Brute Force 1 Example

```
> restart
```

Element Equations

```
> OhmR1 := v1 = i1·R1 :
> OhmR2 := v2 = i2·R2 :
```

KCL Equations (Third one not used)

```
> KCLna := -ia + i1 + i2 = 0 :
> KCLnb := -i2 + ib = 0 :
> KCLnc := ia - i1 - ib = 0 :
```

KVL Equations

```
> KVLl1 := -va + v1 = 0 :
> KVLl2 := -v1 + v2 + vb = 0 :
```

Symbolically Solve

```
> MySoln := simplify(expand(solve({OhmR1, OhmR2, KCLna, KCLnb, KCLnc, KVLl1,
      KVLl2}, [i1, i2, ib, v1, v2, va])))
```

$$MySoln := \left[\left[i1 = \frac{R2\,ia + vb}{R1 + R2},\ i2 = \frac{R1\,ia - vb}{R1 + R2},\ ib = \frac{R1\,ia - vb}{R1 + R2},\ v1 = \frac{R1\,(R2\,ia + vb)}{R1 + R2},\ v2 = \frac{R2\,(R1\,ia - vb)}{R1 + R2},\ va = \frac{R1\,(R2\,ia + vb)}{R1 + R2} \right]\right] \quad (1)$$

Define and Substitute Numerical Values

```
> Vals := R1 = 1000 ⟦Ω⟧, R2 = 2.2e3 ⟦Ω⟧, ia = 5e-3 ⟦A⟧, vb = 12 ⟦V⟧
```

$$Vals := R1 = 1000\ ⟦\Omega⟧,\ R2 = 2200.\ ⟦\Omega⟧,\ ia = 0.005\ ⟦A⟧,\ vb = 12\ ⟦V⟧ \quad (2)$$

```
> MyNumSoln := subs(Vals, MySoln)
```

$$MyNumSoln := \left[\left[i1 = \frac{0.0003125000000\ (11.0\ ⟦\Omega⟧\ ⟦A⟧ + 12\ ⟦V⟧)}{⟦\Omega⟧},\ i2 = \frac{0.0003125000000\ (5.000\ ⟦\Omega⟧\ ⟦A⟧ - 12\ ⟦V⟧)}{⟦\Omega⟧},\ ib = \frac{0.0003125000000\ (5.000\ ⟦\Omega⟧\ ⟦A⟧ - 12\ ⟦V⟧)}{⟦\Omega⟧},\ v1 = 3.437500000\ ⟦\Omega⟧\ ⟦A⟧ + 3.750000000\ ⟦V⟧,\ v2 = 3.437500000\ ⟦\Omega⟧\ ⟦A⟧ - 8.250000000\ ⟦V⟧,\ va = 3.437500000\ ⟦\Omega⟧\ ⟦A⟧ + 3.750000000\ ⟦V⟧\right]\right] \quad (3)$$

```
> evalf[4](simplify(MyNumSoln))
```

$$[[i1 = 0.007188\ ⟦A⟧,\ i2 = -0.002188\ ⟦A⟧,\ ib = -0.002188\ ⟦A⟧,\ v1 = 7.188\ ⟦V⟧,\ v2 = -4.812\ ⟦V⟧,\ va = 7.188\ ⟦V⟧]] \quad (4)$$

Define Auxiliary Equations

```
> AuxEqn := [pdelia = va·ia, pdelvb = -vb·ib, pabsR1 = v1·i1, pabsR2 = v2·i2, ] :
```

```
> MySoln[1][ ]
```

$$i1 = \frac{R2\,ia + vb}{R1 + R2},\ i2 = \frac{R1\,ia - vb}{R1 + R2},\ ib = \frac{R1\,ia - vb}{R1 + R2},\ v1 = \frac{R1\,(R2\,ia + vb)}{R1 + R2},\ v2 = \frac{R2\,(R1\,ia - vb)}{R1 + R2},\ va = \frac{R1\,(R2\,ia + vb)}{R1 + R2} \quad (5)$$

Substitute in Symbolic Solutions to Auxiliary Variables

> $MyFinalAnswer := subs(MySoln[1][\ ], AuxEqn)$

$$MyFinalAnswer := \left[pdelia = \frac{R1\,(R2\,ia + vb)\,ia}{R1 + R2},\ pdelvb = -\frac{vb\,(R1\,ia - vb)}{R1 + R2},\right. \tag{6}$$

$$\left. pabsR1 = \frac{R1\,(R2\,ia + vb)^2}{(R1 + R2)^2},\ pabsR2 = \frac{R2\,(R1\,ia - vb)^2}{(R1 + R2)^2} \right]$$

Substitute in Symbolic Solutions then Numerical Values to Auxiliary Variables

> $MyFinalNumAnswer := subs(MySoln[1][\ ], Vals, AuxEqn)$

$$MyFinalNumAnswer := \left[pdelia = 0.001562500000\,(11.0\,[\![\Omega]\!]\,[\![A]\!] + 12\,[\![V]\!])\,[\![A]\!],\ pdelvb = \right. \tag{7}$$

$$-\frac{0.003750000000\,[\![V]\!]\,(5.000\,[\![\Omega]\!]\,[\![A]\!] - 12\,[\![V]\!])}{[\![\Omega]\!]},\ pabsR1$$

$$= \frac{0.00009765625000\,(11.0\,[\![\Omega]\!]\,[\![A]\!] + 12\,[\![V]\!])^2}{[\![\Omega]\!]},\ pabsR2$$

$$\left. = \frac{0.0002148437500\,(5.000\,[\![\Omega]\!]\,[\![A]\!] - 12\,[\![V]\!])^2}{[\![\Omega]\!]} \right]$$

> $evalf[4](simplify(MyFinalNumAnswer))$

$$[pdelia = 0.03593\,[\![W]\!],\ pdelvb = 0.02625\,[\![W]\!],\ pabsR1 = 0.05166\,[\![W]\!],\ pabsR2 = 0.01053\,[\![W]\!]] \tag{8}$$

>