WJEC CBAC

GCSE LINKED PAIR PILOT

4363/02

METHODS OF MATHEMATICS
UNIT 1: Methods (Non-Calculator)
HIGHER TIER

A.M. FRIDAY, 10 January 2014

2 hours

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	5	
2.	8	
3.	6	
4.	5	
5.	8	
6.	6	
7.	5	
8.	7	
9.	3	
10.	5	
11.	5	
12.	8	
13.	5	
14.	7	
15.	3	
16.	7	
17.	7	
Total	100	

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 **2**(a).

Formula List

Area of trapezium $= \frac{1}{2}(a + b)h$
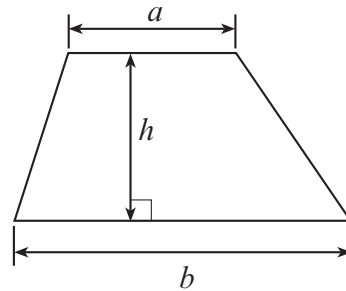
Volume of prism = area of cross-section × length
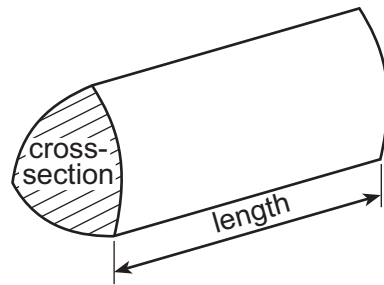
Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$
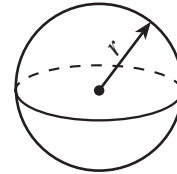
Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$
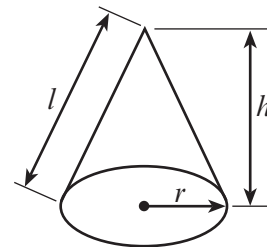
In any triangle ABC

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

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

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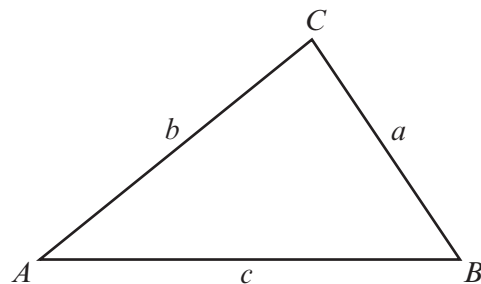
The Quadratic Equation

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

where $a \neq 0$ are given by

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

1. *(a)* Given that $a = -3$, $b = -5$ and $c = 2$, find the value of $\dfrac{6c - 2b}{a^2 + 2}$. [2]

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(b) Simplify $32x - 16y - 50x - 17y$. [2]

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(c) Simplify $\dfrac{(2x + 7)^4}{2x + 7}$. [1]

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2. *(a)* *You will be assessed on the quality of your written communication in this part of the question.*
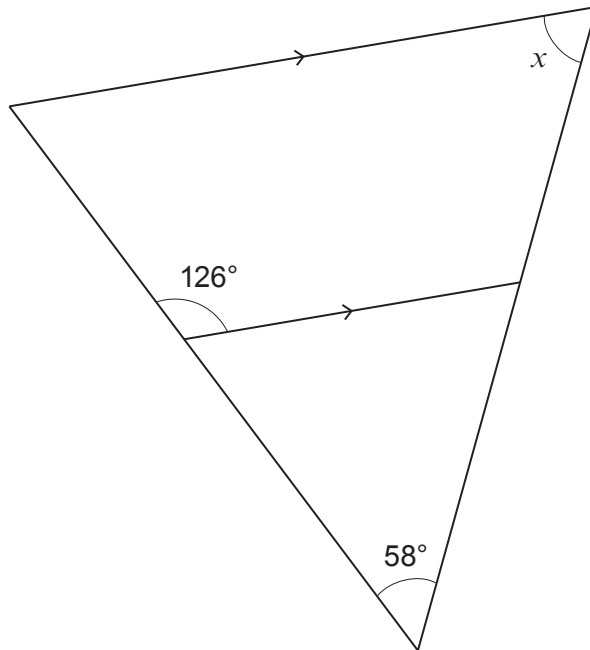
Diagram not drawn to scale

Calculate the size of angle x.
You must show all your working and explain each step of your answer. [5]

