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RANKA

$\dim N(A^T) = m - r$

$\#\text{loops} = \#\text{edges} - (\#\text{nodes} - 1)$

$(\text{rank} = n-1)$

$\#\text{nodes} - \#\text{edges} + \#\text{loops} = 1$

0D 1D 2D

↳ Euler's formula

Ex:

$5 - 7 + 3 = 1$

Steps: Matrix A

Potential $e = Ax$

potential diff $\xrightarrow[\text{OHM's LAW}]{y = Ce}$ current on edges $(y_1, y_2, y_3, y_4, y_5)$

$A^T y = f$ Kirchoff's

A^T

So

$A^T (C(Ax)) = f$