. The ladder has a negligible mass, the woman has a mass of 58.0 kg and the can of paint has a mass of 4.25 kg.

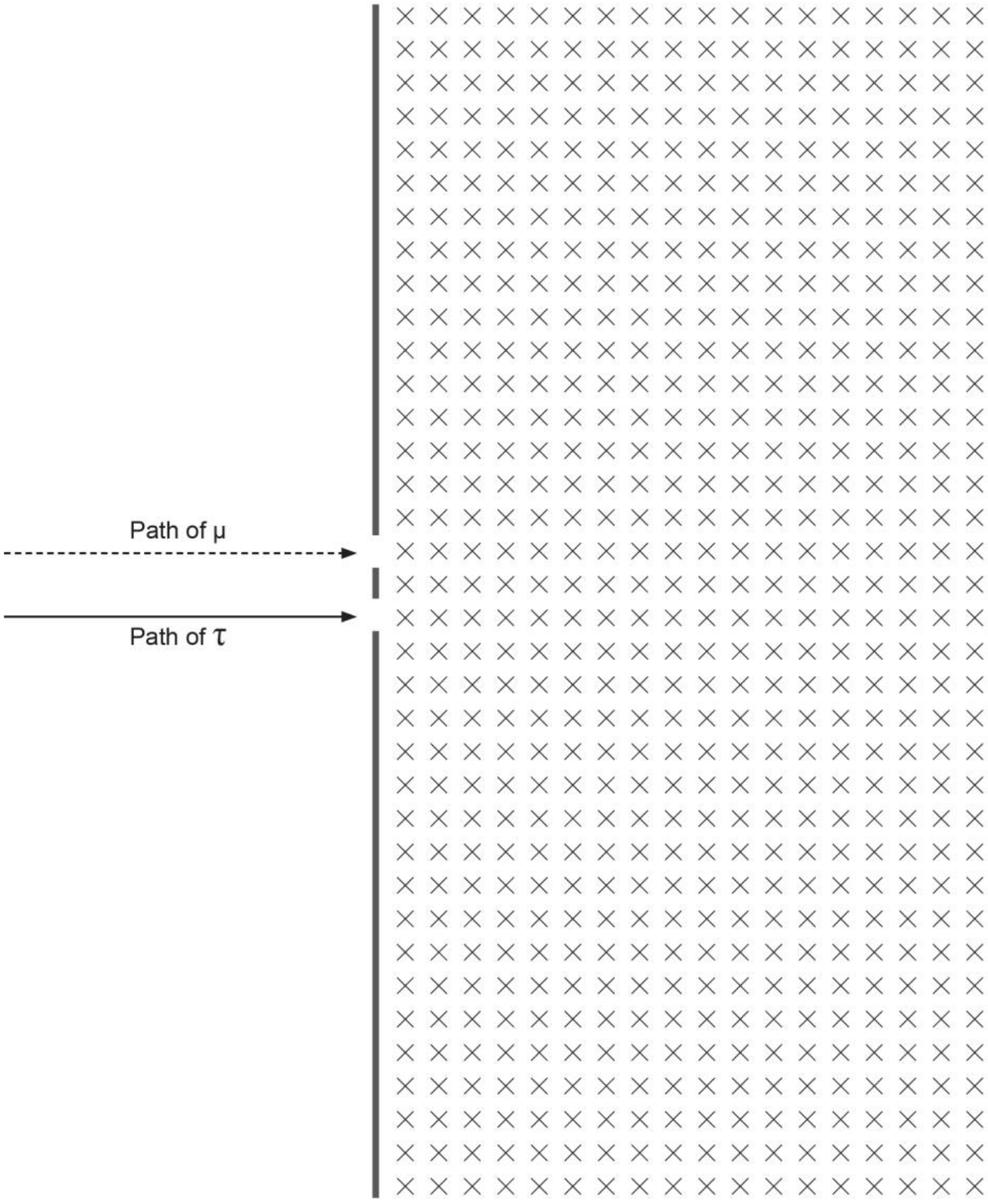
(a) Calculate the force that the roof gutter exerts on the ladder in Position A. Assume that this force acts at a right angle to the ladder. (7 marks)

Position B

(b) Explain how the force exerted on the ladder by the roof gutter changes as the can of paint is moved from Position A to Position B (shown above). (3 marks)

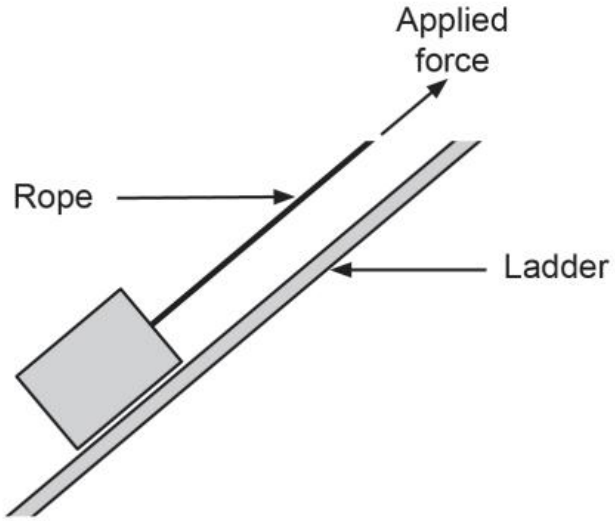
(c) State whether the ladder and person are in equilibrium in Position B. Explain your reasoning. Calculations are **not** required. (4 marks)

(c) Muons and taus are created in a particle accelerator and accelerated to the same velocity. Sketch their paths if the two particles were directed into a magnetic field as shown in the diagram below. (4 marks)



(d) The ladder is then extended to form a 40.0° angle to the ground. The ladder is used as a ramp to pull a 35.1 kg box onto the roof by a rope parallel to the ladder. Calculate the tension in the rope if the box is stationary as shown. Assume that friction is negligible.

(3 marks)



Answer _____ N