Classifying mathematical objects	T1
Interpreting multiple representations	T2
Evaluating mathematical statements	T3
Creating problems	T4
Analysing reasoning and solutions	T5

Learners devise their own problems or problem variants for other learners to solve. This offers them the opportunity to be creative and 'own' problems. While others attempt to solve them, they take on the role of participant and explainer. The 'doing' and 'undoing' processes of mathematics are vividly exemplified.	D1
Learners decide whether given statements are always, sometimes or never true. They are encouraged to develop rigorous mathematical arguments and justifications, and to devise examples and counterexamples to defend their reasoning.	D2
Learners match cards showing different representations of the same mathematical idea. They draw links between different representations and develop new mental images for concepts.	D3
Learners compare different methods for doing a problem, organise solutions and/or diagnose the causes of errors in solutions. They begin to recognise that there are alternative pathways through a problem, and develop their own chains of reasoning.	D4
Learners devise their own classifications for mathematical objects, and apply classifications devised by others. They learn to discriminate carefully and recognise the properties of objects. They also develop mathematical language and definitions.	D5

E1

Van hire

Sanjay wants to hire a van to move some furniture.

He obtains the following information from two hire companies.

Bujit's Van Hire

£30 for the first 50 miles.

Every mile after that costs an extra 20p.

Hurt's Vans

You only pay for the miles you travel.

Miles travelled	50	100	150	200
Hire charge	£16	£32	£48	£64

1. How much do Hurt's vans cost per mile?

2. Sanjay expects to travel 175 miles.
   Which company has the lower charge for this distance?
   You must show all your working.

Car hire

Cath wants to hire a car for a weekend.

She obtains the following information from two hire companies.

..... Car Hire

£ .....for the first .....miles.
Every mile after that costs an extra ..... p.

..... Car Hire

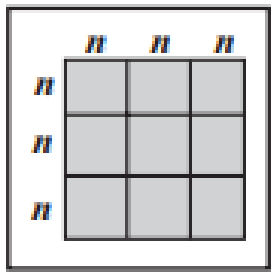
Miles travelled				
Hire charge				

. . . . . .

. . . . . .

. . . . . .

E2



Square n then multiply your answer by 3

Multiply n by 3 then square your answer

$9n^2$

$(3n)^2$

$3n^2$

Square n then multiply your answer by 9

E3

Doing: the problem poser…	Undoing: the problem solver…
• creates an equation step-by-step, starting with a value for x and 'doing the same to both sides'.	• solves the resulting equation.
• draws a rectangle and calculates its area and perimeter.	• tries to draw a rectangle with the given area and perimeter.
• writes down an equation of the form $y = mx + c$ and plots a graph.	• tries to find an equation that fits the resulting graph.
• expands an algebraic expression such as $(x + 3)(x - 2)$.	• factorises the resulting expression: $x^2 + x - 6$.
• writes down a polynomial and differentiates it.	• integrates the resulting function.
• writes down five numbers and finds their mean, median and range.	• tries to find five numbers with the given mean, median and range.

E4

Number operations

The square root of a number is less than or equal to the number.	The square of a number is greater than or equal to the number.

Directed numbers

If you subtract a positive number from a negative number you get a negative answer.	If you subtract a negative number from a negative number you get a positive answer.

Perimeter and area

When you cut a piece off a shape, you reduce its area and perimeter.	If a square and a rectangle have the same perimeter, the square has the smaller area.

Equations, inequations, identities

$p + 12 = s + 12$	$3 + 2y = 5y$

Cut up the following cards. Rearrange them to form two proofs.

E5

The first should prove that: **If n is an odd number, then n^2 is an odd number**

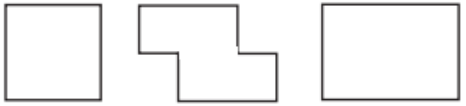
The second should prove that: **If n^2 is an odd number, then n is an odd number.**
You may not need to use all the cards.

If n is odd	**So n is odd**
$n = 2m + 1$ **for some integer m**	$= 2k$ **where $k = 2m^2$**
$(2m + 1)^2 = 4m^2 + 4m + 1$	**But n^2 is odd**
$(2m)^2 = 4m^2$	**So n^2 is odd**
If n is even	$n = 2m$ **for some integer m**
So n^2 is even	$= 2k + 1$ **where $k = 2m(m + 1)$**
If n^2 is odd	$n^2 = 2m + 1$ **for some integer m**

Odd one out

E6

In the triplets below, how can you justify each of (a), (b), (c) as the odd one out?

(a) a fraction (b) a decimal (c) a percentage	(a) sin 60° (b) cos 60° (c) tan 60°
(a) (b) (c) 	(a) $y = x^2 - 6x + 8$ (b) $y = x^2 - 6x + 9$ (c) $y = x^2 - 6x + 10$
(a) (b) (c) 	(a) 20, 14, 8, 2, … (b) 3, 7, 11, 15, … (c) 4, 8, 16, 32, …