

# NUMBER SYSTEMS

Sunim, Noitcarf and other number systems

ONE  $(a, b) = (c, d)$  iff  $a + d = b + c$   
 $(a, b) + (c, d) = (a + c, b + d)$   
 $(a, b) \times (c, d) = (ac + bd, bc + ad)$

TWO  $(a, b) = (c, d)$  iff  $ad = bc$   
 $(a, b) + (c, d) = (ad + bc, bd)$   
 $(a, b) \times (c, d) = (ac, bd)$

THREE  $(a, b) = (c, d)$  iff  $a = c$  and  $b = d$   
 $(a, b) + (c, d) = (a + c, b + d)$   
 $(a, b) \times (c, d) = (ac - bd, bc + ad)$

FOUR The set of all matrices of the form  $\begin{pmatrix} a & -b \\ b & a \end{pmatrix}$  where  $a$  and  $b$  are real.

FIVE The set of all matrices of the form  $\begin{pmatrix} -1 & a \\ 0 & 1 \end{pmatrix}$  where  $a$  is real.

For those who are now quite satisfied that they know what a complex number is.....what is a complex prime?

Restrict attention to those complex numbers  $a + bi$  where  $a$  and  $b$  are whole numbers, then  $3 + 4i$  is not a prime since  $3 + 4i = (2 + i)(2 + i)$ , whereas  $4 + i$  is.

Investigate; and specifically classify the following as prime or composite.  
 (Give complete factorisations of composites.)

$3 + 3i$                    $7 + 3i$                    $5 + 2i$                    $5 + 5i$                    $1 + i$

Last investigation: if the matrix  $A$  represents a rotation and we  
 solve the equation  $A \begin{pmatrix} x \\ y \end{pmatrix} = \lambda \begin{pmatrix} x \\ y \end{pmatrix}$  for some scalar  $\lambda$  what  
 are we doing and what does  $\lambda$  represent?