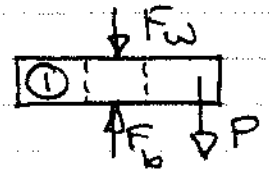
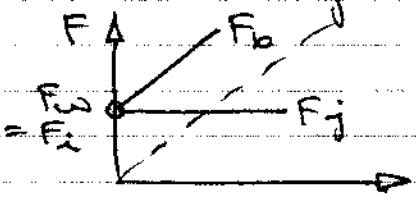
2(a) Since the bolt and I do not deform, the washer's deformation is constant. Its force $F_W$ is therefore also constant, so $F_W = F_i$, its initial value.

For equilibrium of FBD ①

$$F_b = F_W + P = F_i + P$$

while $F_j = F_W \ (= F_i)$



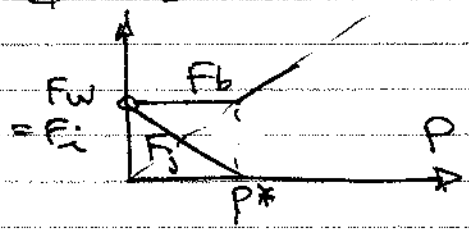

These equations for $F_b$, $F_j$ plot as shown.
Separation is impossible.

(b) If contact between 1 and 2 is maintained then the washer will not deform — so again its force is constant, and $F_W = F_i$

For equilibrium

$$F_j = F_W - P = F_i - P$$

& $$F_b = F_W = F_i$$


The plot of these equations demonstrates the reverse of (a) — now $F_b$ is const. and $F_j$ varies with P.

When $F_j$ is zero, at separation: $P^* = F_i$

The behaviours of (a) & (b) are limiting cases of the behaviour described by equations (3a)

From the $F_b$ equations with $F_i = 10$, $P = 2$ kN

(a) $F_b = F_i + P = 12$ kN

(b) $F_b = F_i = 10$ kN.