MR BARTON'S ANSWERS

1MA0

Edexcel GCSE

Mathematics (Linear) – 1MA0

Paper 1H (Non-Calculator)

Higher Tier

Practice Paper 1A (Set N)

Time: 1 hour 30 minutes

Materials required for examination
Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser.
Tracing paper may be used.

Items included with question papers
Nil

Instructions

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
You must NOT write on the formulae page.
Anything you write on the formulae page will gain NO credit.
If you need more space to complete your answer to any question, use additional answer sheets.

Information

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 18 questions in this question paper. The total mark for this paper is 69.
Mark schemes are not yet available for this paper, though the original source of each question is given on the last page.
Calculators must not be used.

Advice

Show all stages in any calculations.
Work steadily through the paper. Do not spend too long on one question.
If you cannot answer a question, leave it and attempt the next one.
Return at the end to those you have left out.

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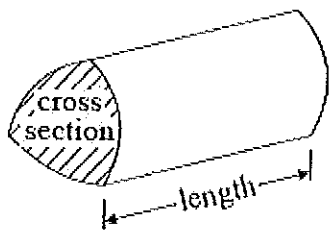
GCSE Mathematics (Linear) 1MA0

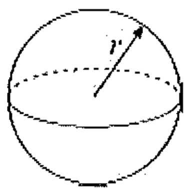
Formulae: Higher Tier

You must not write on this formulae page.
Anything you write on this formulae page will gain NO credit.

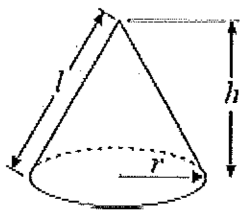
Volume of prism = area of cross section × length



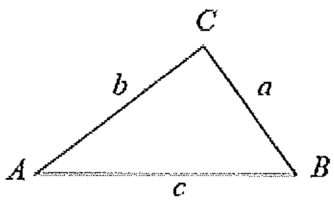
Volume of sphere $\frac{4}{3}\pi r^3$
Surface area of sphere $= 4\pi r^2$



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



In any triangle ABC



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

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 $ax2+ bx + c = 0$
where $a \neq 0$, are given by

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

Answer ALL EIGHTEEN questions.

Write your answers in the spaces provided.

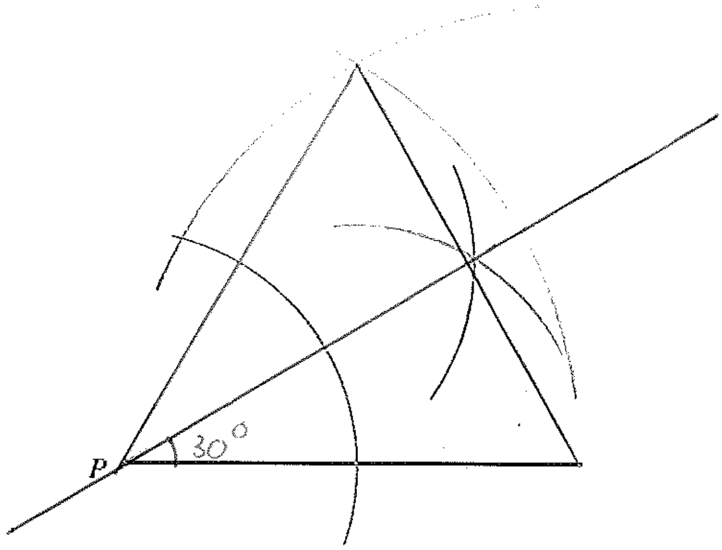
You must write down all stages in your working.

You must NOT use a calculator.

1. Use ruler and compasses to **construct** an angle of 30° at P.
You **must** show all your construction lines.

(1) construct equilateral triangle

(2) bisect the angle !



(Total 3 marks)

[Full marks on this question was achieved by 10.0% of students]

2. Work out an estimate for the value of

$$(0.49 \times 0.61)^2$$

$= (0.5 \times 0.6)^2$

$= (0.3)^2$

$= 0.3 \times 0.3 \quad = 0.09$

....

