

# MADRAS COLLEGE



Mathematics Department

National 5

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The roots of  $ax^2 + bx + c = 0$  are  $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Sine rule:  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

**Cosine rule:**  $a^2 = b^2 + c^2 - 2bc \cos A$   
or  $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle:  $\text{Area} = \frac{1}{2} ab \sin C$

Volume of a sphere:  $\text{Volume} = \frac{4}{3} \pi r^3$

Volume of a cone:  $\text{Volume} = \frac{1}{3} \pi r^2 h$

Volume of a pyramid:  $\text{Volume} = \frac{1}{3} Ah$

1. Algebraic Operations:

<b>Algebra and Problem Solving</b>		
<b>Prior Knowledge:</b>		
Collecting Like Terms	3. Like Terms	
Multiplying out single brackets	4. Expanding Brackets	Targets 1-3
<b>National 5:</b>		
Multiplying out brackets	4. Expanding Brackets	Targets 4-5
Multiplying out double brackets	21. Quadratics 1	Target 5, Tasks 4-7

2. Further Calculations involving percentages:

<b>Number</b>		
<b>Prior Knowledge:</b>		
Percentage of a quantity	19. Percentages 1	Targets 3 and 4
Percentage Increase/Decrease	20. Percentages 2	Target 2
<b>National 5:</b>		
Compound Percentages	20. Percentages 2	Target 5
<i>Note: Does not include compound percentages when the value is decreasing</i>		
Reverse Percentages	20. Percentages 2	Target 4

3. Fractions:

<b>Number</b>		
<b>Prior Knowledge:</b>		
Simplifying Fractions	17. Fractions 1	Target 3
Converting between improper fraction and mixed number	17. Fractions 1	Target 4
Fractions of a quantity	17. Fractions 1	Target 5
<b>National 5:</b>		
Adding fractions	18. Fractions 2	Target 3
Subtracting Fractions	18. Fractions 2	Target 4
Multiplying and Dividing Fractions	18. Fractions 2	Target 5

4. Simultaneous Equations and Linear equations:

<b>Algebra and Problem Solving</b>		
<b>Prior Knowledge:</b>		
One and Two Step Equations	6. Solving Equations 1	Targets 2
Multi-step Equations	6. Solving Equations 1	Targets 3 and 5
Equations with Variables on Both Sides	16. Solving Equations 2	Target 1
Equations with Variables on Both Sides and Simplifying	16. Solving Equations 2	Target 2
Equation with Fractions	16. Solving Equations 2	Target 3
<b>National 5:</b>		
Solving Simultaneous Equations Graphically	19. Simultaneous Equations	Target 1
Solving Simultaneous Equations with no Scaling	19. Simultaneous Equations	Target 2
Solving Simultaneous Equations with Scaling	19. Simultaneous Equations	Target 3
Simultaneous Equations by Substitution (Includes quadratics)	19. Simultaneous Equations	Target 5

5. Pythagoras' Theorem:

<b>Geometry and Measures</b>		
<b>National 5:</b>		
Finding the Hypotenuse	22. Pythagoras	Target 2
Finding the Shorter Side	22. Pythagoras	Targets 3
Mixture of Questions	22. Pythagoras	Target 4, Tasks 1-2
Context Questions and Problem Solving	22. Pythagoras	Target 4, Tasks 3-11
3D Pythagoras	22. Pythagoras	Target 5
Pythagoras on Coordinate Grid	18. Straight Lines 2	Target 4
<i>Note: There is no questions on Converse of Pythagoras</i>		

6. Straight Line:

<b>Algebra and Problem Solving</b>		
<b>National 5:</b>		
Drawing Straight Lines	17. Straight Lines 1	Target 3
Calculating Gradient	17. Straight Lines 1	Target 4
Finding Equation from Plotted Points	17. Straight Lines 1	Target 5
Finding the equation in the form $y=mx + c$	18. Straight Lines 2	
Rearranging $ax + by = c$ to find the gradient and y-intercept	18. Straight Lines 2	Target 2

## 7. Factorising:

<b>Algebra and Problem Solving</b>		
<b>Prior Knowledge:</b>		
Highest Common Factor	5. Factorising	Targets 1-2
Single Bracket with Common Factor	5. Factorising	Targets 3-5
<b>National 5:</b>		
Difference of Two Squares	22. Quadratics 2	Target 2, Task 8 – 9
Trinomial with $x^2 + bx + c$	22. Quadratics 2	Target 1, Task 3 – 5
Trinomial with $ax^2 + bx + c$	22. Quadratics 2	Target 1, Task 6 – 7

