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National 5 Mathematics

Q&A Booklet: Key Facts to Memorise

Ways of using this booklet:

- 1) Write the questions on cards with the answers on the back and **test yourself**.
- 2) **Work with a friend** who is also doing National 5 Maths to take turns reading a random question and answering.
- 3) **Ask a friend or family member**** to test you by reading questions (on the left-hand side) to you.

The questions are on the left-hand side of each page and the answers are on the right.

**If the person who is testing you has not done National 5 level maths topics recently (or ever!), they may need some help reading the maths symbols, so some mathematical symbols have been written out phonetically (in a smaller bold underlined font) to help them.

Questions with a grey background are also repeated on the formula sheet, but it is still a good idea to memorise them ahead of tests.

Expressions and Formulae 1.1: Surds and Indices

1) When you multiply two terms, what happens to the numbers in the powers?	Add the powers
2) When you divide two terms, what happens to the numbers in the powers?	Take away the powers
3) When you take a power of a power ("nested powers"), what happens to the numbers in the powers?	Multiply the powers
4) What is the answer when something has a power of zero?	1
5) What does it mean if the number in a power is negative ?	The answer is a fraction <i>Alternative answer:</i> it is a divide sum.
6) How do you work out a negative power?	Move the letter to the bottom and make the power positive
7) What does it mean if the number in a power is a fraction ?	It is a root (square root, cube root etc.)
8) How do you rationalise the denominator ?	Multiply top and bottom by the surd that is on the bottom of the fraction

Expressions and Formulae 1.2: Brackets and Factorising

9) How do you factorise using the difference of two squares method?	You have two brackets that are almost the same – except that one has a plus sign in and the other has a minus sign in
10) What three things are an indication that you have to have to use the difference of two squares method for factorising?	1) Only two terms 2) Take away sign 3) Contains square sign and/or square numbers
11) When completing the square , how do you get the number inside the bracket?	Half the coefficient of x
12) When completing the square , how do you get the number after the bracket?	Subtract the number in the bracket squared; then add the constant from the question

Expressions and Formulae 1.4: Geometry

13) When do you use squared units e.g. centimetres squared (cm^2) or metres squared (m^2)?	When you are working out an area. Alternative answer: when the formula begins "A ="
14) When do you use cubed units e.g. metres cubed (m^3) or centimetres cubed (cm^3)?	When you are working out a volume. Alternative answer: when the formula begins "V ="
15) When do you use normal units (not squared or cubed)?	When you are working out a distance, perimeter or arc length.
16) What is an arc ?	A curve on the outside of a circle
17) What is a sector ?	A slice of the area of the inside of a circle
18) How do you find the area of a sector of a circle?	a) Use πr^2 [pi r squared] b) Divide by 360 c) Multiply by the angle
19) How do you find the length of an arc in a circle?	a) Use πd [pi d] b) Divide by 360 c) Multiply by the angle
20) What is the formula for the volume of a cylinder ?	$V = \pi r^2 h$ (V equals pi r squared h)
21) What is the formula for the volume of a cone ?	$V = \frac{1}{3} \pi r^2 h$ (V equals one third pi r squared h)
22) What is the formula for the volume of a sphere ?	$V = \frac{4}{3} \pi r^3$ (V equals four thirds pi r cubed)
23) What is the formula for the volume of a pyramid ?	$V = \frac{1}{3} Ah$ (V equals one third A h)

Applications 1.3 / Exp&Fo 1.3: Algebraic Fractions

24) When do you use the “kiss and smile” method with fractions?	When adding or taking away
25) When do you not use the “kiss and smile” method with fractions?	When multiplying or dividing
26) What are the three steps to add or subtract fractions (“kiss and smile”)?	a) Multiply the bottoms to get the new bottom b) Multiply diagonally to get the new tops c) Add or take away the tops and simplify the top line
27) How do you multiply two fractions?	a) Multiply the tops to get the new top b) Multiply the bottoms to get the new bottoms c) Simplify the fraction if needed
28) How do you divide two fractions?	a) Flip the second fraction upside down b) Multiply the fractions
29) What is the formula for the gradient between two coordinate points?	$m = \frac{y_2 - y_1}{x_2 - x_1}$ [m equals y two minus y one over x two minus x one]

Relationships 1.2/1.3: Quadratic Graphs and Equations

Don't forget to use the formula sheet in the exam:

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

30) What is the turning point of $y = (x + b)^2 + c$? <small>(x plus b squared plus c)</small>	$(-b, c)$
31) What is the form of an equation of a line of symmetry ?	$x = \text{something}$
32) How do you find an x-coordinate if you know the y-coordinate?	Substitute y into the original equation
33) How do you find a y-coordinate if you know the x-coordinate?	Substitute x into the original equation