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(b)   The tile shown is a rhombus.
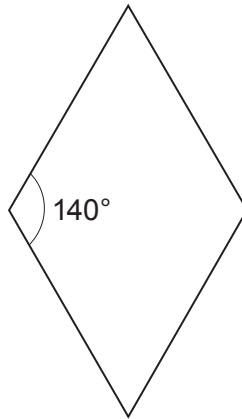
Diagram not drawn to scale

Explain why tiles identical to the one shown tessellate.
You must give reasons for your answer.   [3]

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3. *(a)* Complete the following table.
The fraction must be expressed in its simplest form. [3]

Fraction	Decimal	Is this a recurring or terminating decimal?
$\frac{2}{3}$	$0\cdot\dot{6}$	recurring
....	$0\cdot15$	....
$\frac{7}{11}$	....	....

(b) Express $\dfrac{0\cdot24 \times 0\cdot03}{0\cdot002}$ as an improper fraction in its simplest form. [3]

4. Points are plotted on a grid.
The rule $(a, 3a)$ is used to find all the points.

(a) Does the point with coordinates $(-5, -2)$ fit the rule?
You must give a reason for your answer. [1]

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(b) Plot five possible points with coordinates that fit the rule $(a, 3a)$ on the grid. [2]

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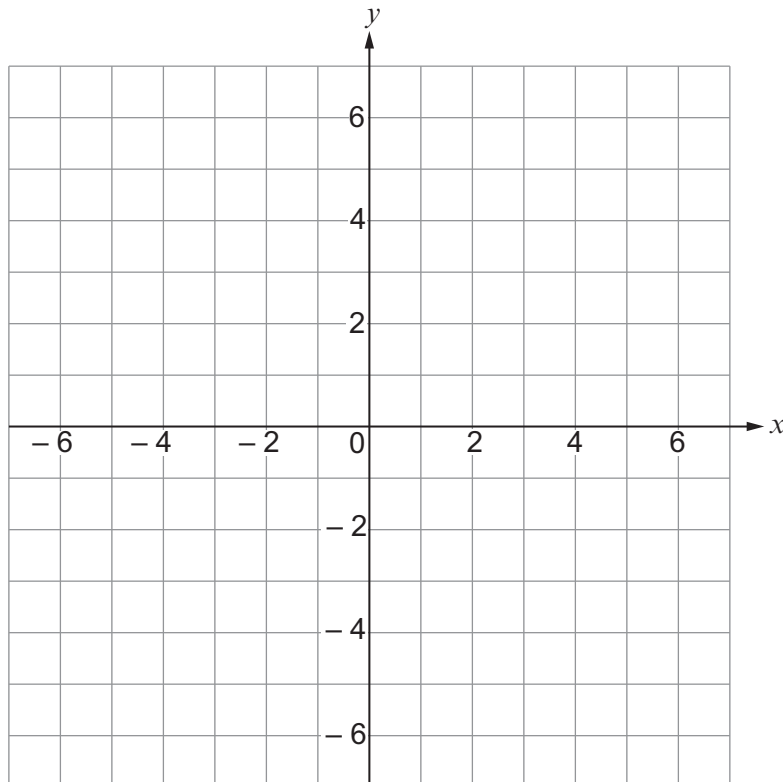
(c) Write down the equation of the straight line that passes through all the points that fit the rule $(a, 3a)$. [2]

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5. The universal set, ε = {22, 23, 24, 25, 26, 27, 28, 29, 30}.

Within this universal set ε,

- set *A* is the multiples of 2
- set *B* is the multiples of 4
- set *C* is the multiples of 5

(a) Complete the Venn diagram. [3]

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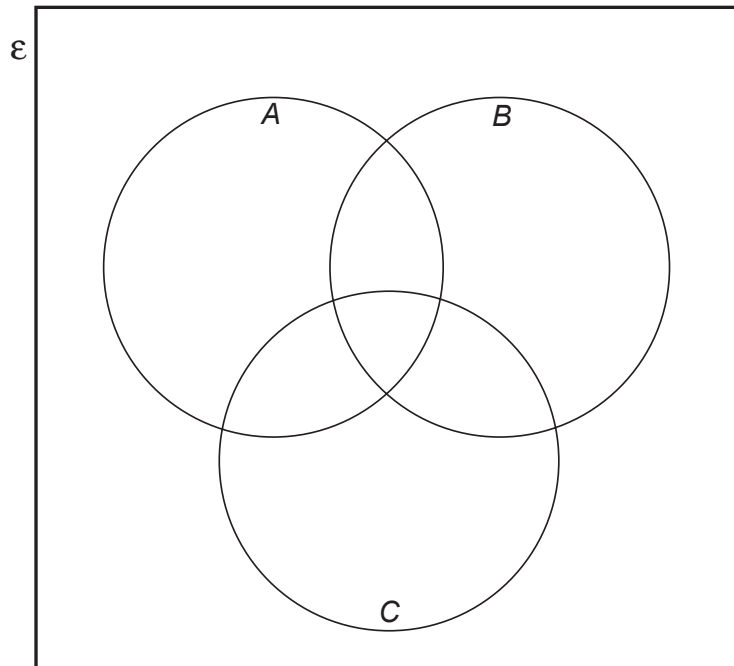
(b) Which one of the following Venn diagrams could also be used to represent the sets ε, *A*, *B* and *C*?
You must give a reason for your choice. [2]
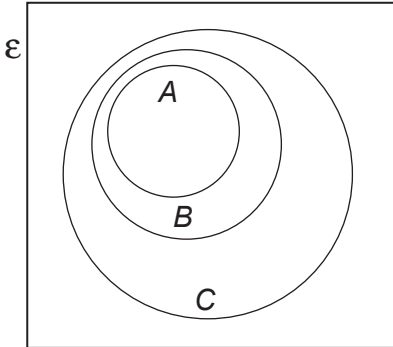
| Venn Diagram 1 | Venn Diagram 2 | Venn Diagram 3 |
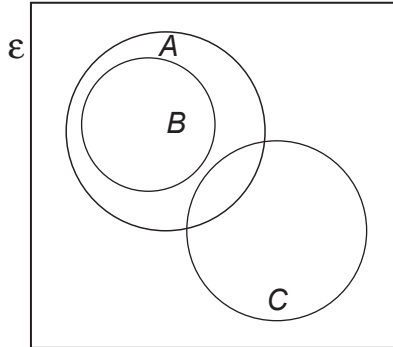
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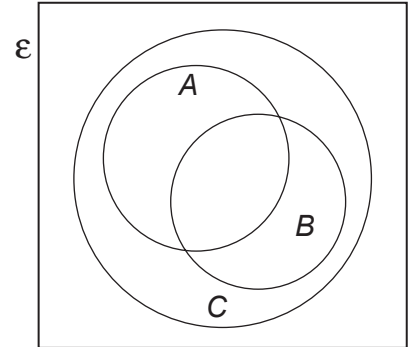
(c) A whole number is selected at random from the universal set
ε = {22, 23, 24, 25, 26, 27, 28, 29, 30}.

Find the probability that the number selected is: [3]

a multiple of 2 but not a multiple of 4 ....

not a multiple of 5 ....

a multiple of 5 and a multiple of 2 ....

(4363-02) **Turn over.**

6. A biased dice is thrown.
The letter 'o' is recorded when an odd number is thrown.
The letter 'e' is recorded when an even number is thrown.

The dice is thrown in groups of ten throws.

Odd and even numbers recorded in each group	ooooo ooeee	ooooo eeeoo	eeeeo ooooo	ooooe eeeee	ooooe eeeee

(a) Calculate the relative frequency of throwing an odd number after 10, 20, 30, 40, and 50 throws.
Use your answers to complete the table below. [3]

Total number of throws		10	20	30	40	50
Relative frequency of throwing an odd number	Fraction	$\frac{7}{10}$				
	Decimal	0·7				

(b) Use the graph paper to plot the relative frequencies. [2]

Relative frequency

Number of throws

(c) Has the experiment been carried out a sufficient number of times to give a good estimate for the probability of throwing an odd number with this biased dice?
You must give a reason for your answer. [1]

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7. Four of the interior angles of a seven-sided polygon are 114°, 150°, 160° and 170°.
The other three interior angles of this polygon are equal.
Calculate the size of each of the other three interior angles. [5]

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8. *(a)* Find the highest common factor of 36 and 54. [1]

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(b) Simplify $\sqrt{(2^4 \times \sqrt{81})}$. [3]

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(c) Use these clues to find the missing number. [3]

- This number is the product of 3 prime numbers
- 10 is a factor of this number
- 210 is a multiple of this number
- This number is greater than 30

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The missing number is ....