(Total 2 marks)

[*Full marks on this question was achieved by 9.5% of students*]

3. Rearrange $y = p - 2qx^2$ to make x the subject of the formula.

$+ 2qx^2 \qquad y + 2qx^2 = p$

$- y \qquad 2qx^2 = p - y$

$\div 2q \qquad x^2 = \dfrac{p-y}{2q}$

$\sqrt{\ } \qquad x = \sqrt{\dfrac{p-y}{2q}}$

....

(Total 3 marks)

[*Full marks on this question was achieved by 8.6% of students*]

4. Make k the subject of the formula $t = \dfrac{k}{k-2}$.

$\times (K-2)$	$t(K-2) = K$
Expand	$Kt - 2t = K$
$+ 2t$	$Kt = K + 2t$
$- K$	$Kt - K = 2t$
Factorise	$K(t-1) = 2t$
$\div (t-1)$	$K = \dfrac{2t}{t-1}$

....

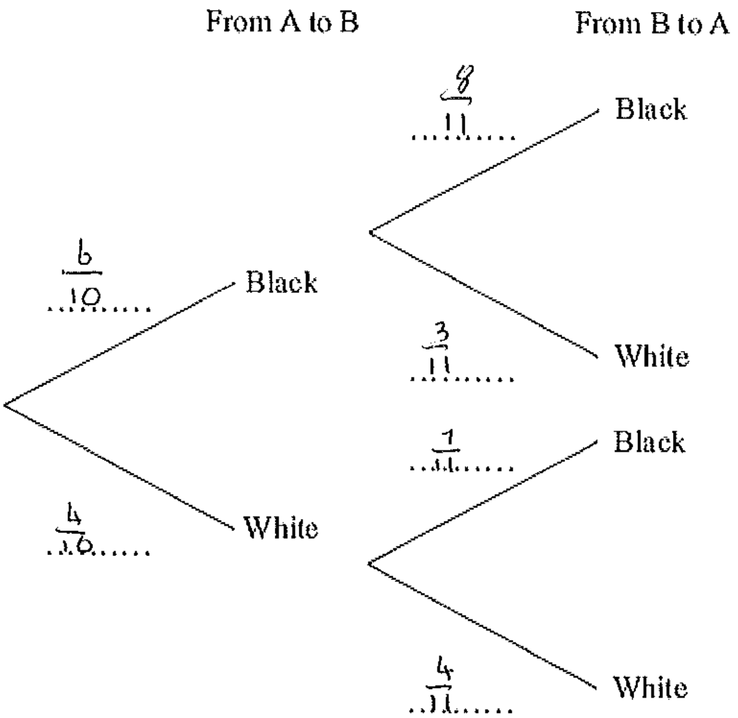
(Total 4 marks)

[*Full marks on this question was achieved by 7.0% of students*]

5. Jan has two boxes.
There are 6 black and 4 white counters in box A.
There are 7 black and 3 white counters in box B.

Jan takes at random a counter from box A and puts it in box B.
She then takes at random a counter from box B and puts it in box A.

(a) Complete the probability tree diagram.



(2)

(b) Find the probability that after Jan has put the counter from box B into box A there will still be 6 black counters and 4 white counters in box A.

P(Black, black) $= \frac{6}{10} \times \frac{8}{11} = \frac{48}{110}$

P(white, white) $= \frac{4}{10} \times \frac{4}{11} = \frac{16}{110}$

Probability of either $= \frac{48}{110} + \frac{16}{110} = \frac{64}{110}$

....

