For Examiner's Use

General Certificate of Secondary Education
November 2007

MATHEMATICS (SPECIFICATION A) **3301/1H**
Higher Tier
Paper 1 Non-Calculator

H

Tuesday 6 November 2007   9.00 am to 11.00 am

**ASSESSMENT and
QUALIFICATIONS
ALLIANCE**

In addition to this paper you will require:
- mathematical instruments.

You must **not** use a calculator.

Time allowed: 2 hours

Instructions
- Use blue or black ink or ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this booklet.

Information
- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- Additional answer paper, graph paper and tracing paper will be issued on request and must be tagged securely to this answer booklet.
- The use of a calculator is **not** permitted.

Advice
- In all calculations, show clearly how you work out your answer.

3301/1H

Formulae Sheet: Higher Tier

You may need to use the following formulae:

Volume of prism = area of cross-section × length
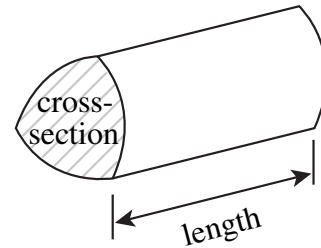
Volume of sphere = $\frac{4}{3}\pi r^3$

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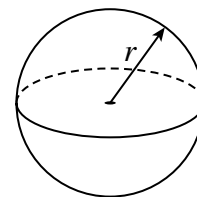
Volume of cone = $\frac{1}{3}\pi r^2 h$

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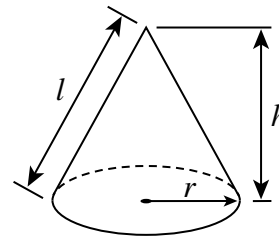
In any triangle *ABC*

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

Sine rule $\quad \dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$
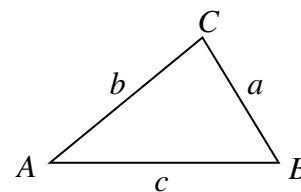
Cosine rule $\quad a^2 = b^2 + c^2 - 2bc \cos A$

The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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

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

1 Use approximations to estimate the value of $\dfrac{2036 \times 2.97}{0.488}$

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Answer .... *(3 marks)*

2 $P = x(y + 2)$

$Q = xy + 2$

Show clearly that $P - Q = 2(x - 1)$

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(3 marks)

Turn over for the next question

6

3 The diagram shows a cylinder.
The diameter of the cylinder is 20 cm.
The height of the cylinder is 2 cm.

20 cm

Not drawn accurately

2 cm

(a) Work out the volume of the cylinder.
Use $\pi = 3.14$

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Answer .... cm^3 *(3 marks)*

(b) Write your answer to part (a) in litres.

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Answer .... litres   *(1 mark)*

4 (a) Complete this table of the powers of 5.

5^0	5^1	5^2	5^3	5^4	5^5	5^6	5^7
1	5	25		625	3125	15 625	78 125

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(1 mark)

(b) You are given that $15\,625 \times 78\,125 = 5^x$
Use the table to find the value of x.

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Answer x = ... *(2 marks)*

(c) Use the table to work out $\dfrac{78\,125}{625 \times 5}$

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Answer .... *(2 marks)*

Turn over for the next question

9

5 The *n*th term of a sequence is $4n - 9$

(a) Work out the first four terms.

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Answer .... , ... , ... , ...   *(2 marks)*

(b) What is the difference between the 74th term and the 73rd term?

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Answer ....   *(1 mark)*

(c) The last term of this sequence is 391.
How many terms are there in this sequence?

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Answer ....   *(2 marks)*

(d) Explain why 29 is not a term in this sequence.