9. Use the axes given below to sketch the following.

(a) $y = x^2$ [1]

(b) $y = -x^2$ [1]

(c) $y = x^3$ [1]

Turn over.
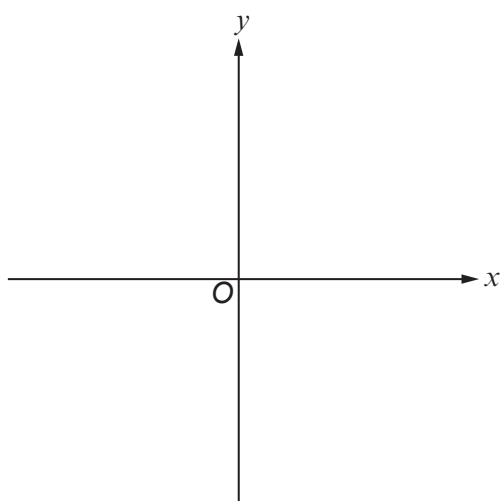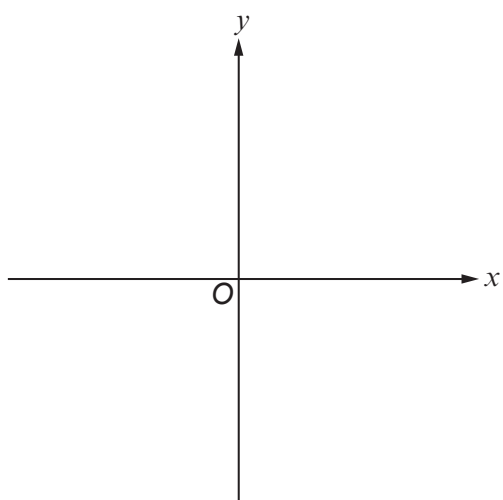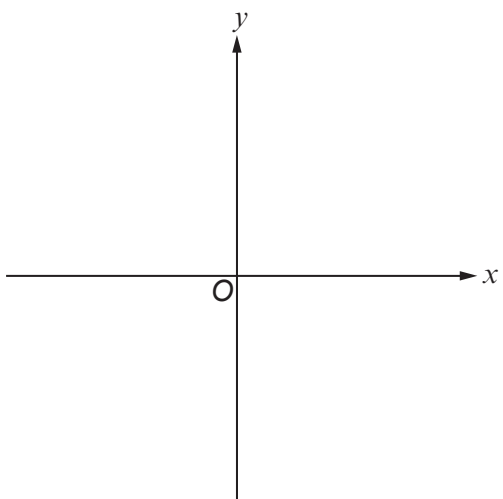
10. *(a)* The nth term of a sequence is $5n^2 - 3n - 1$.
Calculate the 40th term of the sequence. [2]

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(b) The diagram shows the first four patterns of a sequence.
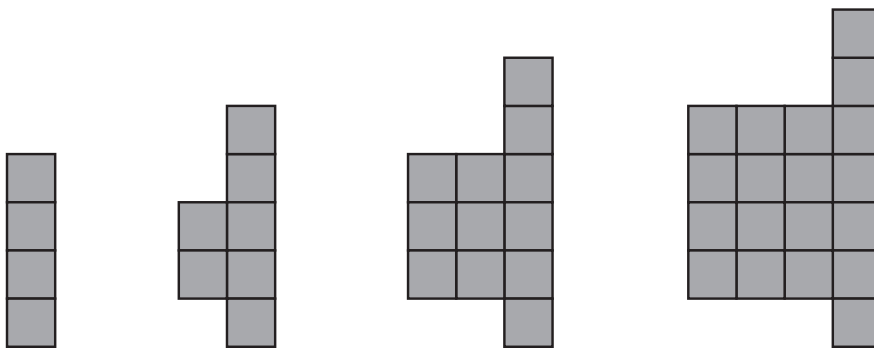
Find the nth term of the sequence. [3]

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11. At breakfast, the probability that Melanie has a bowl of cereal is 0·3 and the probability that Melanie has a slice of toast is 0·2.
Melanie having a bowl of cereal and Melanie having a slice of toast are independent events.

(a) Complete the tree diagram. [3]

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                                              ..............    Melanie has a
                                                              slice of toast


                         Melanie has
                         a bowl of
                         cereal
              0·3
                                              ..............    .......................................................

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              ...............    ...........................................    ..............    .......................................................
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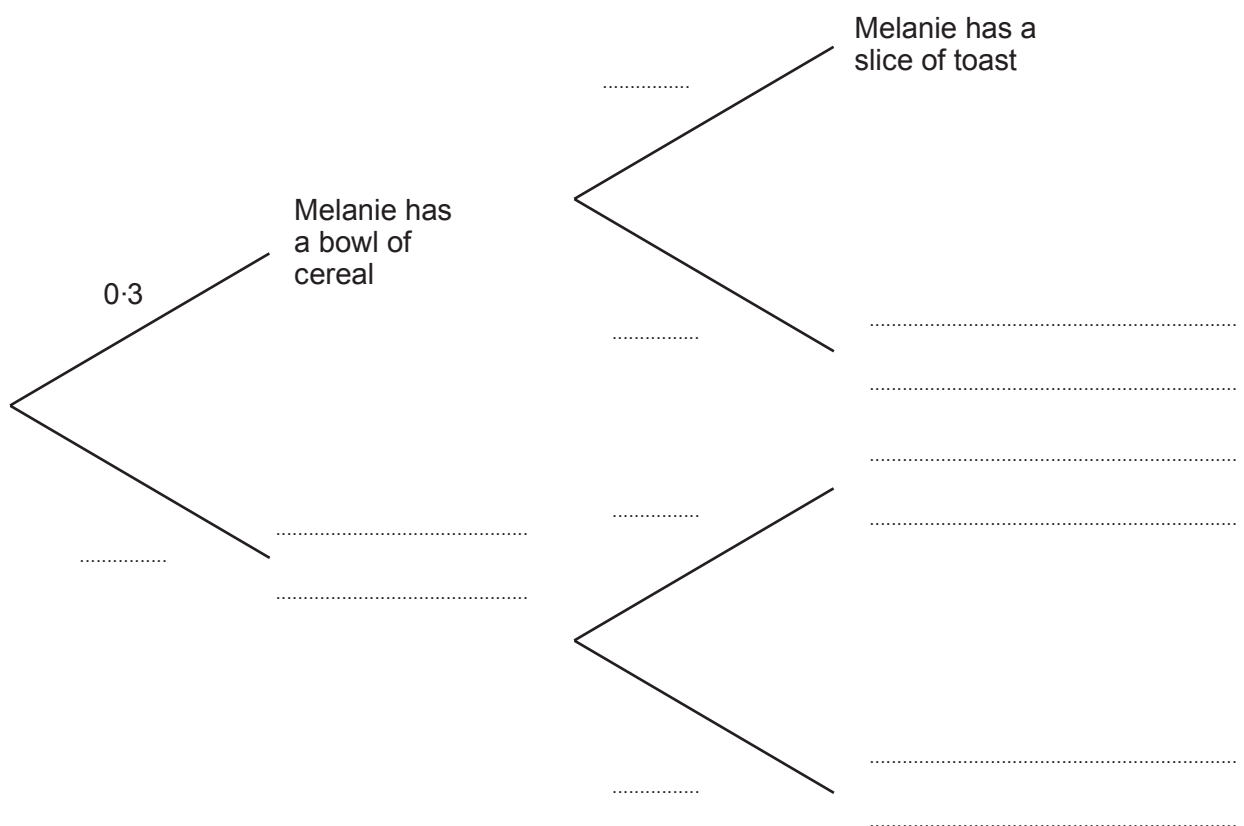
(b) Find the probability that Melanie has a bowl of cereal and a slice of toast. [2]

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12. *(a)* Factorise $6x^2 + 13x - 5$. [2]

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(b) Rearrange to make m the subject of the following formula. [3]

$$w = \frac{3m^2}{d}$$

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(c) Rearrange to make b the subject of the following formula. [3]

$$ab = bc + e$$

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13. In a group of 15 people there are 5 men and 10 women.
One of the men and three of the women are wearing red jumpers.
A man is selected at random from the group.
Then a woman is selected at random from the group.