(4)

(Total 6 marks)

[Full marks on this question was achieved by 6.3% of students]

6. Solve the equation $\frac{x}{2} - \frac{2}{x+1} = 1$.

Same denominator

$$\frac{x(x+1)}{2(x+1)} - \frac{2(2)}{2(x+1)} = 1$$

$$\frac{x^2 + x}{2x+2} - \frac{4}{2x+2} = 1$$

$$\frac{x^2 + x - 4}{2x+2} = 1$$

$\times (2x+2)$ $\quad x^2 + x - 4 = 2x + 2$

$-2x$ $\quad x^2 - x - 4 = 2$

-2 $\quad x^2 - x - 6 = 0$

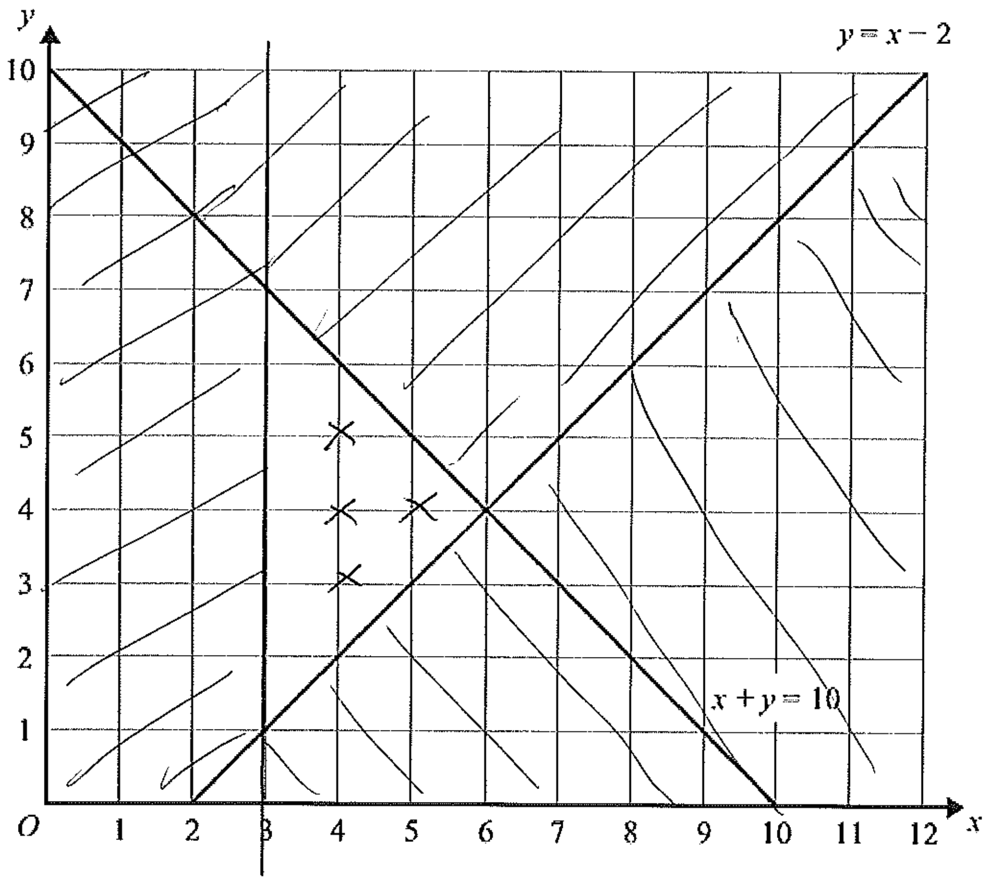
Factorise $\quad (x-3)(x+2) = 0$

$x = 3$ $\quad$ $x = -2$

(Total 4 marks)

[*Full marks on this question was achieved by 6.3% of students*]

7. The lines $y = x - 2$ and $x + y = 10$ are drawn on the grid.



On the grid, mark with a cross (×) each of the points with integer coordinates that are in the region defined by

$y > x - 2$ → above line = true

$x + y < 10$ → below line = true

$x > 3$ → right of $x = 3$ = true

See points marked 'x'

(Total 3 marks)

[Full marks on this question was achieved by 6.1% of students]

8.

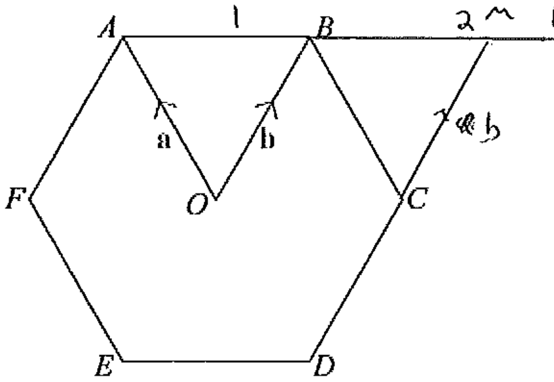


Diagram NOT accurately drawn

ABCDEF is a regular hexagon, with centre *O*.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$.