34) What are the roots of a quadratic equation?	The numbers that make the equation equal to zero
35) Before you can solve a quadratic equation, what must you have on the right-hand side?	Zero
36) What are the two ways of solving a quadratic equation?	1) Factorising 2) The quadratic formula
37) What phrase in an exam question mean it is likely that you need to use the quadratic formula ?	“giving your answer to 2 decimal places” (or to 1 decimal place)
38) What is the discriminant?	$b^2 - 4ac$ <u>(b squared minus four a c)</u>
39) If the discriminant is positive, what is the nature of the roots?	Real and distinct
40) If the discriminant is zero, what is the nature of the roots?	Real and equal (or “real and repeated”)
41) If the discriminant is negative, what is the nature of the roots?	No real roots
42) If the roots of a quadratic equation are real and distinct, what do we know about the discriminant?	It is positive
43) If there are no real roots to a quadratic equation, what do we know about the discriminant?	It is negative
44) If the roots of a quadratic equation are real and equal, what do we know about the discriminant?	It is zero
45) What are the steps for sketch a parabola?	a) Factorise to find the roots b) Substitute $x = 0$ to find the y-intercept c) Complete the square to find the turning point d) Identify whether it is happy or unhappy

Relationships 1.1: Straight Line and Equations	
46) What are the two equations of a straight line ?	$y = mx + c$ $y - b = m(x - a)$
47) In the general equation of any straight line, where do you look to find the gradient?	Before the letter x
48) In the general equation of any straight line, where do you look to find the y -intercept?	It is the number on its own (the one that is not in front of a letter)
49) What does it mean if the gradient of a straight line is negative ?	The line slopes downwards
50) What is the gradient of a horizontal line?	zero
51) What is the gradient of a vertical line?	undefined
52) What is the equation of a horizontal line?	$y = \text{something}$
53) What is the equation of a vertical line?	$x = \text{something}$
54) What are the three steps to find the equation of a straight line when you know its y -intercept?	1) Write down y -intercept 2) Calculate gradient between two points 3) Put into $y = mx + c$
55) What are the two steps to find the equation of a straight line when you don't know its y -intercept?	1) Calculate gradient between two points 2) Put into $y - b = m(x - a)$
56) When solving an inequation, when do you reverse the inequality sign?	When multiplying or dividing by a negative number
57) How do you solve a " system " of equations?	Simultaneous equations
58) When solving an inequation, what do you do when multiplying or dividing by a negative?	Reverse the inequality sign

Relationships 1.4: Angles, Pythagoras and Scale

59) What is a tangent to a circle?	A line that just touches the edge of the circle at one point
60) When you have a circle diagram including a tangent , what can you say about angles?	The angle between the tangent and the radius is a right angle
61) What do you know about the angle in a semicircle ?	It is a right angle
62) What two places can you find right angles in circle diagrams?	1) Between a tangent and radius 2) Angle in a semicircle
63) What do the three angles in a triangle always add up to make?	180 degrees
64) What do the four angles in a quadrilateral always add up to make?	360 degrees
65) What three places can you find equal angles in a diagram?	a) In an isosceles triangle b) In an X shape c) In a F or Z shape (parallel lines)
66) What is the formula for the angles inside a regular polygon with n sides?	$180 - \frac{360}{n}$ (180 minus 360 over n)
67) How do you find the scale factor with similar shapes?	Length in new shape divided by length in old shape
68) How do you find the scale factor for the area of two similar shapes?	Square the scale factor
69) How do you find the scale factor for the volume of two similar shapes?	Cube the scale factor
70) What are the three steps involved in a Pythagoras question?	1) Square 2) Add or take away 3) Square root
71) What do you use to prove whether something is right-angled?	Use the converse of Pythagoras
72) What are the steps to use the converse of Pythagoras?	1) Square the longest length 2) Square and add the two shorter lengths 3) If the answers are equal it's right-angled. If not equal, it's not right-angled.

