The third of these can be written as (a, b, d, and f here are row vectors and c_1 and c_2 are any scalars):

$$\det \begin{bmatrix} c_1 a + c_2 b \\ c \\ \vdots \\ f \end{bmatrix} = c_1 \det \begin{bmatrix} a \\ c \\ \vdots \\ f \end{bmatrix} + c_2 \det \begin{bmatrix} b \\ c \\ \vdots \\ f \end{bmatrix}$$

We show now how these three properties lead to an actual formula for the determinant. We do this by establishing a series of addition properties that follow from these three.

PROP 4: If two rows of A are the same, then $\det A = 0$.
Proof: By DEF PROP 2 we must have $\det A = -\det A$, and so $\det A = 0$.