Surname	Centre Number	Candidate Number
Other Names		0

GCSE LINKED PAIR PILOT

4363/02

W16-4363-02

METHODS IN MATHEMATICS

UNIT 1: Methods (Non-Calculator)
HIGHER TIER

A.M. MONDAY, 11 January 2016

2 hours

CALCULATORS ARE NOT TO BE USED FOR THIS PAPER

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**7**	
3.	**4**	
4.	**4**	
5.	**10**	
6.	**8**	
7.	**5**	
8.	**12**	
9.	**7**	
10.	**5**	
11.	**4**	
12.	**7**	
13.	**8**	
14.	**7**	
15.	**7**	
Total	**100**	

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ADDITIONAL MATERIALS

A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

Take π as 3·14.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question **5***(a)*.

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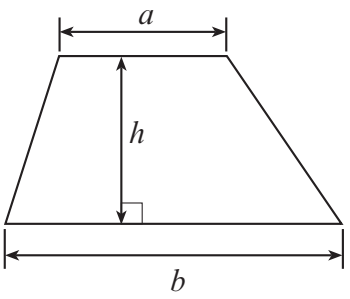
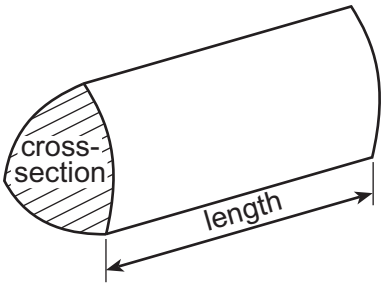
Formula List

Area of trapezium = $\frac{1}{2}(a + b)h$

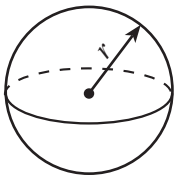


Volume of prism = area of cross-section × length



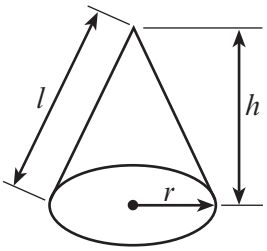
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$



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

Curved surface area of cone = πrl

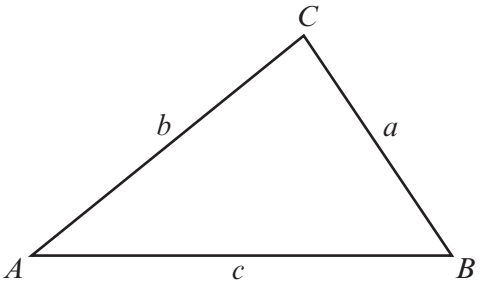


In any triangle ABC

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

Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

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



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$

where $a \neq 0$ are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

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1. *(a)*

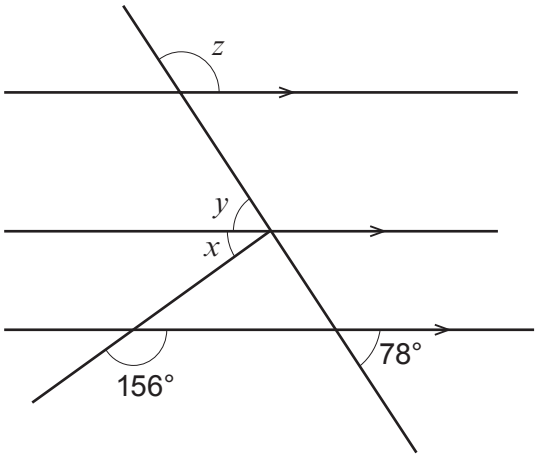

Diagram not drawn to scale

Calculate the size of angles x, y and z. [3]

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x = ... ° y = ... ° z = ... °

(b)

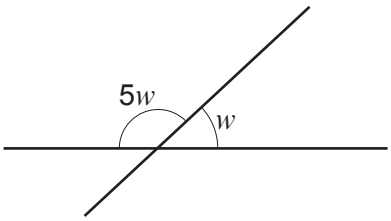

Diagram not drawn to scale

Calculate the size of angle w. [2]

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w = ... °

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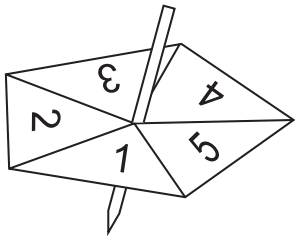
2. A spinner is labelled with the numbers 1, 2, 3, 4 and 5.



After 100 spins, the outcomes were recorded.
The table shows some of the results.

Number	1	2	3	4	5
Frequency	44	.....	22	10	.....

(a) The frequencies of the numbers 2 and 5 are in the ratio 1 : 2.
Complete the table above. [3]

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(b) Write the best estimate of the probability of each of the following:

(i) the number 3 occurring, [1]

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(ii) a number greater than 1 occurring. [2]

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(c) Would you consider this to be a fair spinner?
You must give a reason for your answer. [1]

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3. *(a)* Given that $a = 2$, $b = -1$ and $c = -6$, find the value of $\dfrac{4a - 3c}{b^2 + 1}$. [2]

(b) Simplify $68x - 18y - 70x - 7y$. [2]

4

4. Use **estimation** to complete the table below. [4]

Number	Accuracy required	Rounded number
35^2	Correct to the nearest 100	1200
3^4	Correct to the nearest 10	80
$\sqrt{122}$	Correct to 2 significant figures	.....
$\sqrt{(80{\cdot}805 + 63{\cdot}23)}$	Correct to 1 significant figure	.....
25^2	Correct to the nearest 100	.....
$\dfrac{89{\cdot}8}{0{\cdot}499}$	Correct to the nearest 10	.....

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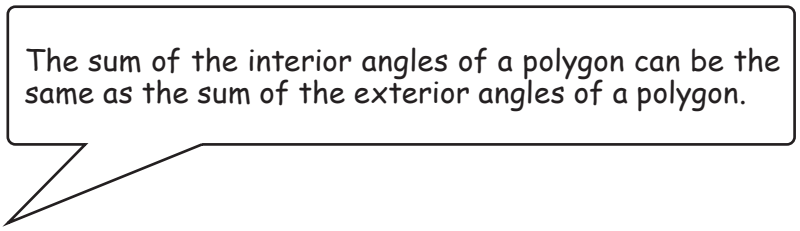
5. *(a) You will be assessed on the quality of your written communication in this part of the question.*

Cari says this to her friend Jake.



Help Cari convince Jake that she is correct.

You must

- name a suitable polygon
- give the sum of its exterior angles
- give the sum of its interior angles and
- show how the sum of its **interior** angles is calculated. [5]

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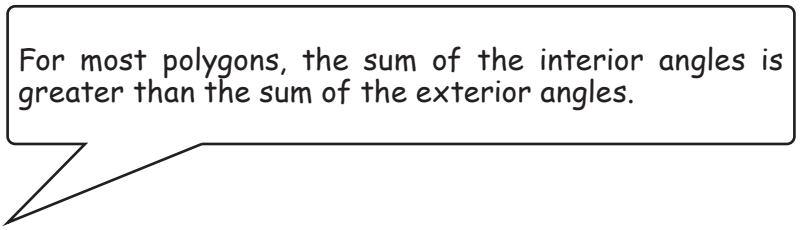
(b) Wesley says this to his friend Amelia.



Help Wesley fully convince Amelia that he is correct. [5]

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6. *(a)* Write each of 450 and 270 as products of prime factors using index notation. [4]

(b) Hence write down the lowest common multiple and the highest common factor of 450 and 270.
You must evaluate your answers. [4]

Lowest common multiple:

Highest common factor:

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7. *(a)* Rearrange $13g = 2(g + 3t)$ to make g the subject of the formula. [3]

(b) Rearrange $\sqrt{h} + 4 = 3f$ to make h the subject of the formula. [2]

5

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8. Bethan is given the following information:

The universal set, ε, is the set of all fractions.

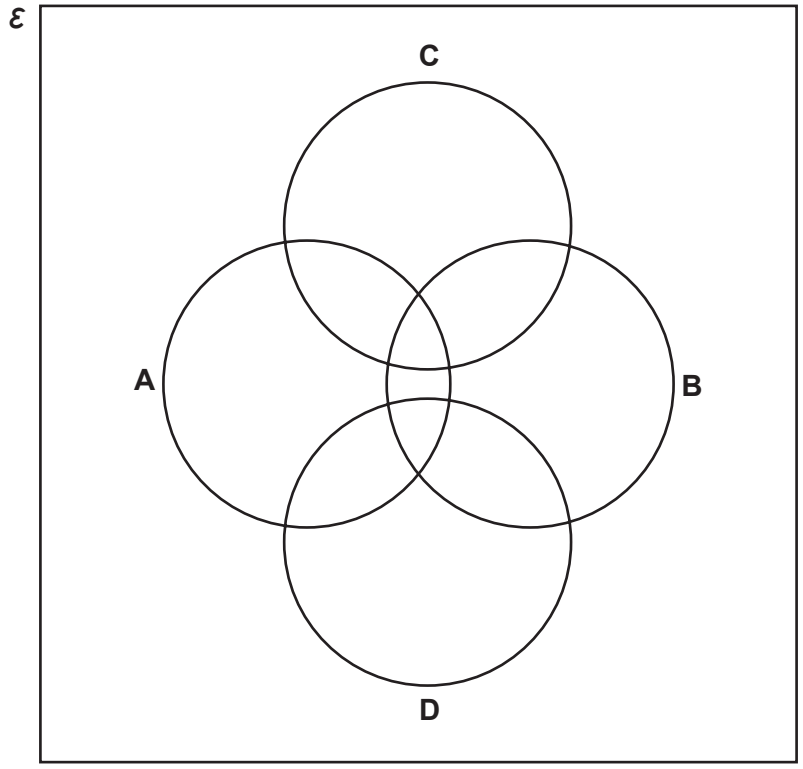
Set **A** contains all the fractions that can be written as **recurring decimals**.

Set **B** contains all the fractions that can be written as **terminating decimals**.

Set **C** contains any fractions that are equivalent to 40%.

Set **D** contains any fractions that are greater than 60%.

Bethan draws a Venn diagram to represent this information. Her Venn diagram is shown below.



(a) (i) Explain why set **C** and set **D** have no intersection in the Venn diagram. [1]

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(ii) Sets with no entries are known as empty sets or null sets.
Shade the region that represents **A** ∩ **B** on Bethan's Venn diagram.
Explain how you know that **A** ∩ **B** will be a null set. [2]

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(b) The following fractions are to be placed in Bethan's Venn diagram.

$$\frac{3}{5} \quad \frac{24}{36} \quad \frac{6}{15} \quad \frac{3}{11} \quad \frac{5}{9} \quad \frac{45}{200}$$

(i) Complete the table below by writing each of these fractions as a decimal. The first two have already been done for you. [4]

Fraction	Decimal
$\frac{3}{5}$	0·6
$\frac{24}{36}$	$0\cdot\dot{6}$
$\frac{6}{15}$	
$\frac{3}{11}$	
$\frac{5}{9}$	
$\frac{45}{200}$	

(ii) Place each of the 6 **fractions** in the appropriate position in the Venn diagram. [3]

(iii) List the fractions that are in the set **A′** in the Venn diagram. [1]

(iv) A fraction is selected at random from this list of 6 fractions.
Find the probability that the fraction selected is in the region $\mathbf{A} \cup \mathbf{B}$. [1]

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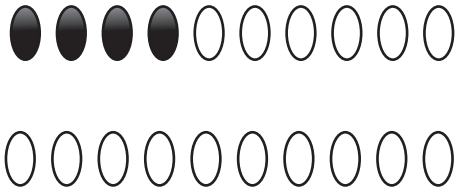
9. Here are 20 beads, 4 are coloured black and 16 are coloured white.



