VOL 10

Vector Solution of two Simultaneous Equations:

Given

(1) $a \cdot r = m$

(2) $b \cdot r = n$

Find r

From (1) and (2) we get

(3) $(na - mb) \cdot r = 0$

and in general

(4) $K \cdot r = 0$

where K is the unit normal to the plane in which r, a, and b lie.

From (3) and (4)

(5) $r' = (K \times (na - mb))'$

From (1) $r_0 = m / a \cdot r' = m / a \cdot (K \times (na - mb))'$

(6) $r = r_0 r' = (m / a \cdot (K \times (na - mb))') (K \times (na - mb))'$

(7) $r = (m / a \cdot (K \times (na - mb))) (K \times (na - mb))$ *

Now $a\cdot(k\times(na-mb)) = na\cdot(k\times a) - ma\cdot(k\times b) = 0 - ma\cdot(k\times b)$

$= -ma\cdot(k\times b) = mk\cdot(a\times b)$

(8) $r = (k\times(na-mb))/k\cdot(a\times b)$ *

$= (nA - mB)/(a\times b)_3$

when $A_3 = a_3$, $B_3 = b_3$ and $A\cdot a = 0$ and $B\cdot b = 0$

When

$a = a_1 i + a_2 j$

$b = b_1 i + b_2 j$

Equation (8) takes the form

(9) $r = (-(na_2 - mb_2)i + (na_1 - mb_1)j)/(a_1 b_2 - a_2 b_1)$ *

Forms (8) and (9) as solutions of (1) and (2) are most important for plane geometry.
Take a good long look at them. It will pay dividends.