M S Narasimhan’s article in this issue on page 482 contains several mathematical terms. In this glossary, we try to briefly explain some of them.

(1) ‘Algebraic geometry’ is the study of solutions of systems of polynomial equations in a number of variables. Of course, the study of roots of a polynomial in a single variable falls within this scope.

Further, this expands on the solutions of systems of linear equations and the study of ‘conics’ (solutions of quadratic equations in two variables).

(2) ‘Number theory’ means different things to different people. It is primarily the study of (counting) numbers and their properties. In the course of this study, one is led to the study of other number systems and their properties as well.

(3) ‘Topology’ is often described as the study of ‘shape’ or ‘rubber-sheet’ geometry. However, within mathematics, there are two subjects – one addressing ‘point-set’ topology, which is primarily a study of certain systems of subsets of a set (called a topology on that set), and the other dealing with ‘algebraic’ topology which is the study of ‘shape’ through algebraic invariants that characterize the presence of non-trivial shape-like properties.

(4) ‘Homological algebra’ grew out of the study of algebraic invariants associated with shape and the study of certain properties of groups. In the seminal work on this topic by Cartan and Eilenberg, it was shown that what was needed was a vast systematic generalization of the rank-nullity theorem of linear algebra.

(5) ‘Functional analysis’ is the study of functionals (functions on

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1 The basic rank-nullity theorem says that for a linear map from a vector space $V$ to a vector space $W$, the sum of its rank and its nullity gives the dimension of $V$. 

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spaces of functions). Elementary examples include the integral of a function or the value of a function. With the advent of point-set topology, it became possible to study these infinite dimensional spaces systematically. Such spaces play an important role in quantum mechanics and more generally in the solution of differential equations.

(6) ‘Weil conjectures’ (which are now theorems due to Dwork, Grothendieck, Deligne and others) are still known by their original name. They provide a link between the divisibility of values of polynomial functions by primes and the topology of the zeroes of these functions over the field of complex numbers.

(7) ‘The Mordell conjecture’ (which is now a theorem due to Faltings) is still known by its original name. The theorem shows that the number of rational solutions to an equation in two variables is finite if the solution set has ‘at least two holes’ in a certain precise sense as described in terms of algebraic topology (see (3)).

(8) ‘Modularity conjecture’ (which is now a theorem due to Wiles–Taylor) asserts that any equation of the form $y^2 = x^3 + ax + b$ with $a$ and $b$ integers (or rational numbers) can be given parametric solutions in terms of certain special functions called modular functions on the upper half-plane. This was conjectured by Shimura and Taniyama and also appeared in a problem posed by Weil. Frey proposed the study of the curve $y^2 = x(x - a')(x + b'n)$ in connection with $a'^n + b'^n + c'^n = 0$, the famous Fermat equation. Serre, Ribet and others were able to develop Frey’s ideas to show that the modularity of such a curve would lead to a contradiction, thus giving a proof of Fermat’s last theorem.

(9) ‘Measure theory’ develops a consistent way to assign a measure to some subsets of a certain fixed space. This theory lies at the intersection between the theory of integration and probability theory. Probability can be formulated via a theory of measure where the measures lie between 0 and 1.

(10) ‘Lebesgue integration’ is the best known way of extending