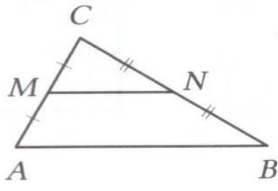
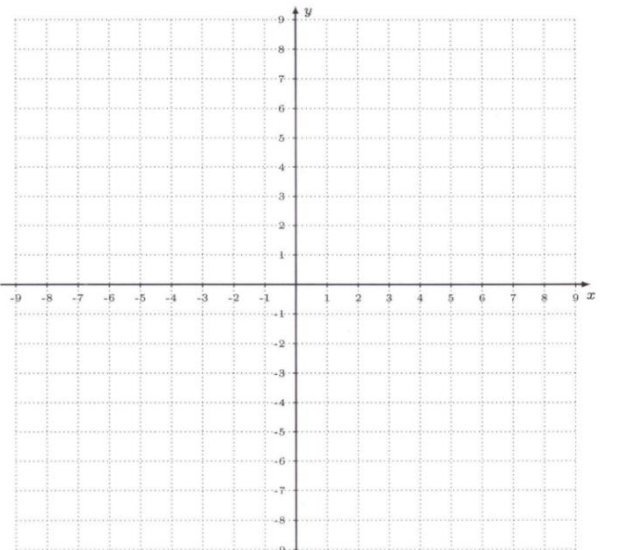
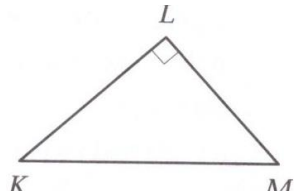


MATHEMATICS TOPICS AND CONTENT

Topic	Content
Numbers	Routine use of addition, subtraction, multiplication and division, using integers, decimals and fractions, including order in operations. Integer exponents. Laws of exponents. Square and cubic roots. Expression of numbers in standard form (scientific notation). Simplification of expressions involving roots, including rationalizing the denominator. Divisibility rules for 2, 5, 10, 3 and 9. Prime numbers. Composite numbers, factors, including greatest common factors and least common multiples. Definition of absolute value (modulus). Applications of ratio, percentage and proportion, linked to similarity. Compound interest. Rounding decimal approximations.
Sets and numbers	Number systems: natural numbers, integers, rational and irrational numbers, real numbers. Intervals on the real number line using inequalities.
Algebra	Basic manipulation of simple algebraic expressions involving factorization, expansion and completing the square. Formulae: $a^2 - b^2 = (a + b)(a - b)$ $(a \pm b)^2 = a^2 \pm 2ab + b^2$. Rearrangement, evaluation and combination of simple formulae, simplifying. Addition, subtraction, multiplication, division and simplifying algebraic fractions. Solutions of linear, quadratic, rational equations and inequalities in one variable. Discriminant. Linear and quadratic equations with parameters. Solution of simultaneous equations in two variables with linear equations or with one quadratic equation. Solution of system of linear inequalities.
Cartesian plane and functions	Distance between two points in the Cartesian plane. Coordinates of midpoint of a line segment. The linear function and its graph, gradient and y-intercept. The quadratic function, its graph, coordinates of vertex, properties. Maximum and/or minimum values of quadratic function in the given interval. Domain and range of linear and quadratic functions.
Geometry	Triangle. Properties of equilateral and isosceles triangles. Pythagoras' theorem and its converse. Equal and similar triangles. Similar plane figures. Ratio of their perimeters and areas.

	<p>Quadrilaterals: parallelograms, rhombuses, rectangles, squares and trapeziums; compound shapes. Their properties, perimeters and areas. Properties of midline of triangle and of trapezium.</p> <p>The circle, its centre and radius, area and circumference. Length of arc, area of sector. Chord, tangent and segment, properties of the tangent.</p> <p>Parallel and perpendicular straight lines, angle between straight lines in three dimensional shapes.</p> <p>Cube, rectangular, prism. Their surface area and volume.</p> <p>Regular pyramid. Its surface area and volume.</p> <p>Volume and surface area of revolutions: cone and cylinder.</p>
Trigonometry	Right-angle trigonometry. Pythagorean identity. Solution of right triangles.
Probability and statistics	<p>Counting principles, addition and multiplication rules. Probability of event.</p> <p>Descriptive statistics: collection of raw data, display of data in pictorial and diagrammatic forms, frequency table. Obtaining simple statistics from discrete data, including mean, median and mode.</p>

For questions 1-6 write down only the answer with no working.