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(2 marks)

6 The diagram shows two triangles A and B.
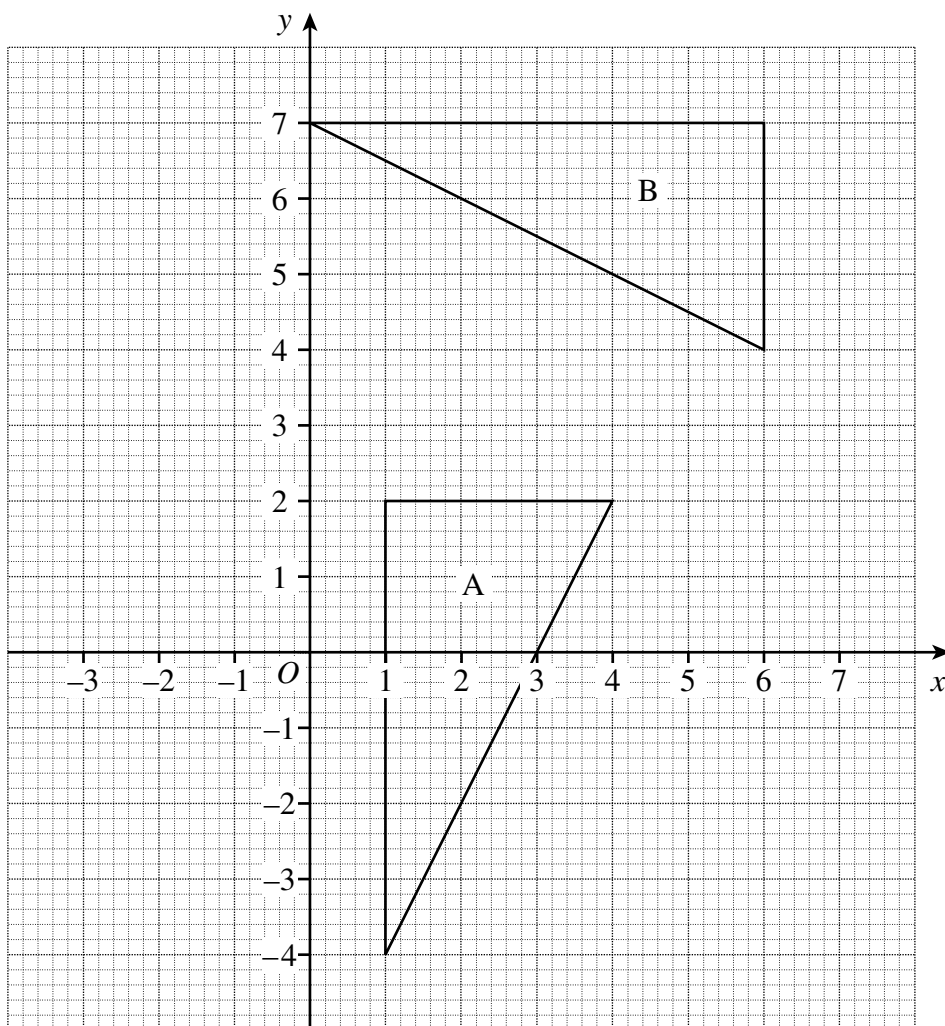
(a) Triangle A is mapped onto triangle B by a rotation.
Describe the rotation fully.

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(2 marks)

(b) On the diagram draw the image of triangle B after it is enlarged by a scale factor
of $\frac{1}{3}$ with centre of enlargement (–3, 1)

(2 marks)

Turn over ▶

7 (a) Complete the table of values of $y = x^2 - 4x + 1$

x	−1	0	1	2	3	4	5
y	6	1		−3	−2		6

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(1 mark)