(a) Write the vector $\overrightarrow{AB}$ in terms of **a** and **b**.

$-a + b$

....

(1)

The line *AB* is extended to the point *K* so that *AB* : *BK* = 1 : 2

(b) Write the vector $\overrightarrow{CK}$ in terms of **a** and **b**.
Give your answer in its simplest form.

$\overrightarrow{CK} = \overrightarrow{CM} + \overrightarrow{MK}$

$= b + \overrightarrow{AB}$

$= b + -a + b$

$= 2b - a$

OR

$\overrightarrow{CK} = \overrightarrow{CB} + \overrightarrow{BK}$

$= a + 2\overrightarrow{AB}$

$= a + 2(-a + b)$

$= a - 2a + 2b$

$= 2b - a$

....

(3)

(Total 4 marks)

[*Full marks on this question was achieved by 5.5% of students*]

*9.

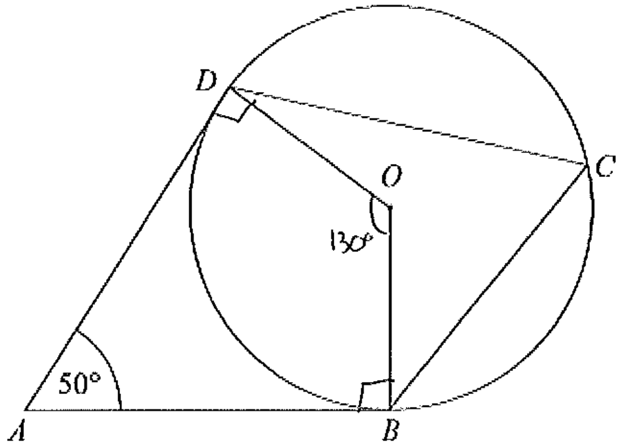


Diagram **NOT** accurately drawn

B, C and D are points on the circumference of a circle, centre O.
AB and AD are tangents to the circle.

Angle $DAB = 50°$

Work out the size of angle BCD.
Give a reason for each stage in your working.

ABO = 90° (tangent meets radius at 90°)

ADO = 90° (same reason)

BOD = 360 − 50 − 90 − 90 = 130° (angles in a quadrilateral add up to 360°)

BCD = 130 ÷ 2 = 65° (angle at the centre = twice angle at the circumference)

(Total 4 marks)

[*Full marks on this question was achieved by 4.7% of students*]

10. Express the recurring decimal $0.2\dot{8}\dot{1}$ as a fraction in its simplest form.

$x = 0.28181818\ldots$

$1000x = 281.81818881\ldots$

$- \quad 10x = 2.81818181\ldots$

$990x = 279$

$x = \dfrac{279}{990} = \dfrac{31}{110}$

....

(Total 3 marks)

[*Full marks on this question was achieved by 4.3% of students*]

