[mex87] Determine canonicity and generating functions I

Consider the following transformation from a set of canonical coordinates (q, p) to a new set of coordinates (Q, P):

$$Q = \ln\left(\frac{\sin p}{q}\right), \qquad P = q\cot p.$$

(a) Verify that this transformation is canonical by investigating its Jacobian determinant. (b) Determine the generating function $F_3(p, Q)$ by integration of the total differential dF_3. (c) Determine the generating function $F_2(q, P)$ from $F_3(p, Q)$.

Solution: