NAME: _____

Sixth Form Transition Task

MATHEMATICS

In order to prepare you for the A Level Mathematics course, you have been given this transition task to complete for the first day. If you are unsure of any of the questions, use HegartyMaths and the list of topics at the back of this booklet. The task is designed to ensure that you are confident in the fundamental skills required for this rigorous course.

You should summarise your opinions on how you found different areas of this task, in the table below.

Topic	Opinions: Your Strengths & Weaknesses	Score
Graphs		/40
Basic Algebra		/25
Powers and Roots		/25
Inequalities		/15
Trigonometry		/20
Probability and Statistics		/20
Proof by Counter-Example		/17
	Total	/162

Teacher's Comments:

_____

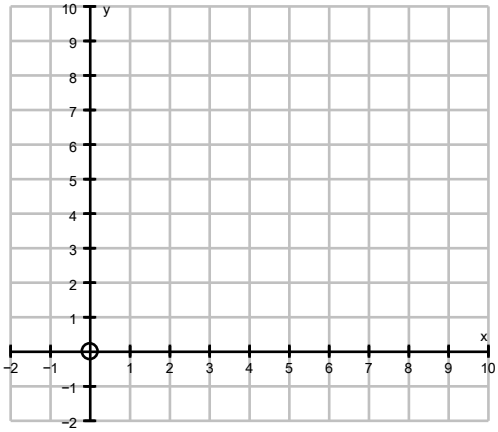
_____

_____

Graphs

1) Draw and label the following graphs on the axes below:

$y = -1$
$x = 0$
$x = 2$
$y = x$
$y = -2x$
$y = 2x + 3$
$2y + x = 7$



(7)

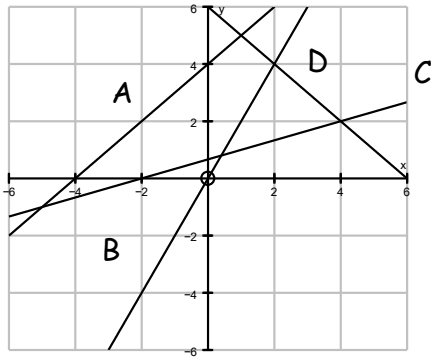
2) Find the gradient and y-intercept for each of the following straight line graphs:

$y = 3x + 2$	.....	.....
$y = 5 - x$	.....	.....
$2x + y = 7$	.....	.....
$x - 5y - 2 = 0$	.....	.....

(8)

3) Match the lines A, B, C and D in the diagram to the equations below:

$y = 4 + x$ .....
$x + y = 6$ .....
$y = 2x$ .....
$3y - x = 2$ .....



(4)

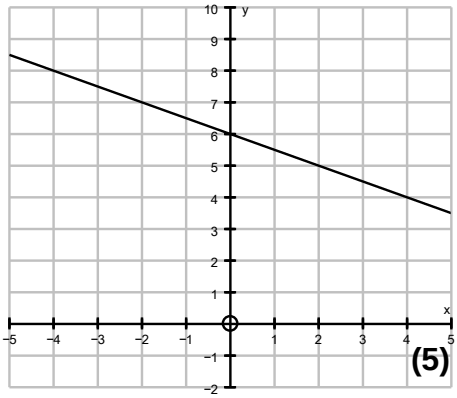
4) Look at the straight line shown in the diagram.

a) Find the equation of the straight line graph.
.....

b) A straight line graph has the same gradient as the one in part (a), but goes through the point (0, -1).

i) Write down the equation of this graph.
.....

ii) Sketch the graph on the axes on the right.



(5)

5) Point P has coordinates (6,5) and point Q has coordinates (2, -1).
Find the length of PQ, giving you answer correct to two decimal places.

…… **(3)**

6) Point P has coordinates (6, 2) and point Q has coordinates (-4, 1).

a) Find the coordinates of the midpoint of PQ.

