

Finding A Matrix (May 12-75)

Given two vectors a and b
and

$$(1) \quad \varphi \cdot a = b$$

Find φ

take any convenient third
vector c and write the above

$$(2) \quad \varphi = (b \cdot c) / a \cdot c.$$

To prove it:

$$\varphi \cdot a = (b \cdot c) \cdot a / a \cdot c = b (c \cdot a) / a \cdot c = b.$$

We give a couple or so of examples

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$$a = 1 + 3 + 2$$

$$b = 2 + 4 + 5$$

$$c = 1 + 1 + 1$$

$$(bc) = (2 + 4 + 5)(1 + 1 + 1) = \begin{array}{l} 2 + 2 + 2 \\ 4 + 4 + 4 \\ 5 + 5 + 5 \end{array}$$

$$a \cdot c = 6$$

$$\varphi = (1/6) \left| \begin{array}{l} 2 + 2 + 2 \\ 4 + 4 + 4 \\ 5 + 5 + 5 \end{array} \right|$$

$$\varphi \cdot a = \frac{1}{6} \left| \begin{array}{l} 2 + 2 + 2 \\ 4 + 4 + 4 \\ 5 + 5 + 5 \end{array} \right| \left| \begin{array}{l} 1 \\ 3 \\ 2 \end{array} \right| = \frac{1}{6} \left| \begin{array}{l} 12 \\ 24 \\ 30 \end{array} \right| \left| \begin{array}{l} 2 \\ 4 \\ 5 \end{array} \right| = 6$$

Example 2

$$a = 3 + 1 + 2 + 4$$

$$b = 1 + 4 + 3 + 5$$

$$c = 1 + 1 + 1 + 1$$

$$(bc) = \begin{array}{l} 1 + 1 + 1 + 1 \\ 4 + 4 + 4 + 4 \\ 3 + 3 + 3 + 3 \\ 5 + 5 + 5 + 5 \end{array} \quad a \cdot c = 10$$

$$\varphi = (1/10) \left| \begin{array}{l} 1 + 1 + 1 + 1 \\ 4 + 4 + 4 + 4 \\ 3 + 3 + 3 + 3 \\ 5 + 5 + 5 + 5 \end{array} \right|$$

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$$\varphi \cdot a = (1/10) \left| \begin{array}{ccc|c} 1+1+1+1 & 3 & 10 & 1 \\ 4+4+4+4 & 1 & 40 & 4 \\ 3+3+3+3 & 2 & 30 & 3 \\ 5+5+5+5 & 4 & 50 & 5 \end{array} \right| = b$$

Example 3

$$a = 1 + 1 + 2$$

$$b = 1 + 5$$

$$c = 1 + 1 + 1$$

$$b \cdot c = \frac{1}{5} + \frac{1}{5} + \frac{1}{5}$$

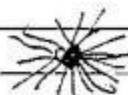
$$a \cdot c = 2$$

$$\varphi = (1/2) \left| \begin{array}{ccc|c} 1+1+1 & 1 & 2 & 1 \\ 5+5+5 & 1 & 10 & 5 \end{array} \right|$$

$$\varphi \cdot a = (1/2) \left| \begin{array}{ccc|c} 1+1+1 & 1 & 2 & 1 \\ 5+5+5 & 1 & 10 & 5 \end{array} \right| = b$$

The formula

$$\varphi = (b \cdot c) / a \cdot c$$



is true for all dimensions

$$\varphi \cdot a = b$$