```
(* PossionBracket
 Here "a" and "b" are the test quantities and
      "q" and "p" are canonical variables
*)
PossionBracket[a_, b_, q_, p_] :=
 Sum[(∂q[[i]] a) (∂p[[i]] b) - (∂p[[i]] a) (∂q[[i]] b), {i, 1, Length[q]}]
```

In[3]:=
```
(* Some test examples *)
(* Example 1 *)
PossionBracket[x, p, {x}, {p}]
```

Out[3]= 1

In[4]:=
```
(* Example 2 *)
PossionBracket[x, x, {x}, {p}]
```

Out[4]= 0

In[5]:=
```
(* Example 3 *)
PossionBracket[p, p, {x}, {p}]
```

Out[5]= 0

In[6]:=
```
(* Example 4 *)
PossionBracket[p, x, {x}, {p}]
```

Out[6]= -1

```
(* Example 5 *)
PossionBracket[α[x, p], β[x, p],  {x},  {p}]
```

Out[8]= $\beta^{(0,1)}[x, p]\, \alpha^{(1,0)}[x, p] - \alpha^{(0,1)}[x, p]\, \beta^{(1,0)}[x, p]$

```
(* Example 6
   Jacobi's identity
    [a,[b,g]] + [b,[g,a]] + [g,[a,b]] = 0
*)
Simplify[PossionBracket[α[x, p], PossionBracket[β[x, p], γ[x, p], {x}, {p}], {x}, {p}] +
  PossionBracket[β[x, p], PossionBracket[γ[x, p], α[x, p], {x}, {p}], {x}, {p}] +
  PossionBracket[γ[x, p], PossionBracket[α[x, p], β[x, p], {x}, {p}], {x}, {p}]]

0

(* Canonical Transformation *)

(* Example 1 *)
Q = (2 q) ^ (1 / 2) Cos[p];
P = (2 q) ^ (1 / 2) Sin[p];
If[(Simplify[PossionBracket[Q, P, {q}, {p}]] == 1),
 Print["Transformation is canonical"], Print["Transformation is not canonical"]]
```

```
Transformation is canonical
```

In[32]:=
```
(* Example 2 *)
Q = Log[(1 / q) Sin[p]];
P = q Cot[p];
If[(Simplify[PossionBracket[Q, P, {q}, {p}]] == 1),
 Print["Transformation is canonical"], Print["Transformation is not canonical"]]
```
```
Transformation is canonical
```

In[35]:=
```
(* Example 3 *)
Q = ArcTan[α q / p];
P = (α q^2 / 2) (1 + (p / (α q))^2);
If[(Simplify[PossionBracket[Q, P, {q}, {p}]] == 1),
 Print["Transformation is canonical"], Print["Transformation is not canonical"]]
```
```
Transformation is canonical
```

In[41]:=
```
(* Example 4 *)
Q = Log[1 + Sqrt[q] Cos[p]];
P = 2 (1 + Sqrt[q] Cos[p]) Sqrt[q] Sin[p];
If[(Simplify[PossionBracket[Q, P, {q}, {p}]] == 1),
 Print["Transformation is canonical"], Print["Transformation is not canonical"]]
```
```
Transformation is canonical
```

In[44]:=
```
(* Example 5 *)
Q1 = q1;
P1 = p1 - 2 p2;
Q2 = p2;
P2 = -2 q1 - q2;
PossionBracket[Q1, P1, {q1, q2}, {p1, p2}]
```
Out[48]= 1

In[49]:=
```
PossionBracket[Q2, P2, {q1, q2}, {p1, p2}]
```
Out[49]= 1

In[50]:=
```
PossionBracket[Q1, Q2, {q1, q2}, {p1, p2}]
```
Out[50]= 0

In[51]:=
```
PossionBracket[P1, P2, {q1, q2}, {p1, p2}]
```
Out[51]= 0

In[52]:=
```
PossionBracket[Q1, P2, {q1, q2}, {p1, p2}]
```
Out[52]= 0

In[53]:=
```
PossionBracket[Q2, P1, {q1, q2}, {p1, p2}]
```
Out[53]= 0

```
(* This means Transformation is canonical *)
```