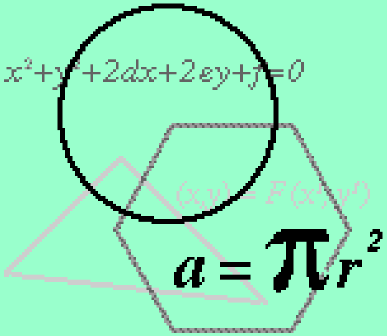
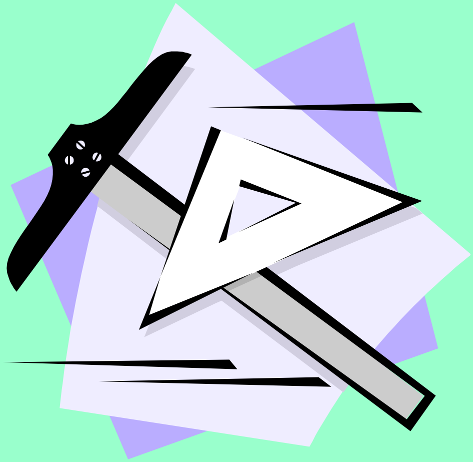
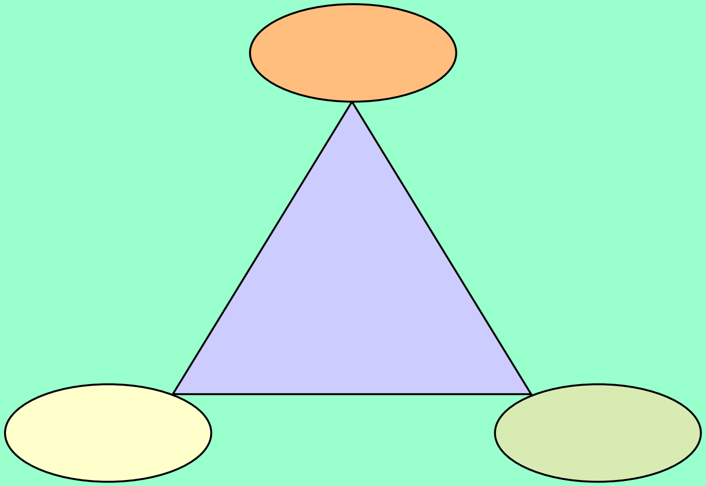
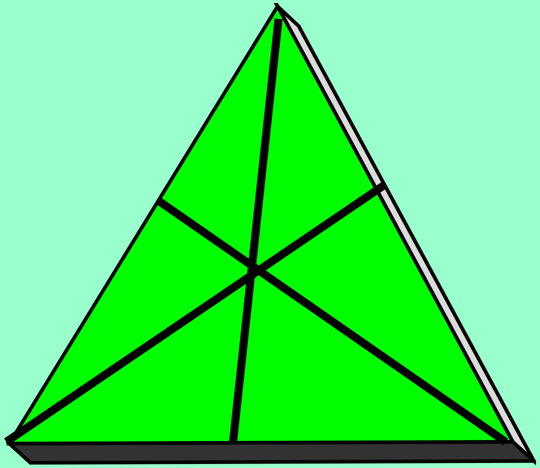






9.

Scalar Product



$$a \cdot b = |a||b|\cos\theta$$

Scalar Product

So far we have looked at vector addition and subtraction. We have also looked at the result of multiplying a single vector by a scalar.

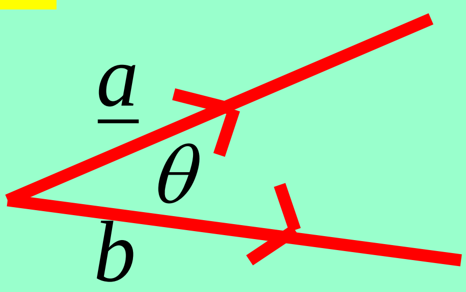
We are now going to look at a form of vector multiplication. The result of multiplying two vectors together is known as the
SCALAR PRODUCT (**or dot product**).

There are two versions, both are given on your formulae list:

Version 1: $$a \cdot b = |a||b|\cos\theta$$

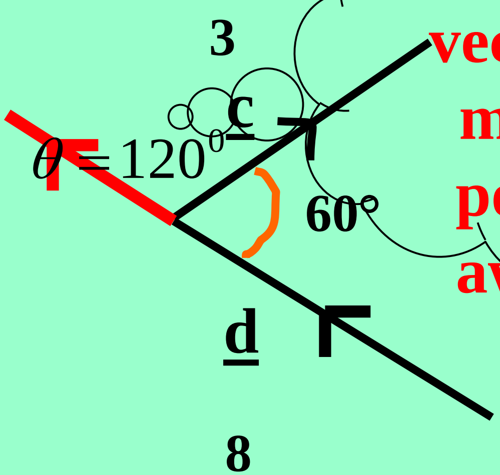
Version 2: $$a \cdot b = a_1 b_1 + a_2 b_2 + a_3 b_3$$

Component form



NOTE : **BOTH** vectors must point **away** from vertex.

Example 1



Both vectors must point away

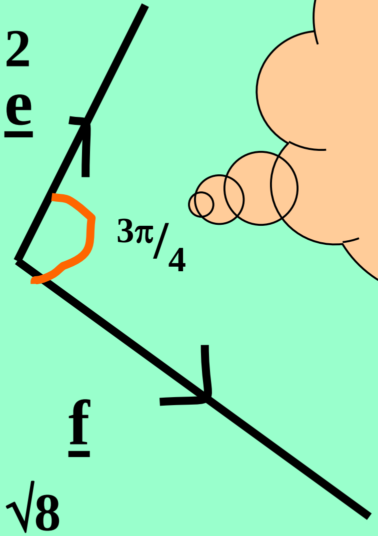
$$c \cdot d = |c||d|\cos\theta$$

$$c \cdot d = 3 \times 8 \times \cos 120^0$$

$$c \cdot d = -12$$

Answers always a scalar

Example 2



Obtuse angle means negative answer

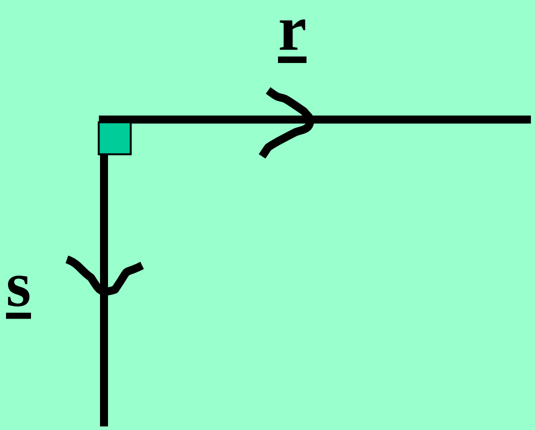
$$e \cdot f = |e||f|\cos\theta$$

$$e \cdot f = \sqrt{8} \times 2 \times \cos 135^0$$

$$e \cdot f = 2\sqrt{2} \times 2 \times -\frac{1}{\sqrt{2}}$$

$$e \cdot f = -\frac{4\sqrt{2}}{\sqrt{2}} = -4$$

Example 3



$$r \cdot s = |r||s|\cos\theta$$

$\cos 90^0 = 0$

$$r \cdot s = |r||s|\cos 90^0$$

$$r \cdot s = 0$$

NB:

Whenever 2 vectors are perpendicular the dot product is zero.

Heinemann, p.250, EX 13O, Q1 & 2