(……,……)

Point R has coordinates (*a, b*)

b) The midpoint of PR is (3, 5). Find the values of *a* and *b*.

a = …… *b* = …… **(5)**

7) Describe the key features of the following graphs:

a) $y = 3x^2+2$

b) $y = 4 - x^3$

c) $xy = 2$

d) $x^2 + y^2 = 36$

(8)

Basic Algebra

1) Simplify:

a) $5x + 3y – 4 - 2y – x$

……

b) $4k + 3y^2 - 6k + y^2 + 2$

……

c) $\dfrac{2(x+1)^2}{x+1}$

……

(3)

2) Expand:

a) $2pq(3p – 4q^2)$

……

b) $(2g + 5)(4g – 2)$

……

c) $(4 – 3h)^2$

……

(3)

3) Factorise:

a) $14x^2y^3 + 21xy^2 - 35x^3y^4$

……

b) $12h^2j^3 + 6h^4j^2k – 36h^3jk$

……

c) $x^2 - x – 12$

……

d) $8x^2 + 16x – 10$

……

(4)

4) Solve the following equations:

a) $5 + 3y = y – 11$

……

b) $\sqrt{(3x + 10)} = 7$

……

c) $3x^2 = 12$

.....

d) $x^2 + 5x + 6 = 0$

.....

e) $6x^2 - 10x = 4$

.....

f) $x^2 + 10x - 4 = 0$ (Hint! What can you use if it does not factorise?)

.....

(6)

5) Rearrange the formula to make t the subject:

$$s = \tfrac{1}{2} gt^2$$

.....

(3)

6) Rearrange the formula to make y the subject:

$$a + y = \frac{b - y}{a}$$

.....

(3)

7) Solve these pairs of simultaneous equations:

$$x^2 + y = 4$$
$$y = 4x - 1$$

(3)

Powers and Roots

1) Use the laws of indices to simplify the following:

a) $3^2 \times 3^6$

……

b) $4^3 \div 4^2$

……

c) $(8^3)^4$

……

d) $\dfrac{(3^2 \times 3^3 \times 1^6)}{3^5}$

……

e) $7^3 \times 7 \times 7^2$ ……

f) $5^2 \times 5^7 \times 5^3$

……

g) $1^3 \times 5^0 \times 6^2$

……

h) $(4^3 \times 4 \times 4^2) \div (2^3 \times 2^4)$ ……

i) If $6 \times 6 \times 6 = 216$, what is the value of $216^{1/3}$?

……

(9)

2) Use your calculator to find:

a) $56^{1/2}$

……

b) $450^{1/3}$

……

c) $\sqrt{200}$

……

d) $\sqrt[3]{8000}$

……

(4)

3) Simplify the following as much as possible:

a) $\sqrt{2} \times \sqrt{8}$

……

b) $\sqrt{48}$

……

c) $5\sqrt{125}$

……

d) $\sqrt{27} \times \sqrt{18}$ ……

(8)

4) Expand and simplify $(2 + \sqrt{3})(2 - \sqrt{3})$

…… **(4)**

Inequalities

1) Solve the following inequalities:

a) $3x \leq 5 + 2x$

.....

b) $10 < 2x - 6$

.....

c) $4x + 1 > x - 5$

.....

