§5  
 IMP14  
Interesting inverses

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| Socks and shoes The inverse of 'put on my socks, put on my shoes' is 'take off my shoes, take off my socks'.  The inverse of 'add 2 and multiply by 4' is 'divide by 4 and subtract 2'.  The graphs of a linear function and its inverse are reflections of each other across the line *y = x*. Why? Is this true for all functions?  Make up 'think of a number' problems where the answer is 'the number you first thought of'. |
| Adding from ? Inverse operations undo the operation: e.g. the inverse of 'subtract 3' is 'add 3':  what action undoes 'subtract from 13'?  what action undoes 'divide into 24'? |
| Fractional Actions What action undoes ‘multiplying by 3 and then dividing by 4’? |
| Flipping cups You have N cups, all pointing upwards initially.  On any move, you can turn over any M of them.  Is it possible to make all N cups point downwards?  *(there is further information about this question on a supplementary sheet)* |
| Translations of Translations X means 'translate from English into French'; Y means 'translate from French into German'.  So X-1 means what? And Y-1?  What do these mean?  XY; YX; X-1 Y-1; Y-1X-1 ; X-1 Y; etc.  XX-1 = ?  XY X-1 Y-1;  Does (YX)-1 = X-1 Y-1  Do geometrical translations work the same way? |

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| An arrow operation Assume there is an arrow operation ⌂ such that ⌂ (it may help to draw these)  Is this commutative?  Is there an identity - a vector so that, for any :  ⌂ and ⌂ ?  Are there inverses - a vector so that ⌂ gets you back where you started?  Is the operation associative? |
| LCMs Assume a \* b = lcm (a,b)  What is the identity? Are there any inverses? |
| More stuff from Budden: Fascination for Groups Let O be a fixed point and for points on the plane such as A, B, ... etc. there is the operation:  A \* B = P so that OAPB is a parallelogram  Show that this operation is associative (i.e. (A\*B)\*C = A\*(B\*C)) and investigate its identity and inverses.  Can the same be said of this operation: A\*\*B = P so that OABP is a parallelogram? (Budden p.70 q. 24) |
| Rational inverses Find inverse functions for: ; ; ; ; ; *(if you have been to previous institutes you may have met these before with a differently posed question - suggestions can be made)*  For what values of *a, b, c, d* does *f(*x) = f–1(x)? f2(x) = f-1(x)? f3(x) = f-1(x)? etc. |