Is the probability that the people selected are both wearing red jumpers greater or less than 5%?
You must show your working and give a reason for your answer.

[5]

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14. *(a)* Simplify $(3x + 7y)(2x - 5y) + xy$. [3]

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(b) Express $\dfrac{7x}{2x + 3} + \dfrac{2}{3x - 2}$ as a single fraction in its simplest form. [4]

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15. Two of the equations below represent straight lines that are perpendicular to each other.

$$4y = x \qquad\qquad 4y = 3x \qquad\qquad 3y = x$$

$$y = x \qquad\qquad -4y = x \qquad\qquad y = -4x$$

Select the two equations that represent lines that are perpendicular to each other.
You must show by calculation that the equations represent perpendicular lines. [3]

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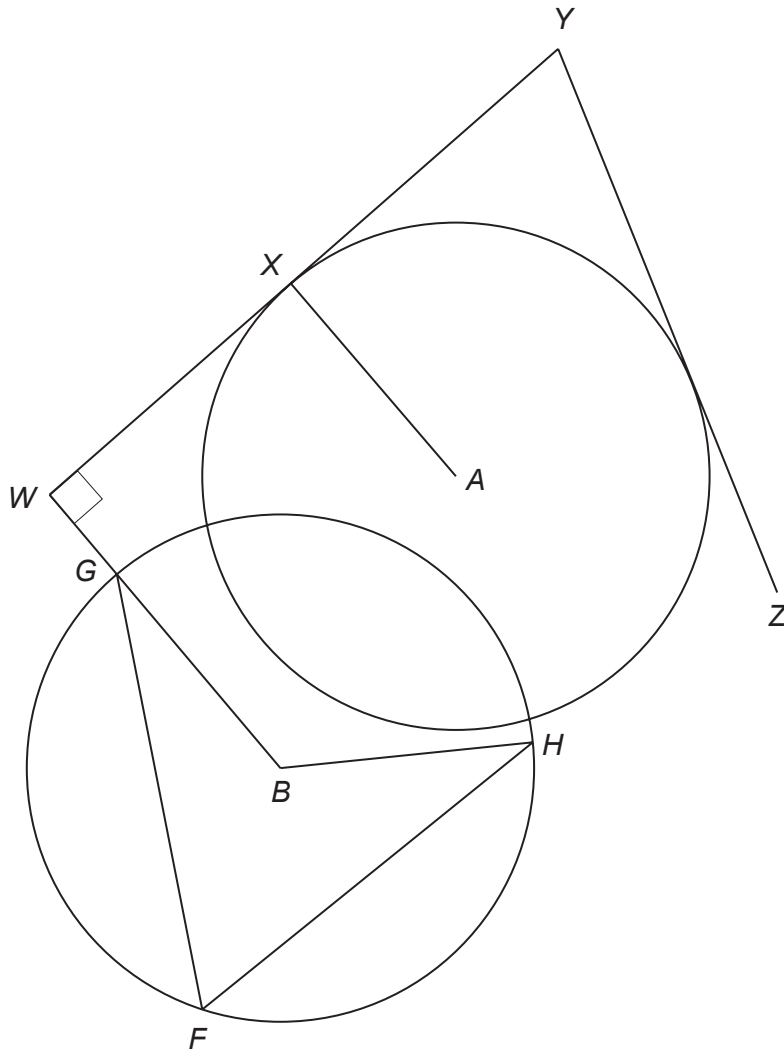
16. Two circles of equal radius intersect as shown in the diagram below.

Diagram not drawn to scale

The centres of the circles are *A* and *B*.
The straight lines *WXY* and *YZ* are tangents to the circle with centre *A* and $G\hat{F}H$ = 80°.

(a) Indicate on one of the lines on the diagram on the previous page, where the point *P* lies, so that *YP = YX*. [1]

(b) Explain why *XA* is parallel to *WB*. [2]

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(c) Given that a straight line drawn between the centres of the two circles bisects $H\hat{B}G$, calculate the size of $X\hat{A}B$. You must give reasons for your answer. [4]

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17. *(a)* The expression $x^2 + 8x + 5$ 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 $x^2 + 8x + 5 = 0$ leaving your answer in surd form. [4]

END OF PAPER

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