Basic Competency Descriptors for Key Stage 3 Mathematics Curriculum

Number and Algebra Strand

Learning Unit	Code	Objectives
		Students can:
1. Basic computation	KS3-NA01-1	use powers to express the repeated multiplication of a number and use repeated multiplication to express the power of a number.
	KS3-NA01-2	perform prime factorisation of a positive integer, which is less than 200 and its prime factors are less than 100.
	KS3-NA01-3	find the greatest common divisor and the least common multiple of two or three numbers which are expressed as products of prime factors.
	KS3-NA01-4	perform mixed arithmetic operations of positive integers involving two levels and at most three pairs of brackets.
2. Directed numbers	KS3-NA02-1	demonstrate recognition of the ordering of integers on the number line.
	KS3-NA02-2	use positive numbers, negative numbers and zero to describe situations such as profit and loss, floor levels relative to the ground level, temperature, etc.
	KS3-NA02-3	perform mixed arithmetic operations of directed numbers (with at most three operations in each expression).
3. Approximate values and numerical estimation	KS3-NA03-1	round off a number to a certain number of (a) decimal places (at most 3 decimal places); (b) significant figures (at most 3 significant figures).
	KS3-NA03-2	use suitable estimation strategies to solve simple real-life problems.

Learning Unit	Code	Objectives
		Students can:
4. Rational and irrational numbers	KS3-NA04-1	calculate the value of x in the expressions $\sqrt{x} = a$, $\sqrt[3]{x} = a$, $\sqrt{a} = x$ and $\sqrt[3]{a} = x$, where a is a positive integer.
	KS3-NA04-2	demonstrate recognition of the concepts of rational and irrational numbers.
	KS3-NA04-3	represent rational and irrational numbers on the number line.
5. Using percentages	KS3-NA05-1	solve problems on percentage increase, percentage decrease and percentage change in mathematical context.
	KS3-NA05-2	solve simple problems on discount and profit or loss.
	KS3-NA05-3	solve problems on simple interest.
	KS3-NA05-4	solve simple problems on compound interest, compounded yearly (confined to calculations for at most 3 years; excluding problems to find the number of years and the interest rate).
	KS3-NA05-5	solve simple problems on growths and depreciations (confined to calculations of new values for at most 3 repeated growths/depreciations).
6. Rates, ratios and proportions	KS3-NA06-1	distinguish direct and inverse proportions.
	KS3-NA06-2	represent a ratio in the form $a : b$ (or $\frac{a}{b}$), $a : b : c$.
	KS3-NA06-3	use rate and ratio to solve simple real-life problems.
	KS3-NA06-4	use direct and inverse proportions to solve simple real-life problems (confined to two variables).

Learning Unit	Code	Objectives
		Students can:
7. Algebraic expressions	KS3-NA07-1	demonstrate recognition of notations of algebraic expressions such as $2x$, $2 + x$, x^2, $(-2)^n$ and -2^n, etc.
	KS3-NA07-2	formulate algebraic expressions from word phrases.
	KS3-NA07-3	write down the next term of a sequence of odd numbers, even numbers, square numbers and triangular numbers with several consecutive terms given.
	KS3-NA07-4	find a particular term from the general term of a sequence.
8. Linear equations in one unknown	KS3-NA08-1	solve simple linear equations in one unknown (with integral and fractional coefficients and constants).
	KS3-NA08-2	demonstrate understanding of the meaning of solutions of equations.
	KS3-NA08-3	formulate a linear equation in one unknown from a simple problem situation.

Learning Unit	Code	Objectives
		Students can:
9. Linear equations in two unknowns	KS3-NA09-1	plot graphs of linear equations in two unknowns.
	KS3-NA09-2	demonstrate recognition that graphs of equations of the form $ax+by+c=0$ are straight lines.
	KS3-NA09-3	determine whether a point lies on a straight line given its linear equation.
	KS3-NA09-4	solve simple simultaneous linear equations in two unknowns (with integral coefficients and constants) which have a unique solution by the graphical method.
	KS3-NA09-5	solve simple simultaneous linear equations in two unknowns (with integral coefficients and constants) which have a unique solution by algebraic methods.
	KS3-NA09-6	formulate simultaneous linear equations in two unknowns from a simple problem situation.
10. Laws of integral indices	KS3-NA10-1	find the value of a^n, where a $(a \neq 0)$ is an integer and n is zero or a negative integer.
	KS3-NA10-2	use the laws of integral indices to simplify simple algebraic expressions (up to 2 variables and applying integral index laws for at most 2 times).
	KS3-NA10-3	represent a positive number in scientific notations.
	KS3-NA10-4	convert a positive number in scientific notations to an integer or a decimal.