Relationships 1.5: Further Trigonometry

73) In a sin or cos graph, what is the amplitude ?	The height of the graph
74) In a sin, cos or tan graph, what is the frequency ?	How often the graph repeats itself in 360° for sine or cos, or 180° for tan
75) In a sin, cos or tan graph, what is the period ?	How many degrees it takes for the graph to do one complete cycle before it begins to repeat
76) In a sin, cos or tan graph, what is the phase angle ?	How far the graph has been shifted to the right
77) For a graph of the form $y = a\sin bx$ or $y = a\cos bx$, what is a ?	The amplitude
78) For a graph of the form $y = a\sin bx$, $y = a\cos bx$ or $y = a\tan bx$, what is b ?	The frequency
79) For a graph of the form $y = a\sin(x - b)$, $y = a\cos(x - b)$ or $y = a\tan(x - b)$, what number is b ?	The phase angle
80) What are the three steps to solve an equation for $0 \leq x < 360^\circ$?	<ol style="list-style-type: none"> 1) Rearrange 2) Use shift (inverse) sin/cos/tan 3) Use CAST to find the second answer
81) What fact do you need to know about $\sin^2 x$ and $\cos^2 x$? (sine squared x) (cos squared x)	$\sin^2 x + \cos^2 x = 1$ (sine squared x plus cos squared x equals 1)
82) What fact do you need to know about how tan is linked to sin and cos?	$\tan x = \frac{\sin x}{\cos x}$ (tan x equals sine x over cos x)
83) What does $\sin^2 x + \cos^2 x$ always equal? (sine squared x plus cos squared x)	1
84) What does $\frac{\sin x}{\cos x}$ always equal? (sine x over cos x)	$\tan x$

Applications 1.1: Trigonometry

85) What is the National 5 formula for the area of a triangle?	$A = \frac{1}{2}ab\sin C$ <p>[A = half a b sine C]</p>
86) What is the sine rule?	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ <p>(a over sine a equals b over sine b equals c over sine c)</p>
87) What is the cosine rule for lengths?	$a^2 = b^2 + c^2 - 2bc\cos A$ <p>(a squared equals b squared plus c squared minus two b c cos A)</p>
88) What is the cosine rule for angles?	$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$ <p>(cos A equals b squares plus c squared minus a squared over two b c)</p>
89) In the formula for the area of a triangle , which angle do you use?	The angle that is in between the two sides you have used
90) When do you use the cosine rule for lengths in a triangle?	When you know two lengths and the angle in between
91) When do you use the sine rule in a triangle?	With two sides and an angle that is not in between them
92) When do you use the cosine rule for angles in a triangle?	When you know all three lengths but no angles
93) In the cosine rule for lengths, does it matter which side is <i>b</i> and which side is <i>c</i> ?	No
94) In the sine rule, does it matter which side is <i>a</i> and which side is <i>b</i> ?	No
95) In the cosine rule for angles, does it matter which side is <i>a</i> , <i>b</i> or <i>c</i> ?	Yes. <i>a</i> has to be the side <u>opposite</u> the angle you are finding.
96) What three things do you have to remember when measuring a bearing?	<ol style="list-style-type: none"> 1) Start from North 2) Measure clockwise 3) Use three digits
97) How do you work out a back bearing ?	Subtract from 180°

Applications 1.2: Vectors

98) What are the three steps for finding the magnitude of a vector?	1) Square all the components 2) Add them 3) Square root
99) How do you add two vectors when given a picture	Place the vectors nose to tail
100) What does a picture of the negative vector look like?	The same as the original vector, but the arrow points backwards.
101) What does a picture of a vector that has been multiplied by a scalar look like?	The same as the original vector, but the length has changed by a scale factor

Applications 1.3: Fractions and Percentages

102) How do you work out a fraction ?	Divide by the bottom and times (multiply) by the top
103) What sum do you do to work out 75% ?	Divide by 4 and times by 3 Alternative answer: find three-quarters
104) What do you do to work out 30% <u>without</u> a calculator?	Divide by 10 and times by 3 Alternative answer: find 10% and times by 3
105) What sum do you do to work out 70% <u>without</u> a calculator?	Divide by 10 and times by 7 Alternative answer: find 10% and times by 7
106) What sum do you do to work out 3% <u>without</u> a calculator?	Divide by 100 and times by 3 Alternative answer: find 1% and times by 3
107) What sum do you do to work out 5% <u>without</u> a calculator?	Divide by 100 and times by 5 Alternative answer: find 1% and times by 5 Alternative answer: find 10% and half it
108) How do you work out a percentage with a calculator?	either change to a decimal and multiply or divide by 100 and multiply

109) What sum do you do to work out 2½% <u>without</u> a calculator?	Divide by 10, half it and half again Alternative answer: find 5% and half it
110) What fraction is the same as $33\frac{1}{3}\%$? (thirty three and one third per cent)	$\frac{1}{3}$
111) What fraction is the same as $66\frac{2}{3}\%$? (sixty six and two thirds per cent)	$\frac{2}{3}$