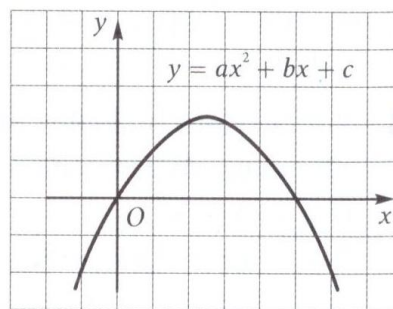
<p>1. Solve the inequalities:</p> <p>a) $\frac{1}{x} \geq 0$; b) $(x+1)(x-2) < 0$.</p> <p>Answers: a)..... b).....</p>	<p>(2 marks)</p>
<p>2. Midsegment of the triangle ABC is MN (see the picture). $MN = 10\text{cm}$ and $\angle CAB = 35^\circ$. Find:</p> <p>(a) the length of AB; (b) the measure of the angle AMN.</p> <p>Answers: (a)..... (b).....</p>	 <p style="text-align: right;">(2 marks)</p>
<p>3.</p> <p>(a) Sketch the graph of the function $f(x) = 6 - 2x$ on a coordinate plane. Show clearly the points of intersection of the graph and the axes.</p> <p>(b) A region R is bounded by the graph of $f(x) = 6 - 2x$, the x-axis and the y-axis. Shade the region R on a coordinate plane and find the area of this region.</p> <p>Answer: (b).....</p>	 <p style="text-align: right;">(4 marks)</p>
<p>4. If $\sqrt{63} - \sqrt{7} = \sqrt{a}$, find the value of a.</p> <p>Answer:</p>	<p>(1 mark)</p>
<p>5. KLM is the right triangle ($\angle KLM = 90^\circ$). $KM = 13\text{cm}$ and $KL = 12\text{cm}$ (diagram not to scale). Find:</p> <p>(a) length of LM; (b) $\tan LKM$.</p> <p>Answers: (a)..... (b).....</p>	 <p style="text-align: right;">(2 marks)</p>

6. In the diagram, parabola $y = ax^2 + bx + c$ is given, which passes through the origin. Are values of the coefficients and the expression below **positive, negative** or **equal to zero**?

- (a) a ; (b) c ; (c) $b^2 - 4ac$; (d) b .

Answers: (a)..... (b).....

(c) (d).....



(4 marks)

For questions 7-14 provide the working. Write on the squared sheet.

7. In the following diagram, O is the centre of the circle and AT is the tangent to the circle.

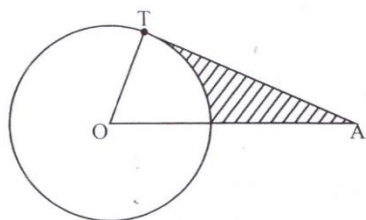


diagram not to scale

If $OA = 12\text{cm}$, and the circle has a radius of 6cm , find:

- (a) the measure of the angle TOA;
 (b) the area of the shaded region.

(2 marks)
 (2 marks)

8. What is the percentage in increase of the product of two numbers, a and b , if number a is increased by 20%, and number b is decreased by 10%?

(2 marks)

9. Prove that with any possible value of α the value of the expression $\cos^2 \alpha \cdot (1 + \tan^2 \alpha)$ is constant.

(2 marks)

10. Express as a product of linear factors:

- a) $1 - 9x^2$;
 b) $x^3 - 7x + 6$.

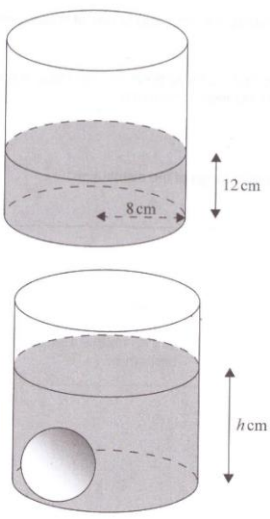
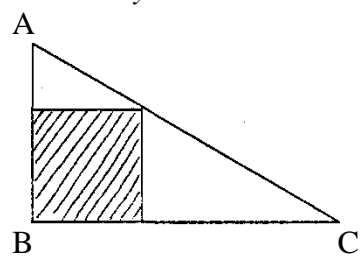
(1 mark)
 (3 marks)

11. a) Given $3^m = 2$. Find the value of 27^{m+1} .

(2 marks)

b) Prove that the number $6^{2017} - 6^{2015}$ is divisible by 70.

(2 marks)

<p>12. A cylindrical container with a radius of 8 cm is placed on a flat surface. The container is filled with water to a height of 12cm, as shown in the diagram (diagram not to scale).</p> <p>(a) Find the volume of water in the container (in terms of π).</p> <p>A heavy ball with a radius of 3cm is dropped into the container. As a result, the height of water increases to h cm, as shown in the following diagram (diagram not to scale).</p> <p>(b) Find the value of h.</p> <p>You can use formulae: Volume of a cylinder: $V = \pi r^2 h$, where r is the radius, h is the height. Volume of a sphere: $V = \frac{4}{3} \pi r^3$, where r is the radius.</p>	 <p>(1 mark)</p> <p>(3 marks)</p>
<p>13. A group of 5 boys and 3 girls are to be photographed together. Find the number of different possible arrangements, if the girls are to sit on 3 chairs placed in a row and the boys are to stand in a line behind them.</p>	<p>(2 marks)</p>
<p>14. The square is inscribed in the right triangle ABC (see the picture below). The sides of the right angle of the triangle are $AB = x$ and $BC = y$. Express the length a of the side of the square in terms of x and y.</p> 	<p>(3 marks)</p>