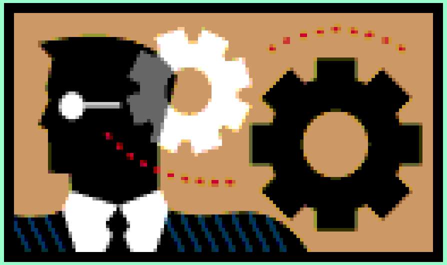
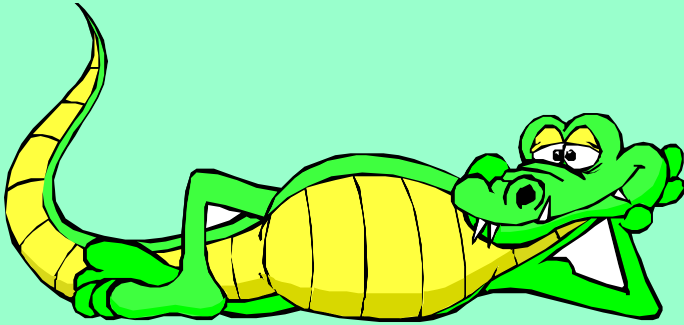
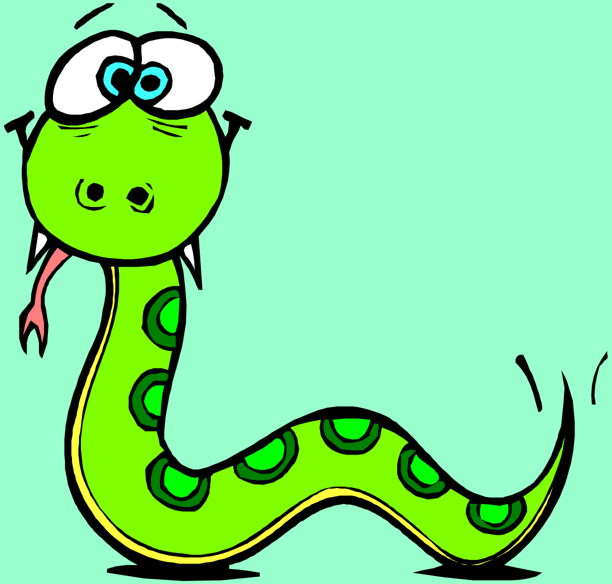




13.

Properties of the scalar product



Properties of Scalar Product

The distributive law

Recall from previous work that:

$$a(b+c) = ab + ac$$

This is known as the distributive law and it also applies to vectors:

$$a \cdot (b+c) = a \cdot b + a \cdot c$$

Self Dot Product

The angle between a vector & itself is 0 so $\cos\theta = 1$

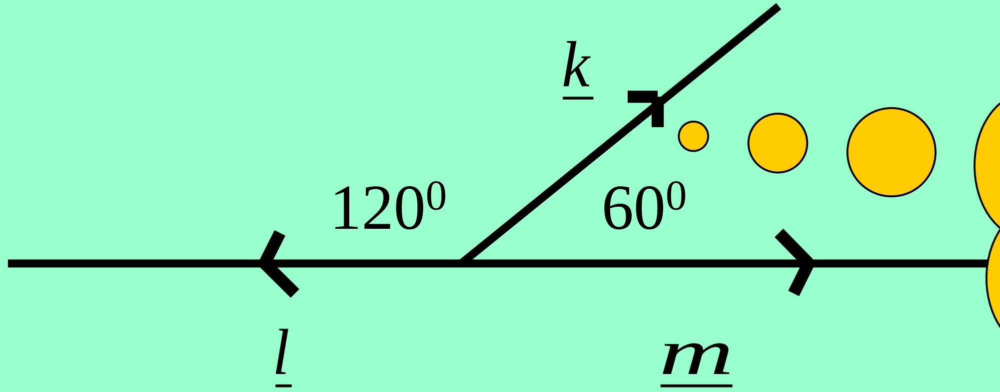
This means that

a.a = |a||a|cosθ **becomes**

$$\underline{\mathbf{a}}.\underline{\mathbf{a}} = |\underline{\mathbf{a}}|^2$$

Example 1

Calculate $k \cdot (l + m)$ when $|k| = 5,\ |l| = 3\ and\ |m| = 4$



Make sure both vectors **point away** from vertex

Solution:

$$k \cdot (l + m) = k \cdot l + k \cdot m = -\frac{15}{2} + \frac{20}{2} = \frac{5}{2}$$

$$k \cdot l = |k||l| \cos 120^0 = 5 \times 3 \times (-\tfrac{1}{2}) = -\frac{15}{2}$$

$$k \cdot m = |k||m| \cos 60^0 = 5 \times 4 \times (\tfrac{1}{2}) = \frac{20}{2}$$

Heinemann , p.257, EX 13U, Q1 & 4

This is not the end

Example 2

If $\underline{p} = \begin{pmatrix} 3 \\ 1 \\ 2 \end{pmatrix}$, $\underline{q} = \begin{pmatrix} 2 \\ -1 \\ 0 \end{pmatrix}$ *and* $\underline{r} = 3\underline{i} - 2\underline{j} + 4\underline{k}$ find $r \cdot (p - q)$

Solution:

$r \cdot (p - q) = r \cdot p - r \cdot q$ = 15 - 8 **= 7**

$r \cdot p = \begin{pmatrix} 3 \\ -2 \\ 4 \end{pmatrix} \times \begin{pmatrix} 3 \\ 1 \\ 2 \end{pmatrix} = 9 + (-2) + 8$ = 15

$r \cdot q = \begin{pmatrix} 3 \\ -2 \\ 4 \end{pmatrix} \times \begin{pmatrix} 2 \\ -1 \\ 0 \end{pmatrix} = 6 + 2 + 0$ = 8

Heinemann , p257, EX 13U, Q2 & 5