Learning Unit	Code	Objectives
		Students can:
11. Polynomials	KS3-NA11-1	distinguish polynomials from algebraic expressions.
	KS3-NA11-2	demonstrate recognition of terms, monomials, binomials, orders, powers, constant terms, like terms, unlike terms and coefficients.
	KS3-NA11-3	arrange the terms of a polynomial in ascending order or descending order.
	KS3-NA11-4	perform addition or subtraction of two polynomials (of at most 4 terms), in which the terms involved contain at most two variables.
	KS3-NA11-5	perform multiplication of a monomial by a binomial or a trinomial, in which the terms involved contain at most two variables.
	KS3-NA11-6	perform multiplication of two binomials, in which the terms involved contain at most two variables.
	KS3-NA11-7	distinguish factorisation and expansion of polynomials.
	KS3-NA11-8	factorise simple polynomials of not more than 4 terms by taking out common factors and/or grouping terms.
	KS3-NA11-9	factorise expressions of the form $ax^2 + bx + c$, where a, b, c are integers, $1 \le a \le 3$ and $-20 \le c \le 20$.
12. Identities	KS3-NA12-1	indicate whether an equation is an identity.
	KS3-NA12-2	use the identities of difference of two squares and perfect square once to expand simple algebraic expressions.
	KS3-NA12-3	use the identities of difference of two squares and perfect square once to factorise simple polynomials.

Learning Unit	Code	Objectives
		Students can:
13. Formulae	KS3-NA13-1	perform operations of two algebraic fractions, both the numerators and denominators being monomials, such as $\frac{1}{x}, \frac{3x}{2y}$, etc.
	KS3-NA13-2	substitute values into formulae (in which all exponents are positive integers) and find the value of a specified variable.
	KS3-NA13-3	perform change of subject in simple formulae not involving radical sign.
14. Linear inequalities in one unknown	KS3-NA14-1	determine whether a number satisfies a given inequality of $x > a$, $x \geq a$, $x < a$ and $x \leq a$.
	KS3-NA14-2	represent the inequalities $x > a$, $x \geq a$, $x < a$ and $x \leq a$ on the number line, and vice versa.
	KS3-NA14-3	demonstrate recognition of the following properties of inequalities: For $x \geq y$, (a) $x + c \geq y + c$; (b) $cx \geq cy$ $(c > 0)$, $cx \leq cy$ $(c < 0)$.
	KS3-NA14-4	solve simple linear inequalities in one unknown with integral coefficients and constants.
	KS3-NA14-5	formulate a linear inequality in one unknown from a simple problem situation.

Basic Competency Descriptors for Key Stage 3 Mathematics Curriculum

Measures, Shape and Space Strand

Learning Unit	Code	Objectives
Students can:		
15. Errors in measurement	KS3-MSS15-1	find maximum absolute errors when using given measuring tools for measurement.
	KS3-MSS15-2	find the range of measures in measurements of given degrees of accuracy.
	KS3-MSS15-3	calculate relative errors and percentage errors from given measurements.
16. Arc lengths and areas of sectors	KS3-MSS16-1	calculate arc lengths.
	KS3-MSS16-2	calculate areas of sectors.
17. 3-D figures	KS3-MSS17-1	demonstrate recognition of the concepts of right prisms, right circular cylinders, right pyramids and right circular cones.
	KS3-MSS17-2	demonstrate recognition of the sections of prisms, circular cylinders, pyramids and circular cones.
	KS3-MSS17-3	sketch the 2-D representations of right prisms, right circular cylinders, right pyramids and right circular cones.

Learning Unit	Code	Objectives
		Students can:
18. Mensuration	KS3-MSS18-1	calculate the volumes of prisms, circular cylinders, pyramids, circular cones and spheres.
	KS3-MSS18-2	calculate the surface areas of right prisms, right circular cylinders, right pyramids, right circular cones and spheres.
	KS3-MSS18-3	use the relationships between sides and surface areas/volumes of similar 3-D figures to solve problems (calculations related to frusta are not included).
	KS3-MSS18-4	use the formulae for the volumes of prisms and circular cylinders to find unknowns.
	KS3-MSS18-5	use the formulae for the surface areas of right prisms and right circular cylinders to find unknowns.
19. Angles and parallel lines	KS3-MSS19-1	use the properties of adjacent angles on a straight line, vertically opposite angles, and angles at a point to find unknowns.
	KS3-MSS19-2	identify corresponding angles, alternate interior angles and interior angles.
	KS3-MSS19-3	use the conditions of alternate interior angles are equal, corresponding angles are equal, and interior angles are supplementary to perform simple proof of two straight lines being parallel.
	KS3-MSS19-4	use the angle properties associated with parallel lines to find unknowns.
	KS3-MSS19-5	use the properties of angles of triangles to find unknowns.