(b) On the grid below, draw the graph of $y = x^2 - 4x + 1$ for values of x from −1 to +5.
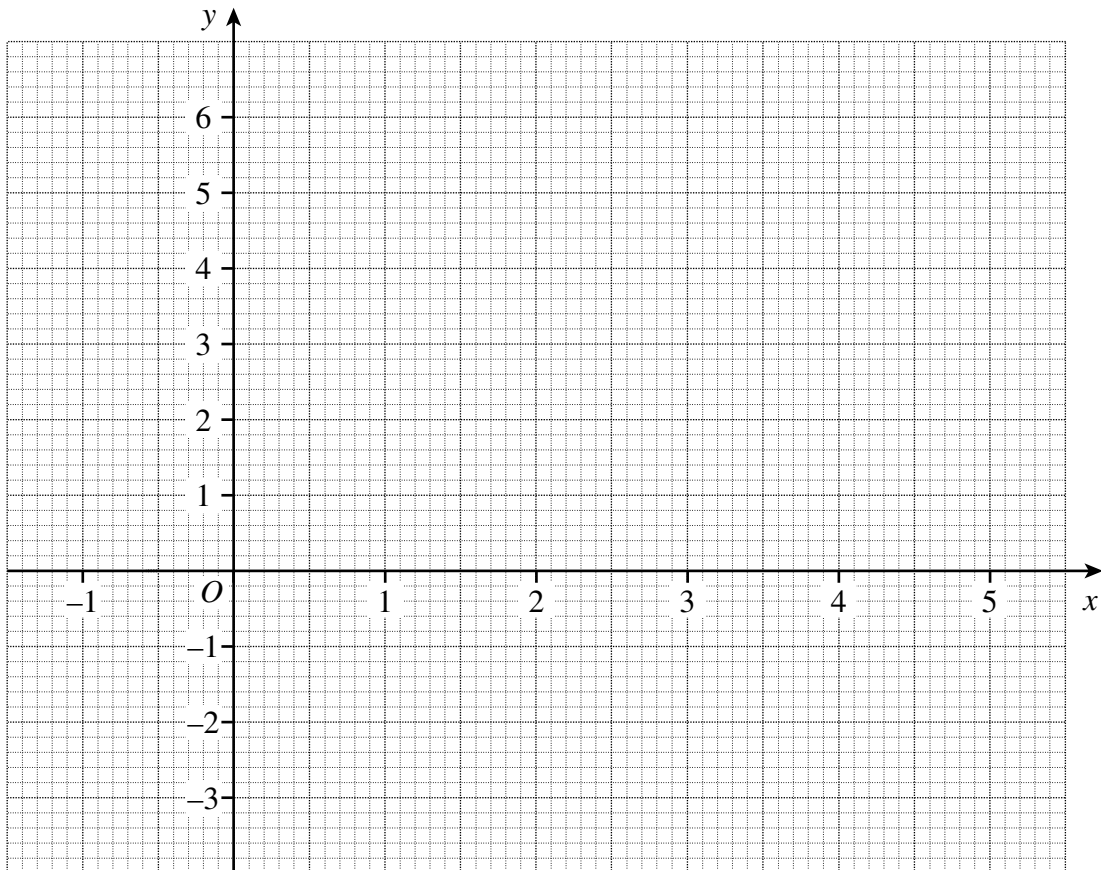
(2 marks)

(c) Explain how the graph shows that the equation $x^2 - 4x + 1 = 0$ has two solutions.

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(1 mark)

8 The probability that a boy is left-handed is 0.2
The probability that a girl is left-handed is 0.3
A school has 480 boys and 520 girls.

(a) Estimate the number of left-handed students in the school.

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Answer ....   *(4 marks)*

(b) A student is picked at random from the whole school.
Estimate the probability that the student is left-handed.

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Answer ....   *(1 mark)*

Turn over for the next question

Turn over ▶

9 Triangles *ABC* and *XYZ* are similar.
Angle *ABC* = angle *XYZ*.

Not drawn accurately
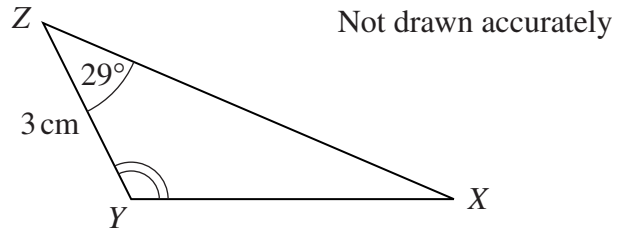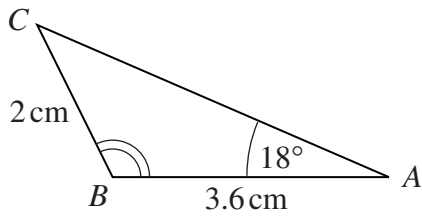
(a) Work out the size of angle *XYZ*.