11. Make *t* the subject of the formula

$$p = \frac{3-2t}{4+t}$$

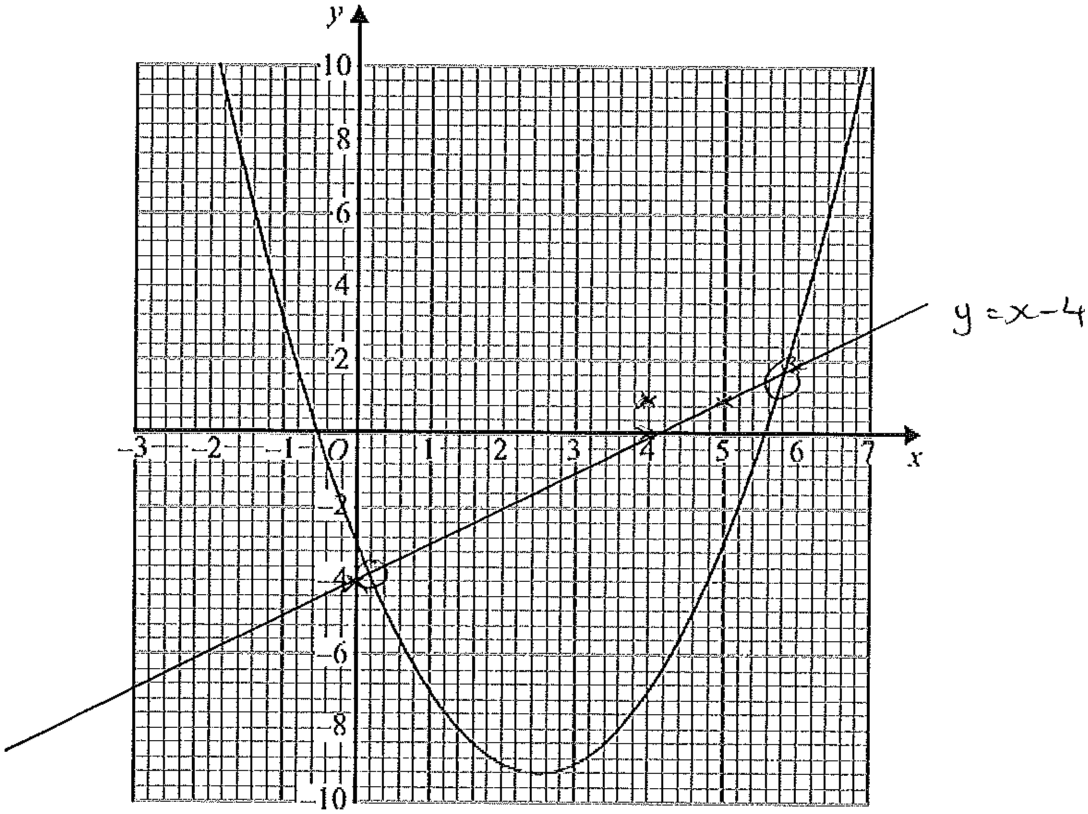
$\times (4+t)$	$= p(4+t) = 3-2t$
Expand	$4p + pt = 3 - 2t$
$+2t$	$4p + pt + 2t = 3$
$-4p$	$pt + 2t = 3 - 4p$
Factorise	$t(p+2) = 3 - 4p$
$\div (p+2)$	$t = \dfrac{3-4p}{p+2}$

....

(Total 4 marks)

[*Full marks on this question was achieved by 4.1% of students*]

12. The diagram shows the graph of $y = x^2 - 5x - 3$



Use the graph to find estimates for the solutions of the simultaneous equations

$$y = x^2 - 5x - 3$$

$$y = x - 4$$ → Draw it!

x	4	5	6
y	0	1	2

Write co-ordinates of where they cross!

(0.4, −3.6) (5.6, 1.6) ....

(Total 3 marks)

[*Full marks on this question was achieved by 3.3% of students*]

14. The diagram shows a solid metal cylinder.

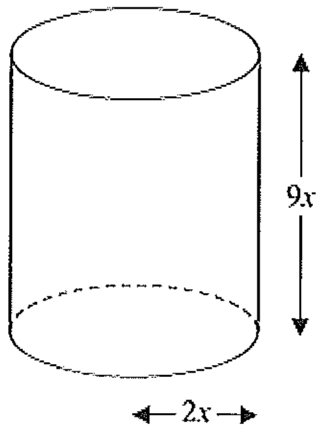


Diagram **NOT** accurately drawn

The cylinder has base radius $2x$ and height $9x$.

The cylinder is melted down and made into a sphere of radius r.

Find an expression for r in terms of x.