## 8. Trigonometric Formulae:

<b>Geometry &amp; Measures</b>		
<b>Prior Knowledge:</b>		
Finding an Angle	23. Trigonometry 1	Target 2
Finding a Side	23. Trigonometry 1	Target 3
Find the Hypotenuse (with sin or cos), and the adjacent with tan	23. Trigonometry 1	Target 4
Mixed Examples	23. Trigonometry 1	Target 5
<b>National 5:</b>		
Area of a Triangle	24. Trigonometry 2	Target 2
Sine Rule (finding a side)	24. Trigonometry 2	Target 3, Task 1 – 4
Sine Rule (finding an angle)	24. Trigonometry 2	Target 3, Task 5 - 7
Sine Rule (with Bearings)	24. Trigonometry 2	Target 3 Task 8 - 9
Cosine Rule (finding a side)	24. Trigonometry 2	Target 4 Task 1 – 4
Cosine Rule (finding an angle)	24. Trigonometry 2	Target 4 Task 5 - 7
Cosine Rule (with Bearings)	24. Trigonometry 2	Target 4 Task 8 - 9
Mixture	24. Trigonometry 2	Target 5

9. Algebraic Fractions:

<b>Algebra and Problem Solving</b>		
<b>Prior Knowledge:</b>		
Factorising	See Section 8	
<b>National 5:</b>		
Equivalent fractions and Simplifying	24. Algebraic Fractions	Target 1
Factorising then Simplifying	24. Algebraic Fractions	Target 2
Multiplying and Dividing Algebraic Fractions	24. Algebraic Fractions	Target 3
Adding and Subtracting Algebraic Fractions	24. Algebraic Fractions	Target 4

10. Changing the Subject:

<b>Algebra and Problem Solving</b>		
<b>National 5:</b>		
Easier Examples	20. Changing the Subject of a Formula	Targets 1 – 2
Harder Examples	20. Changing the Subject of a Formula	Target 3 - 4
<i>Target 5 contains examples that involve factorising.</i>		

11 and 18. Statistics

<b>Statistics &amp; Probability</b>		
<b>Prior Knowledge:</b>		
Mean, Mode, Median and Range	3. Mean, Median, Mode & Range	Targets 1 – 5
<b>National 5:</b>		
Line of Best Fit	7. Scatter Graphs	Targets 1 - 3
Semi-Interquartile Range	17. Measures of Spread 1	Target 3
Box Plots	17. Measures of Spread 1	Target 4
SIQR with Box Plots	17. Measures of Spread 1	Target 5
<i>There are no Tasks on Standard Deviation</i>		

12. Functions and Graphs

There is no Task on Functions and Graphs on Mathsworkout but Task 8. Substitution of Algebra and Problem Solving can be used for revision.

13. Circles:

<b><u>Geometry and Measures</u></b>		
<b>Prior Knowledge:</b>		
Circumference/ Perimeter	25. Circle Geometry	Target 1
Area of the Circle	25. Circle Geometry	Target 2
Angles (straight line and circle)	8. Angles	Target 2
Angles (Triangle and Quadrilaterals)	8. Angles	Target 3
Angles (Corresponding and Alternate)	8. Angles	Target 4 Tasks 1 – 6
Angles (Mixture)	8. Angles	Target 4 Tasks 7 - 10
<b>National 5:</b>		
Arc Length	25. Circle Geometry	Target 3 Task 1 - 3
Sector Area	25. Circle Geometry	Target 3 Tasks 4 – 6
Mixture including finding angle	25. Circle Geometry	Target 3 Tasks 7 - 8
Trickier Examples	25. Circle Geometry	Target 3 Tasks 9 - 10
Angles in the Semi Circle	25. Circle Geometry	Target 4 Tasks 1 - 2
Tangents	25. Circle Geometry	Target 5 Tasks 1 - 4
<p><i>The Circle Geometry section includes a lot of examples that are part of GCSE but not National 5 Mathematics</i></p> <p><i>There are no Tasks on Pythagoras in the Circle</i></p>		

14 and 19. Quadratics:

<b>Algebra and Problem Solving</b>		
<b>Prior Knowledge:</b>		
Factorising	See Section 8	
Straight Line	See Section 6	
<b>National 5:</b>		
Plotting Quadratics	21. Quadratics 1	Targets 1 - 4
Solving Quadratic Equations (by factorising)	22. Quadratics 2	Target 2, Tasks 1 - 5
Rearranging equations and then solving	22. Quadratics 2	Target 3, Tasks 1 - 4
Factorising and Solving Trickier quadratics	22. Quadratics 2	Target 3, Tasks 7 - 8
Completing the Square	22. Quadratics 2	Target 4, Tasks 1 - 4
Solving Equations by Completing the Square	22. Quadratics 2	Target 4, Tasks 5 - 8
The Quadratics Formula	22. Quadratics 2	Target 5 Tasks 1 - 2
<p><i>Note: Mathsworkout covers the basics of quadratics. It does not cover the axis of symmetry, turning points, sketching from the completed square or factorised forms, the form <math>y=kx^2</math>, the discriminant and intersections with lines/other quadratics</i></p>		