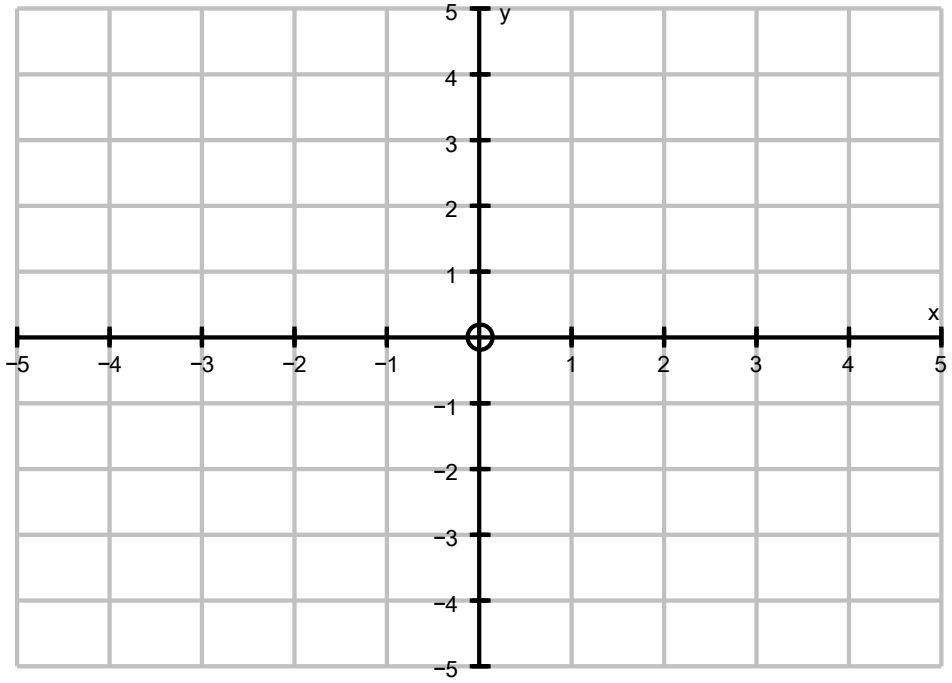
d) $\frac{2x}{5} \leq 3$

.....

(8)

2) $-2 < x \leq 1$ $y > -2$ $y < x + 1$ x and y are integers.

On the grid, mark with a cross (✕), each of the six points which satisfies **all** these 3 inequalities.



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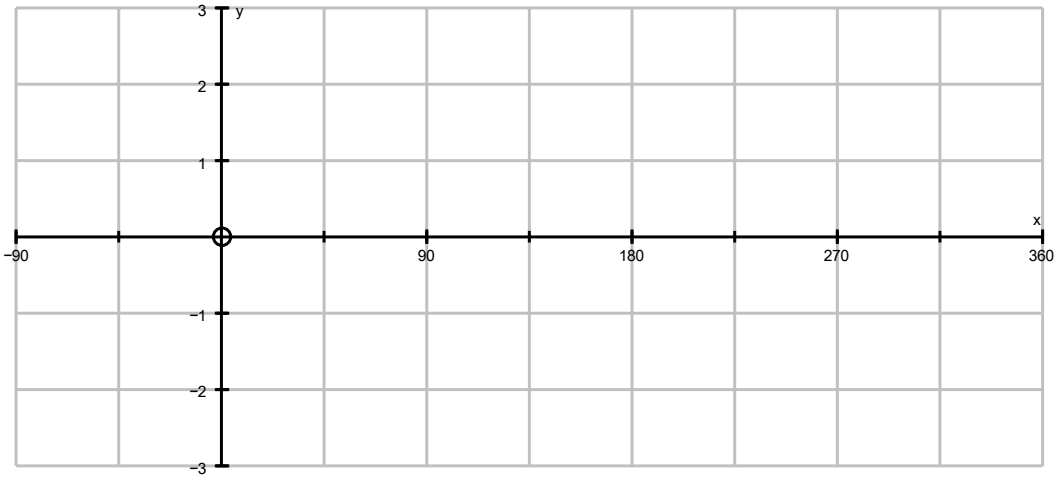
Trigonometry

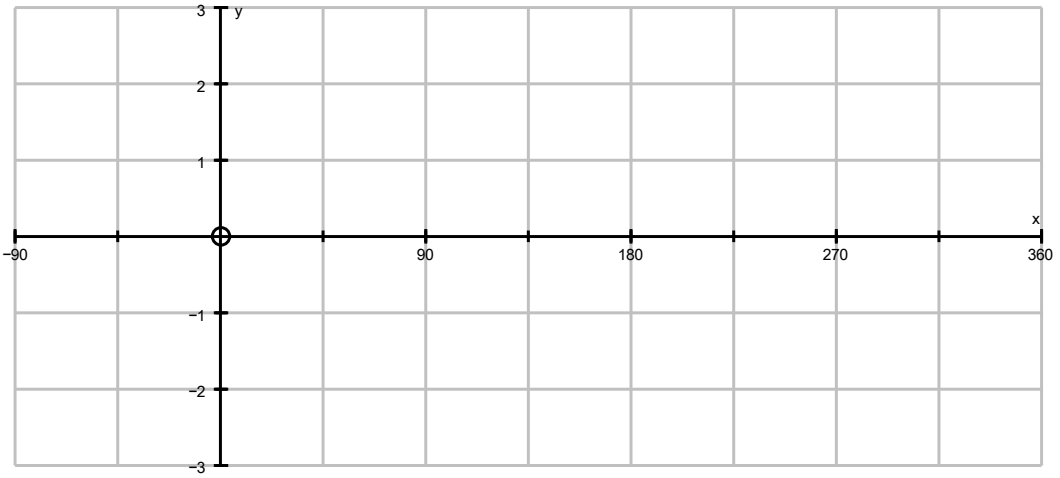
1) Draw the graphs of the following functions:

a) $y = \sin x$ $y = 2\sin x$ $y = \sin 2x$



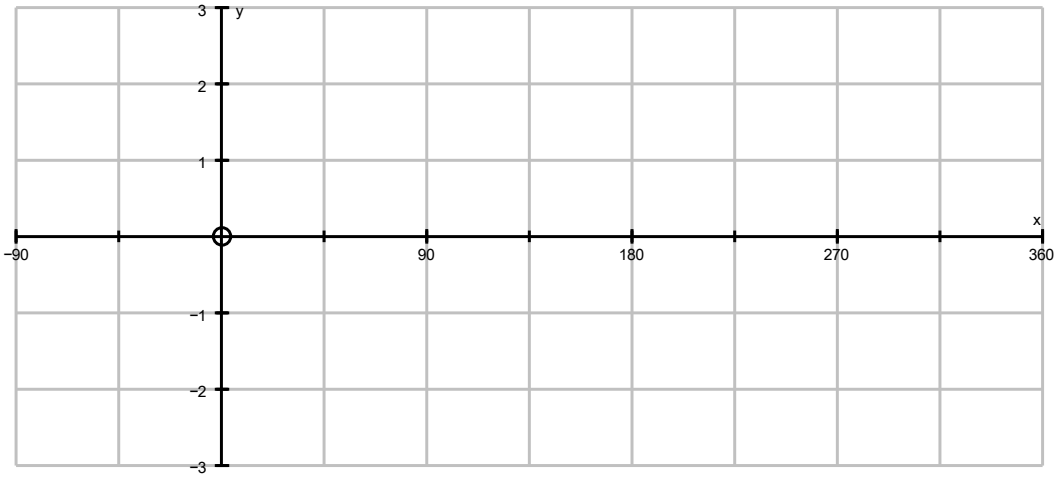
(3)

b) $y = \cos x$ $y = 1 + \cos x$ $y = \cos(x + 45°)$



(3)

c) $y = \tan x$



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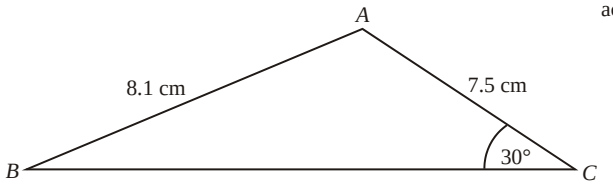


Diagram **NOT** accurately drawn

In triangle *ABC*,

AB = 8.1 cm, *AC* = 7.5 cm, angle *ACB* = 30°.

a) Calculate the size of angle *ABC*.
Give your answer correct to 3 significant figures.

……°

b) Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures.

……..cm²

(7)

3)

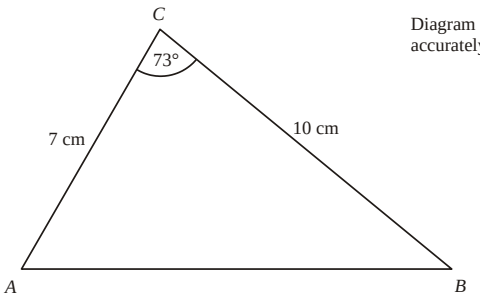


Diagram **NOT** accurately drawn

In triangle *ABC,*
AC = 7 cm, *BC* = 10 cm, angle *ACB* = 73°.
Calculate the length of *AB.*
Give your answer correct to 3 significant figures.

…… cm

(5)

Probability and Statistics

1) The table gives information about the ages of 160 employees of an IT company.

Age (A) in years	Frequency
$15 < A \leq 25$	44
$25 < A \leq 35$	56
$35 < A \leq 45$	34
$45 < A \leq 55$	19
$55 < A \leq 65$	7

a) Complete the cumulative frequency table.

Age (*A*) in years	Cumulative Frequency
$15 < A \leq 25$	
$15 < A \leq 35$	
$15 < A \leq 45$	
$15 < A \leq 55$	
$15 < A \leq 65$	

b) On the grid below, draw a cumulative frequency graph for your table.

c) Use your graph to find an estimate for

i) the median age of the employees,

..... years

ii) the interquartile range of the ages of the employees.