These beads are to be placed inside two boxes, *A* and *B*.

There are 5 beads in box *A* and 15 beads in box *B*.
All the black beads are in box *B*.

A contestant in a TV game show has to first select a box at random, and then select a bead at random from the chosen box.

(a) Complete the tree diagram. [4]

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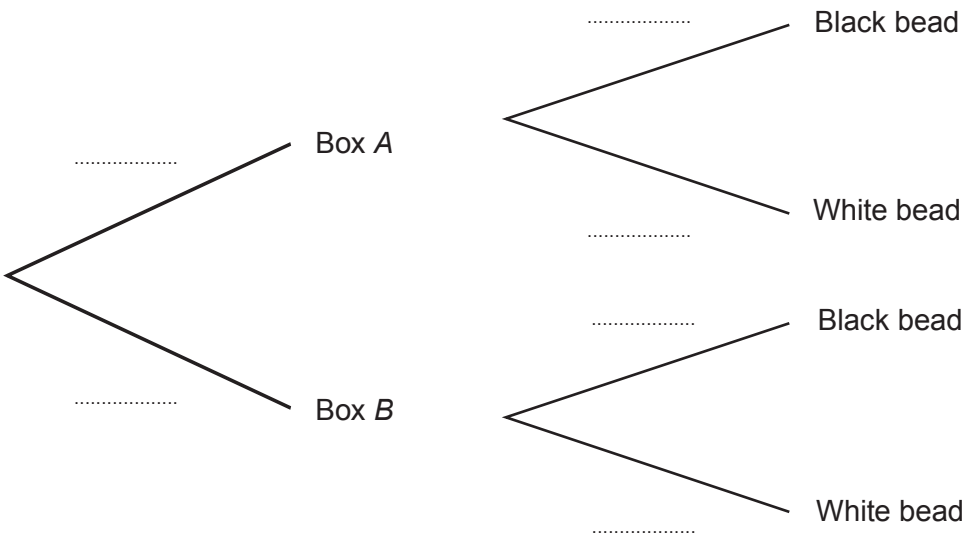

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(b) If a contestant selects a black bead they win a prize.
Calculate the probability of a contestant winning a prize. [2]

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(c) The boxes are always prepared in the same way for each game.
Each of the last four contestants selected a black bead and won a prize.

Does this affect the probability that the contestant in the next game will win a prize?
You must give a reason for your answer. [1]

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10. *(a)* The nth term of a sequence is $3n^2 + 2n - 1$.
Calculate the 20th term of the sequence. [2]

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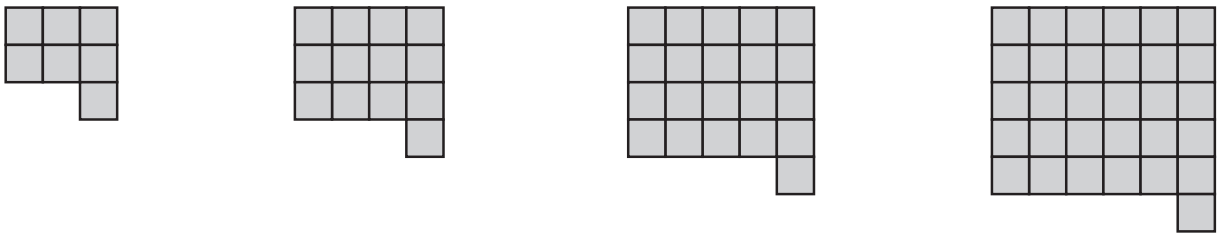
(b) The diagram shows the first 4 patterns in a sequence.