Applications 1.4: Statistics

Don't forget to use the formula sheet in the exam:

$$\text{Standard Deviation: } s = \sqrt{\frac{\sum(x - \bar{x})^2}{n-1}} = \sqrt{\frac{\sum x^2 - (\sum x)^2 / n}{n-1}}$$

112) How do you find the Semi-Interquartile Range (SIQR) ?	$\frac{\text{Upper Quartile} - \text{Lower Quartile}}{2}$
113) What does the symbol Σ (sigma) mean?	Add together all the numbers
114) What does the symbol \bar{x} (x bar) mean?	The mean
115) In the standard deviation formula, what does n stand for?	How many numbers there are
116) If a <u>standard deviation</u> is higher , what comment can you make?	The numbers are more varied
117) If a <u>semi-interquartile range</u> is higher , what comment can you make?	The numbers are more varied
118) If a <u>mean or median</u> is higher , what comment can you make?	On average, the numbers are higher
119) If a <u>standard deviation</u> is lower , what comment can you make?	The numbers are more consistent
120) If a <u>semi-interquartile range</u> is lower , what comment can you make?	The numbers are more consistent
121) If a <u>mean or median</u> is lower , what comment can you make?	On average, the numbers are lower
122) How do you find the equation of a line of best fit in a scattergraph?	$y - b = m(x - a)$
123) How do you use a line of best fit to estimate a value from a scattergraph?	Substitute a number into the equation of the line of best fit

Whole Course: Choosing the Correct Method

otherwise known as "how to stop yourself failing because you end up leaving questions worth lots of marks blank because you don't know (or can't be bothered choosing) the method"

124) How do you choose between the sine rule and the cosine rule?	Use cosine rule when you have two sides and the angle in between. Use sine rule in any other question.
125) How do you find a length in a triangle when you do <u>not</u> have two sides and the angle in between?	Sine rule
126) How do you find a length in a triangle when you know two sides and the angle between?	Cosine rule
127) How do you find an angle in a triangle when you know the length of all three sides?	Cosine rule for angles
128) How do you find an area of a circular shape?	Use πr^2 (pi r squared), divide by 360, multiply by the angle
129) How do you find the area of a triangle?	Use $A = \frac{1}{2}ab\sin C$ (A equals half a b sine C)
130) How do you find the length of a curved line?	Use πd , divide by 360, multiply by the angle
131) How do you find the length of a straight side of a triangle?	Use either sine rule or cosine rule
132) How do you find the length of a straight line inside a circle?	Use Pythagoras and symmetry
133) What do you do with a shape with sides that have lengths containing x ?	It wants you to write each length in a bracket and then multiply out the brackets
134) What do you do if question has a straight line graph in?	Find the equation using $y = mx + c$ or $y - b = m(x - a)$
135) What is it telling you if a factorise question says to factorise FULLY ?	Take a common factor out first, then use two brackets
136) What do you do if a question wants you to solve a " system " of equations?	Use simultaneous equations
137) How do you solve an equation "for $0 \leq x < 360^\circ$ "? (x between zero and 360)	Rearrange, use inverse sin/cos/tan and use CAST to find the second answer
138) How do you solve an equation "giving your answer to 2 (or 1) decimal places"?	Use the quadratic formula

*This booklet may be used and distributed **for free** by schools/colleges, teachers, learners and parents/carers so long as the Dynamic Maths name and branding is retained.*

Command Words in Exams

139) What do you need to include when a question asks you to ' explain your answer ' (or ' give a reason ')?	Two numbers and a comparing word.
140) When a question asks you to round your answer, what do you have to remember?	Write the unrounded answer as well as the rounded one.
141) If the answer to a question is a fraction, what do you have to remember?	You must simplify the fraction
142) If a question uses the word "hence", what does this tell you?	Your <u>must</u> use your last answer somehow
143) If a question uses the word "show that", what does this tell you?	The question is telling you the answer and you have to show all the working to get that answer.
144) If a question uses the words "state" or "write down", what does this tell you?	You should be able to get the answer easily without working

Numeracy: Measurement

145) How do you change centimetres to metres ?	Divide by 100
146) How do you change metres to centimetres ?	Multiply by 100
147) How do you change kilometres to metres ?	Multiply by 1000
148) How do you change metres to kilometres ?	Divide by 1000
149) How do you change centimetres to millimetres ?	Multiply by 10
150) How do you change millimetres to centimetres ?	Divide by 10
151) How do you change grams to kilograms ?	Divide by 1000
152) How do you change kilograms to grams ?	Multiply by 1000
153) How many centimetres cubed are in a litre ?	1000