..... years

Another IT company has 80 employees.

The age of the youngest employee is 24 years.
The age of the oldest employee is 54 years.

The median age is 38 years.
The lower quartile age is 30 years.
The upper quartile age is 44 years.

d) On the grid, draw a box plot to show information about the ages of the employees.

(8)

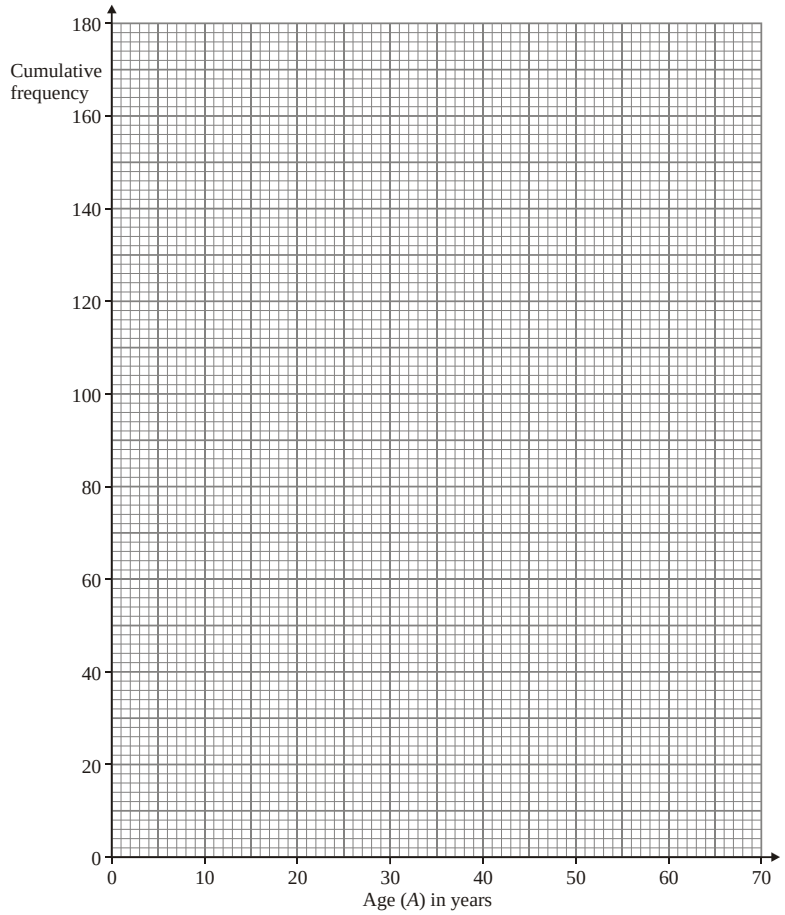
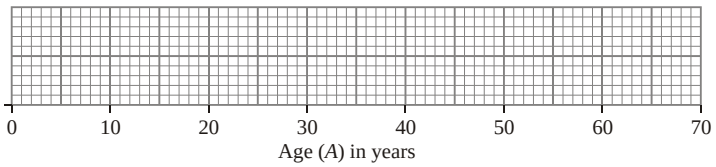


Diagram for part (d).



2) Rosie had 10 boxes of drawing pins. She counted the number of drawing pins in each box. The table gives information about her results.

Number of drawing pins	Frequency	
29	2	
30	5	
31	2	
32	1	

a) Write down the modal number of drawing pins in a box.

.....

b) Work out the range of the number of drawing pins in a box.

.....

c) Work out the mean number of drawing pins in a box.

..... (5)

3) A bag contains 6 red disks, 4 blue disks and 5 green disks.
A fair dice has 4 faces painted red and the other 2 faces painted blue.
Lisa takes a disk at random from the bag and records its colour.
Lisa then throws the dice twice and each time records the colour of the face it lands on. Work out the probability that, of the three colours Lisa records, exactly two are the same.