17. Surds and Indices

<b>Number</b>		
<b>Prior Knowledge:</b>		
Revision of Square Numbers	24. Surds 1	Target 1
<b>National 5:</b>		
Simplifying Surds	24. Surds 1	Target 2, Tasks 1-8
Multiplication of Surds (including powers of)	24. Surds 1	Target 3
Adding and Subtracting Surds	24. Surds 1	Target 4
BODMAS with Surds	24. Surds 1	Target 5
Dividing Surds ( <i>the above targets should be completed before attempting these</i> )	25. Surds 2	Target 1
Rationalising Denominator	25. Surds 2	Target 2
Rationalising Denominator (Trickier)	25. Surds 2	Target 3 Tasks 1 – 5 And Target 4
Rationalising Denominator (adding fractions)	25. Surds 2	Target 3 Tasks 6 - 8
<p><i>Target 5 looks at the conjugate which is not examinable at National 5</i></p>		
<b>Number</b>		
<b>Prior Knowledge:</b>		
Powers and Roots	23. Indices 1	Target 1

<b>National 5:</b>		
The Reciprocal	23. Indices 1	Target 2
$a^{\frac{m}{n}} = \sqrt[n]{a^m}$	23. Indices 1	Target 3
$a^m \times a^n = a^{m+n}$	23. Indices 1	Target 4, Tasks 1 - 3
$a^m \div a^n = a^{m-n}$	23. Indices 1	Target 4, Tasks 4 - 6
$(a^m)^n = a^{mn}$	23. Indices 1	Target 5, Tasks 1 - 3
Mixture of problems	23. Indices 1	Target 5, Tasks 4 - 6
<b><u>Algebra and Problem Solving</u></b>		
<b>Prior Knowledge:</b>		
Powers with Algebra	23. Indices 2	Target 1
<b>National 5:</b>		
Examples (including algebra) of: $a^m \times a^n = a^{m+n}$ $a^m \div a^n = a^{m-n}$	23. Indices 2	Target 2
Trickier mixture of examples (including algebra) of: $a^m \times a^n = a^{m+n}$ $a^m \div a^n = a^{m-n}$ $(a^m)^n = a^{mn}$	23. Indices 2	Target 3
Trickier examples of: $a^{\frac{m}{n}} = \sqrt[n]{a^m}$	23. Indices 2	Target 4 and 5

The following topics are part of the National 5 Mathematics course but are not covered completely in the TJ N5 textbook:

1. Volumes:

<b><u>Geometry &amp; Measures</u></b>		
<b>Prior Knowledge:</b>		
Area	11. Area	
Volume of Cuboids	13. Volume	Target 1
Volume of Prisms (Target 3 - 4 require the formula for area of triangle, kite, parallelogram and trapezium)	13. Volume	Target 2
<b>National 5:</b>	13. Volume	
Volume of Cylinder	13. Volume	Target 3
Volume of Pyramid	13. Volume	Target 4, Tasks 1 - 2
Volume of Cone	13. Volume	Target 4, Task 4
Volume of Sphere	13. Volume	Target 4, Task 4
Composite Volumes	13. Volume	Target 4, Task 5



## 2. Inequalities:

<b>Algebra and Problem Solving</b>		
<b>Prior Knowledge:</b>		
Equations	See section 4 Prior Knowledge	
Understanding Inequalities	25. Inequalities	Target 1 and 2
<b>National 5:</b>		
Solving Inequalities <i>(Section 4 prior knowledge should be attempted beforehand since these examples quickly reintroduce brackets)</i>	25. Inequalities	Target 3
Solving trickier inequalities <i>(good practice of algebraic fractions, rearranging subject of formula and solving equations)</i>	25. Inequalities	Target 4

## 3. Similarity

<b>Geometry and Measures</b>		
<b>National 5:</b>		
Understanding Similarity and Congruency	21. Similarity	Targets 1, Tasks 1 - 9
Finding a Missing Length <i>(Task 1 may use a different method to the way you were taught in class. Do tasks 2 – 9 using scale factor, if you prefer)</i>	21. Similarity	Target 2
Finding a Missing Length using Scale Factor	21. Similarity	Targets 3, Tasks 1 - 7
Finding an Area	21. Similarity	Targets 3, Tasks 8 - 10
Mixture of finding scale factor, missing length, area and missing length from known area.	21. Similarity	Targets 3, Tasks 11 - 14
Finding a Volume <i>(Tasks 4 – 5 use capacity and mixture of ml and L)</i>	21. Similarity	Target 4 and Target 5 Tasks 1 – 3 only

**There are no sections on the following aspects of National 5 Mathematics on MathsWorkout:**

- **Vectors**
- **Trigonometric Equations**
- **Trigonometric Graphs**