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Answer .... degrees   *(2 marks)*

(b) Calculate the length of *XY*.

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Answer .... cm   *(2 marks)*

10 (a) Solve the simultaneous equations

$$4x - 3y = 13$$
$$2x + y = 4$$

You **must** show your working.
Do **not** use trial and improvement.

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Answer *x* = ... , *y* = ...   *(3 marks)*

(b) (i) Factorise $x^2 - 13x + 30$

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Answer .... *(2 marks)*

(ii) Hence, solve the equation $x^2 - 13x + 30 = 0$

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Answer .... *(1 mark)*

11 You are given that $p = 3 \times 10^2$ and $q = 3 \times 10^{-2}$

(a) Calculate the value of $p + q$

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Answer .... *(2 marks)*

(b) Calculate the value of $p \div q$

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Answer .... *(2 marks)*

14

Turn over ▶

12 The table shows Peter's electricity bills from December 2004 to March 2006.

Date	Dec 2004	Mar 2005	Jun 2005	Sep 2005	Dec 2005	Mar 2006
Bill (£)	33.50	27.00	19.20	16.30	27.50	23.00

(a) Explain why a four-point moving average is appropriate for this data.

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(1 mark)

(b) Show that the first four-point moving average is £24.

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(1 mark)

(c) Calculate the second four-point moving average.

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Answer £ ....   *(2 marks)*

13 Solve the equation $\dfrac{2x-1}{4} + \dfrac{x+2}{3} = 2$

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Answer $x =$ ....   *(4 marks)*

14 There are 600 members in a sports club.
A stratified sample, by age, is taken.

The table shows the age grouping of the members.
Some information is given in the table.

Age (years)	10 - 24	25 - 44	45 - 60	61+
Number of members	150			120
Number in sample			22	20

Complete the table.

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(4 marks)

15 Evaluate $5^{-2} \times 100^{0.5}$
Write your answer in its simplest form.

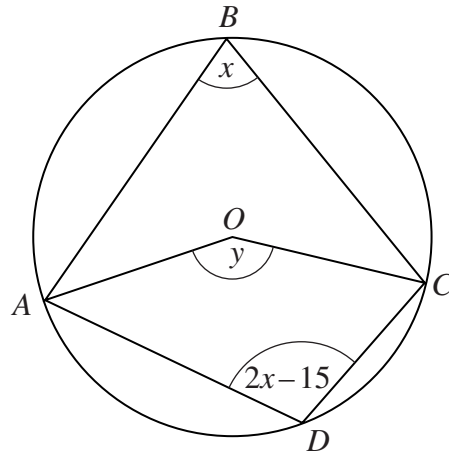..

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Answer .... *(3 marks)*

15

Turn over ▶

16 (a) *A*, *B*, *C* and *D* are four points on the circumference of a circle, centre *O*.

Angle *ABC* = *x*

Angle *AOC* = *y*

Angle *ADC* = 2*x* – 15

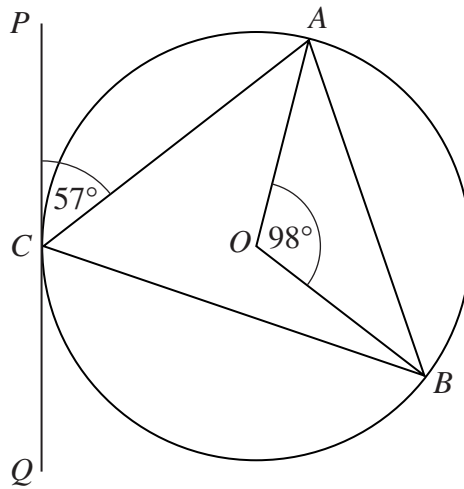Not drawn accurately

(i) Explain why 3*x* – 15 = 180

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(1 mark)

(ii) Work out the size of angle *AOC* (marked *y* on the diagram).