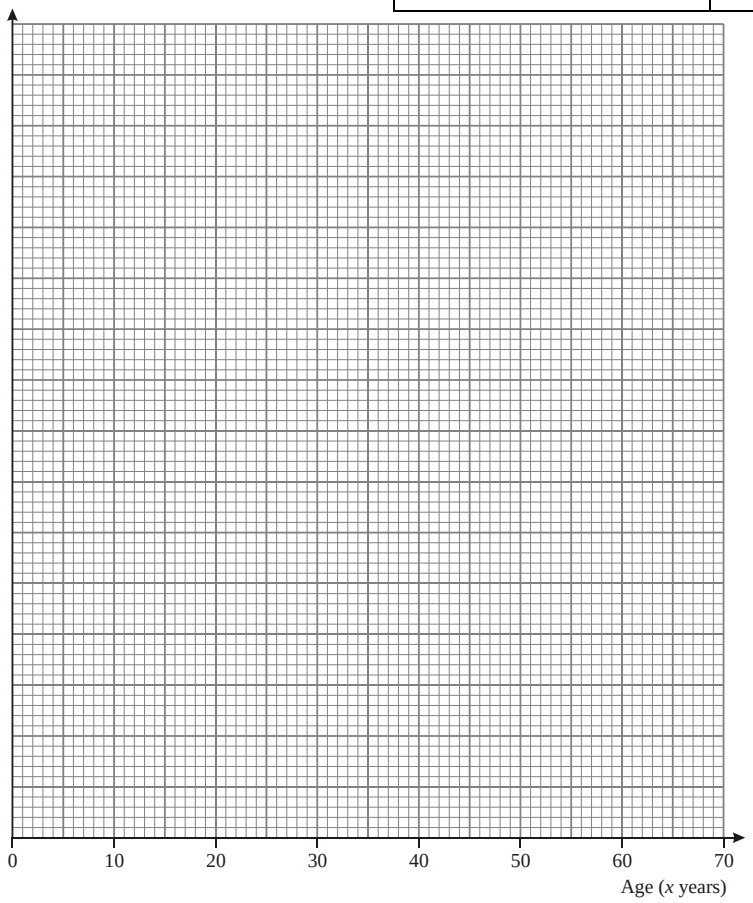
.....

(4)

4) The table shows the distribution of the ages of passengers travelling on a plane from London to Belfast.

Age (x years)	Frequency
$0 < x \leq 20$	28
$20 < x \leq 35$	36
$35 < x \leq 45$	20
$45 < x \leq 65$	30

On the grid below, draw a histogram to show this distribution.



(3)

Proof by Counter Example

1. Which of the statements are false? If so, give a counterexample.
    a. The sum of two odd numbers is even.
    b. The sum of two even numbers is even.
    c. The product of two odd numbers is even.
    d. The product of two even numbers is even.

2. Jim says 'Prime numbers are always odd'. Prove that Jim is wrong.

3. 'The square root of a number is always smaller than the number itself.' Is this correct? Give an example to support your claim.

4. Show that each statement is false.
    a. $3n + 1$ is odd for all integers n.
    b. $2n$ is even for all values of n.
    c. $2^n \geq 1$ for all values of n.
    d. $2n^2 + 11$ is prime for all integers n.
    e. If $k^2 > 0$ then $k > 0$.
    f. If k is even then $\frac{k}{2}$ is even.
    g. If p is prime then $p + 2$ is prime.
    h. If $a < 1$ and $b < 1$ then $ab < 1$.

5. Some of the statements below can be disproven by one example. What is that example?

    The difference between consecutive square numbers is always prime

    The sum of any even number of consecutive numbers is always a multiple of that even number.

    If you add 1 to an even square number then you get a prime number.

Optional Forward Thinking (Name immediately written down in the good books if you've tried this question):
How can we proof that $\sqrt{2}$ is an irrational number?

HegartyMaths Help

As you transition from Year 11 to Year 12, it is very important to refresh your memory on certain core mathematical skills. Moreover, it is vital that you have a sound understanding of some more difficult skills. In the tables below, you will find **184 skills** that you should be confident with as you start Year 12.

Number

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Index form 4 (multiplying indices)	105			
Index form 5 (dividing indices)	106			
Index form 6 (power of power rule)	107			
Index form 7 (powers of unit fractions)	108			
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Brackets involving surds 1	116			
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Algebra

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Substitution 4	783			
Substitution 5	784			
Substitution 6	785			
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Geometry and measures

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Proof

Topics	Clip Number	R	A	G
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Direct Algebraic Proof 2	326			
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