Learning Unit	Code	Objectives
		Students can:
20. Polygons	KS3-MSS20-1	use common notations to represent polygons.
	KS3-MSS20-2	demonstrate recognition of the concepts of polygons and regular polygons.
	KS3-MSS20-3	use the formula for the sum of the interior angles of a convex polygon to find unknowns.
	KS3-MSS20-4	use the formula for the sum of the exterior angles of a convex polygon to find unknowns.
21. Congruent triangles	KS3-MSS21-1	demonstrate recognition of the properties of congruent triangles.
	KS3-MSS21-2	demonstrate recognition of the conditions for congruent triangles.
	KS3-MSS21-3	use the conditions for congruent triangles to perform simple proofs.
	KS3-MSS21-4	use the relations between sides and angles associated with isosceles triangles to find unknowns.
	KS3-MSS21-5	use the condition for isosceles triangles to perform simple proofs.
22. Similar triangles	KS3-MSS22-1	demonstrate recognition of the properties of similar triangles.
	KS3-MSS22-2	demonstrate recognition of the conditions for similar triangles.
	KS3-MSS22-3	use the conditions for similar triangles to perform simple proofs.

Learning Unit	Code	Objectives
		Students can:
23. Quadrilaterals	KS3-MSS23-1	use the properties of parallelograms to find unknowns.
	KS3-MSS23-2	use the properties of rectangles, rhombuses and squares to find unknowns.
24. Centres of triangles	KS3-MSS24-1	identify medians, perpendicular bisectors, altitudes and angle bisectors of a triangle.
25. Pythagoras' theorem	KS3-MSS25-1	use Pythagoras' theorem to find unknowns.
	KS3-MSS25-2	use the converse of Pythagoras' theorem to identify right-angled triangles.
26. Rectangular coordinate system	KS3-MSS26-1	use coordinates to represent the position of a point and mark the point with given coordinates.
	KS3-MSS26-2	calculate areas of polygons that can be dissected into triangle(s) and rectangle(s) (one side of each of the figures resulted from dissection must be either horizontal or vertical).
	KS3-MSS26-3	find the image of a given point under a single transformation (the transformation includes only translation, reflection in a line parallel to the *x*-axis, or *y*-axis and rotation about the origin through 90°, 180° and 270°) in the rectangular coordinate plane.
	KS3-MSS26-4	use the distance formula to find the distance between two points.
	KS3-MSS26-5	use the mid-point formula to find the mid-point between two points.
	KS3-MSS26-6	use the formula slope = $\frac{y_2 - y_1}{x_2 - x_1}$ to find the slope of the straight line which passes through two given points.
	KS3-MSS26-7	demonstrate recognition of the relation between the slopes of parallel lines, and that of perpendicular lines.

Learning Unit	Code	Objectives
		Students can:
27. Trigonometry	KS3-MSS27-1	find the sine, cosine and tangent of angles between 0° to 90° and vice versa.
	KS3-MSS27-2	solve right-angled triangles.
	KS3-MSS27-3	demonstrate recognition of the concepts of gradients, angles of elevation, angles of depression and bearings.
	KS3-MSS27-4	solve simple problems involving one right-angled triangle.

Remarks:
Students are not required to state geometric reasons for numerical problems. However, they are expected to give acceptable reasons in geometric proofs.

Basic Competency Descriptors for Key Stage 3 Mathematics Curriculum

Data Handling Strand

Learning Unit	Code	Objectives
Students can:		
28. Organisation of data	KS3-DH28-1	organise the same set of data by different grouping methods.
29. Presentation of data	KS3-DH29-1	construct stem-and-leaf diagrams and histograms.
	KS3-DH29-2	interpret stem-and-leaf diagrams and histograms.
	KS3-DH29-3	read off data from statistical charts representing two different sets of data.
	KS3-DH29-4	construct frequency polygons, frequency curves, cumulative frequency polygons and cumulative frequency curves.
	KS3-DH29-5	interpret frequency polygons, frequency curves, cumulative frequency polygons and cumulative frequency curves.
	KS3-DH29-6	choose appropriate statistical charts to present data.
	KS3-DH29-7	indicate the abuses from examples of abuses of statistical charts.

Learning Unit	Code	Objectives
		Students can:
30. Measures of central tendency	KS3-DH30-1	find mean, median and mode from a set of ungrouped data.
	KS3-DH30-2	find median (from cumulative frequency polygons/curves only), mean and modal class from a set of grouped data.
	KS3-DH30-3	indicate the abuses from examples of abuses of mean, median and mode/modal class.
	KS3-DH30-4	calculate the weighted mean of a set of data.
31. Probability	KS3-DH31-1	calculate the relative frequency.
	KS3-DH31-2	calculate the probability by listing.