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Answer .... degrees   *(2 marks)*

(b) The diagram shows a circle, centre *O*.
PQ is a tangent to the circle at *C*.
Angle *PCA* = 57°
Angle *AOB* = 98°

Not drawn accurately

Calculate the size of angle *OBC*.
Show your working.

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Answer .... degrees   *(3 marks)*

17 Expand and simplify $(\sqrt{27} + 3)(\sqrt{6} - \sqrt{2})$

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Answer ....   *(4 marks)*

10

Turn over ▶

18 Leonardo is revising for his Higher tier GCSE Mathematics exam.
He comes across this question …

Two events A and B are independent.
The probability of B is double the probability of A.
The probability of both A and B occurring is $\dfrac{9}{32}$
Find the probability that event A occurs.

Complete Leonardo's solution.

Let the probability of event A occurring = p

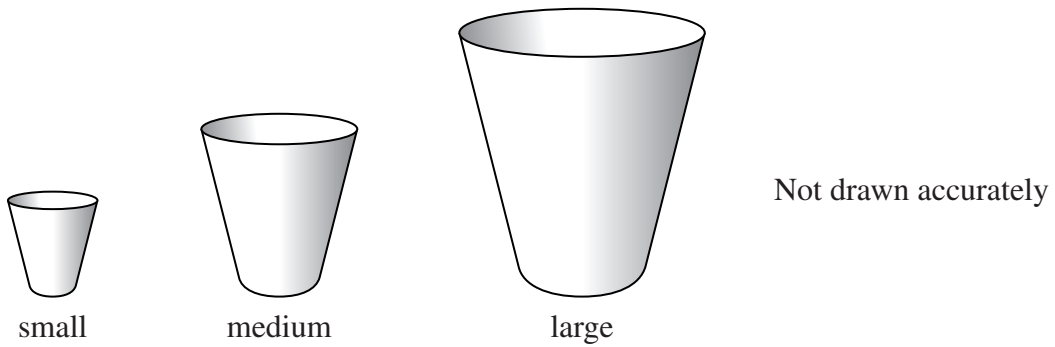*therefore, the probability of event B occurring = 2p*

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Answer .... *(3 marks)*

19 The diagram shows three mathematically similar containers.

small   medium   large

Not drawn accurately

This table shows some information about the containers.

	Height (cm)	Area of top of container (cm²)	Volume (cm³)
small	12	X	400
medium	24	500	
large	36		Y

Calculate the missing entries, X and Y.

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Answer X = ... , Y = ...   *(4 marks)*

7

Turn over ▶

20 (a) Make x the subject of $\sqrt{\dfrac{a}{x+b}} = c$

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Answer $x = $ .... *(4 marks)*

(b) Find the values of p and q such that $x^2 + px + 17 \equiv (x - 5)^2 + q$

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Answer $p = $ .... , $q = $ .... *(2 marks)*

21 *OACB* is a trapezium in which $\overrightarrow{OA} = 4\mathbf{a}$, $\overrightarrow{OB} = 3\mathbf{b}$ and $\overrightarrow{AC} = 6\mathbf{b}$
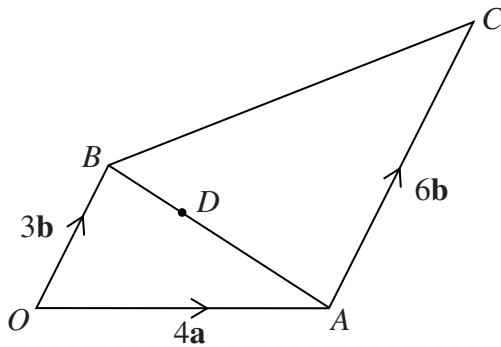
Not drawn accurately

(a) Write these vectors in terms of **a** and **b**.