Volume of cylinder $= \pi r^2 \times h$

$= \pi (2x)^2 \times 9x$

$= 4\pi x^2 \times 9x$

$= 36\pi x^3$

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

must be equal $\rightarrow$ $\frac{4}{3}\pi r^3 = 36\pi x^3$

$\times 3$ $4\pi r^3 = 108 \cancel{x}\pi x^3$

$\div 4$ $\pi r^3 = \cancel{108}\ 27\pi x^3$

$\div \pi$ $r^3 = 27x^3$

$\sqrt[3]{}$ $r = \sqrt{27x^3} = 3x$ ...... $r = 3x$

(Total 3 marks)

[*Full marks on this question was achieved by 2.4% of students*]

13. (a) Rationalise the denominator of $\frac{5}{\sqrt{2}}$

$$\frac{5}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{5\sqrt{2}}{2}$$

....

(2)

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

$$(2+\sqrt{3})(2+\sqrt{3}) - [(2-\sqrt{3})(2-\sqrt{3})]$$

$$= 4 + 2\sqrt{3} + 2\sqrt{3} + 3 - [4 - 2\sqrt{3} - 2\sqrt{3} + 3]$$

$$= 4\sqrt{3} + 7 - [-4\sqrt{3} + 7]$$

$$= 8\sqrt{3}$$

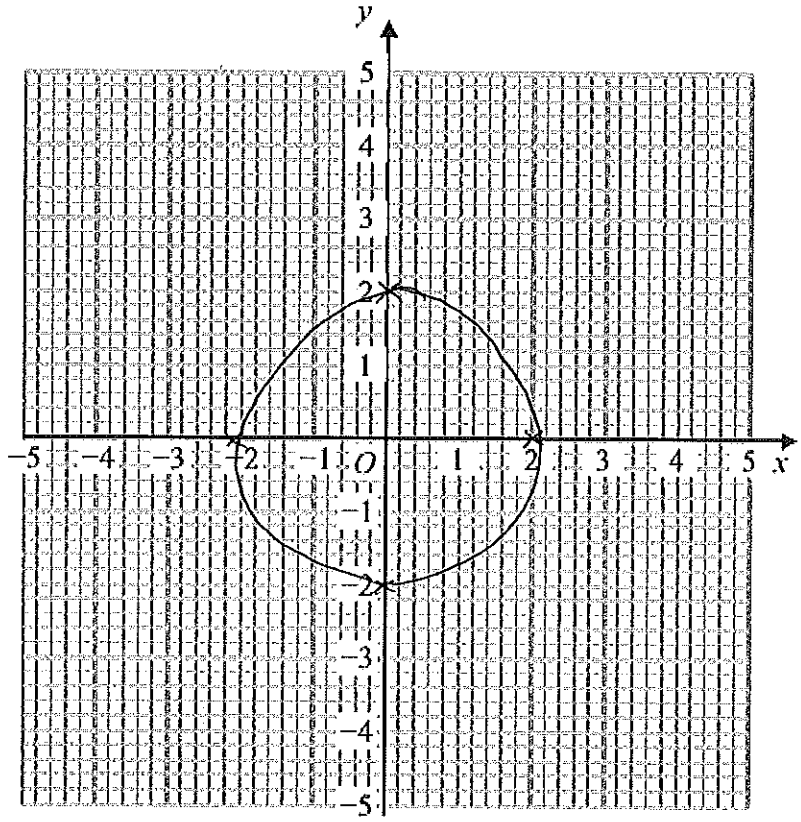
....

(2)

(Total 4 marks)

