A? Problem 1.1 (3 pts)

A thick plate of aluminium alloy, 200 mm wide, contains an edge crack of 60 mm in length. The plate is loaded by a tensile stress perpendicular to the crack plane. The plate fractures in a brittle way at an applied stress of 40 MPa.

(a) Determine the fracture toughness K_{Ic} of the material.

(b) What would be the fracture stress if the plate was wide enough to assume an infinite width?

A? Problem 1.2 (3 pts)

Find the stress intensity factor K_I for an edge crack loaded by a pressure p over a portion b as shown below. Hint: you will have to integrate the solution for a point force.
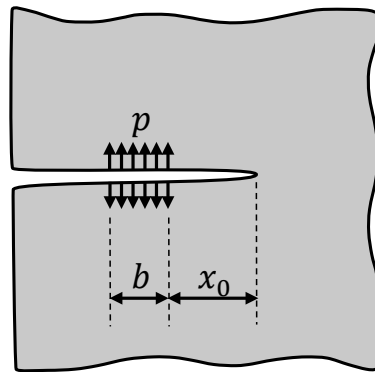
A? Problem 1.3 (4 pts)

A thin polymer plate is fabricated by casting. The process creates a central crack of length $2a = 50$ mm. The plate is then tested by applying a tensile stress σ_∞ in the direction normal to the crack plane.

(a) If the plate failed at a stress $\sigma_\infty = 5$ MPa, evaluate the fracture toughness K_{Ic} of the material.

(b) Another plate is produced from the same material, but this time copper wires are introduced to act as reinforcements. These wires have a 20 mm spacing, and one of them crosses the central crack exactly through the middle. These wires can be assumed to create local forces closing the crack as shown in the figure below (where $P_1 = 50$ kN/m and $P_2 = 30$ kN/m). Determine the value of σ_∞ that will trigger fracture.