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Θ[K_] := Θ[K] = Module[{{X, ϕ, n, A, Δ, G, ev, θ}},
  {X, ϕ} = Rot[K]; n = Length[X];
  A = IdentityMatrix[2 n + 1];
  Cases[X, {s_, i_, j_} :>
    (A[[{i, j}, {i + 1, j + 1}]] += (
      
$$\begin{pmatrix} -T^s & T^s - 1 \\ \theta & -1 \end{pmatrix}$$

    ))];
  Δ = T^(-Total[ϕ] - Total[X[[All, 1]]]) / 2 Det[A];
  G = Inverse[A];
  ev[ε_] := Factor[ε /. gv_, α_, β_ :> (G[[α, β]] /. T → Tv)];
  θ = ev[Σk=1n F1[X[[k]]]];
  θ += ev[Σk1=1n Σk2=1n F2[X[[k1]], X[[k2]]]];
  θ += ev[Σk=12 n F3[ϕ[[k]], k]];
  Factor@{Δ, (Δ /. T → T1) (Δ /. T → T2) (Δ /. T → T3) θ}
];

```