Pattern 1 Pattern 2 Pattern 3 Pattern 4

Write down an expression for number of squares in the nth pattern of the sequence. [3]

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11. *(a)* Factorise $3x^2 + 7x + 2$. [2]

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(b) Complete the following identity by inserting the missing values. [2]

$$10x^2 + \ldots\ldots x - 6 \equiv (5x \ldots\ldots)(2x + 3)$$

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12. *PQ* is a tangent to both the circles.
The points *A* and *S* lie on the tangent *PQ*.
E is the centre of one of the circles, with points *A* and *B* on the circumference of this circle.
The points *S*, *T*, *W* and *Y* lie on the circumference of the other circle.

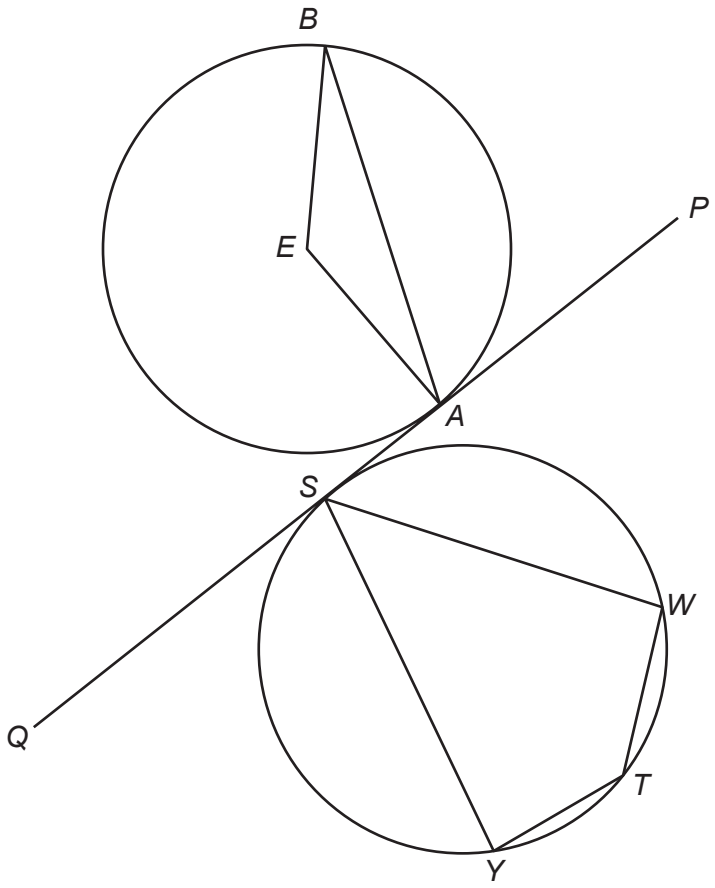

Diagram not drawn to scale

You are given three further facts:

- $B\hat{E}A = 144°$
- $P\hat{A}B = P\hat{S}W$
- $S\hat{W}T = 96°$

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Calculate the size of $W\hat{Y}T$.

You must show your working.
To do this, you may wish to label the size of any angles that you calculate and show any extra lines on the diagram. [7]

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13. *(a)* Express $\frac{5x}{x+6} - \frac{3x}{2x+7}$ as a single fraction in its simplest form. [4]

(b) Simplify $\left(2+3\sqrt{2}\right)\left(7+5\sqrt{2}\right)$. [4]

8

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14. *(a)* The expression $x^2 + 10x + 3$ can be written in the form $(x + a)^2 + b$, where a and b are whole numbers.
Find the values of a and b. [3]

(b) Hence solve $x^2 + 10x + 3 = 0$ leaving your answer in surd form. [4]

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15. The clues below describe a straight line.

The straight line:

- is perpendicular to $x + 4y - 3 = 0$,
- passes through the mid-point of the line joining (2, 2) and (6, 6).

Find the coordinates of the point where the straight line described intersects the x-axis. [7]

Intersection with x-axis is at (..... , ...)

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END OF PAPER

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