(i) $\overrightarrow{OC}$

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Answer .... *(1 mark)*

(ii) $\overrightarrow{AB}$

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Answer .... *(1 mark)*

(b) Point *D* lies on *BA* such that *BD* : *DA* = 1 : 2

Write $\overrightarrow{OD}$ in terms of **a** and **b**.
Give your answer in its simplest form.

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Answer .... *(3 marks)*

(c) Explain why *ODC* is a straight line.

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(2 marks)

13

Turn over ▶

22 This is the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$
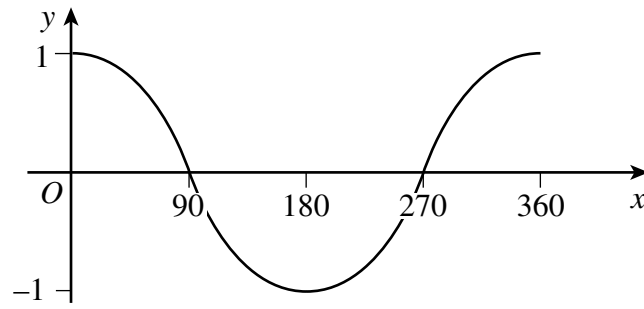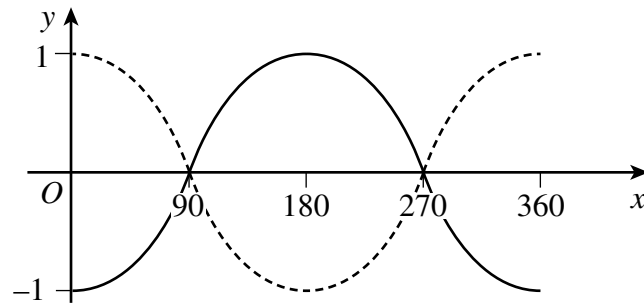

For each of the following graphs,

Describe the transformation that has been applied to the graph of $y = \cos x$
State the equation of the graph.

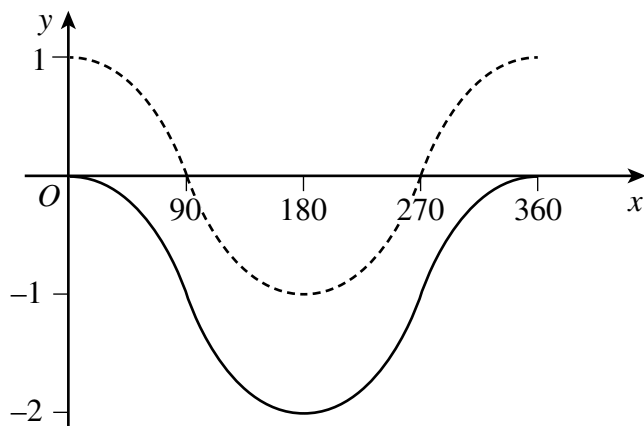In each case, the graph of $y = \cos x$ is drawn dotted, to help you.

(a)

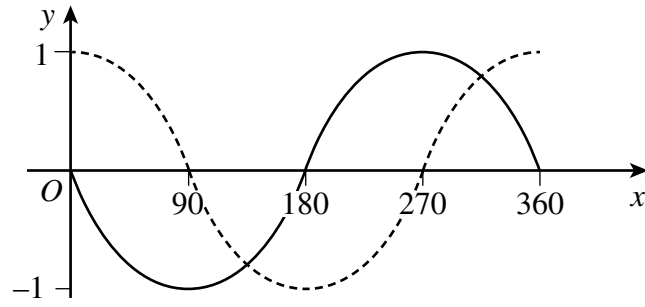Transformation ....

.... *(1 mark)*

Equation.. *(1 mark)*

(b)

Transformation ....

.... *(1 mark)*

Equation.. *(1 mark)*

(c)

Transformation ....

.... *(1 mark)*

Equation.. *(1 mark)*

END OF QUESTIONS

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