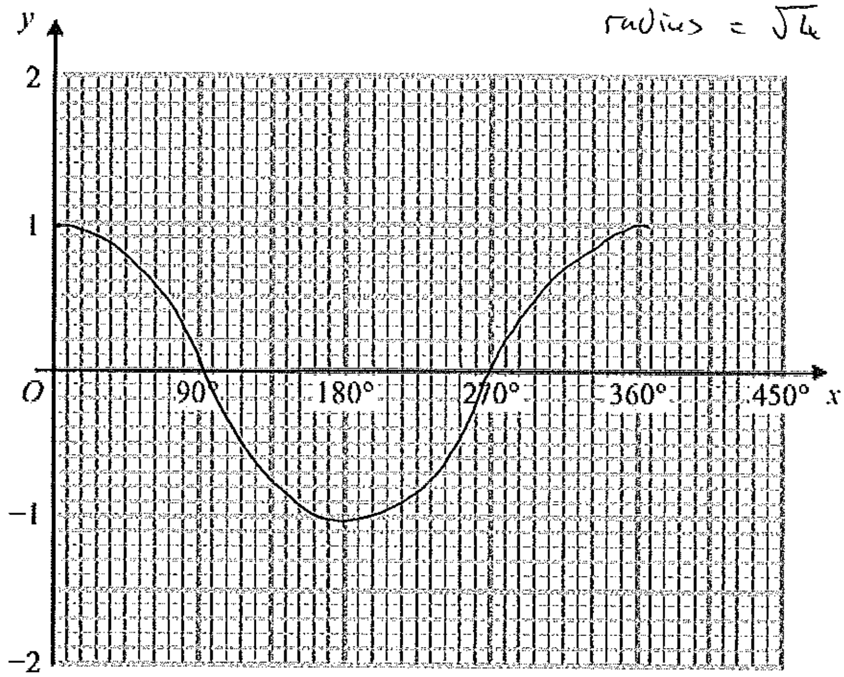
[*Full marks on this question was achieved by 2.8% of students*]

15.



(a) On the grid, draw the graph of $x^2 + y^2 = 4$

circle, centre (0,0)
radius = $\sqrt{4}$ = 2



(2)

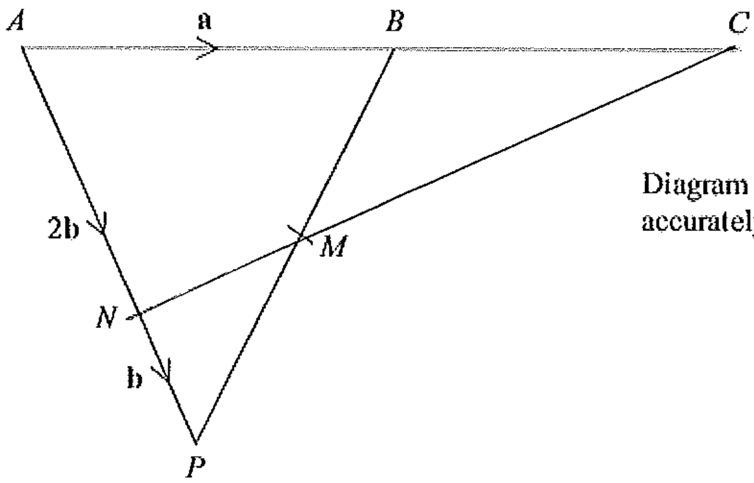
(b) On the grid, sketch the graph of $y = \cos x$ for $0° \leq x \leq 360°$

(2)

(Total 4 marks)

[*Full marks on this question was achieved by 1.9% of students*]

16.



APB is a triangle.
N is a point on *AP*.

$\overrightarrow{AB} = \mathbf{a}$ $\quad\quad$ $\overrightarrow{AN} = 2\mathbf{b}$ $\quad\quad$ $\overrightarrow{NP} = \mathbf{b}$

(a) Find the vector $\overrightarrow{PB}$, in terms of **a** and **b**.

$-3b + a$ ....

(1)

B is the midpoint of *AC*.
M is the midpoint of *PB*.

*(b) Show that *NMC* is a straight line.

$\vec{NM} = \vec{NP} + \vec{PM}$

$= b + \frac{1}{2}(\vec{PB})$

$= b + \frac{1}{2}(-3b + a)$

$= b \cancel{+} - 1.5b + 0.5a$

$= -0.5b + 0.5a$

$\vec{NC} = \vec{NA} + \vec{AC}$

$= -2b + 2(\vec{AB})$

$= -2b + 2a$

$= 4(-0.5b + 0.5a)$

(4)

(Total 5 marks)

[Full marks on this question was achieved by 1.5% of students]

$\therefore$ $\vec{NM}$ and $\vec{NC}$ are parallel and both pass through N, so are on the same straight line.

17.

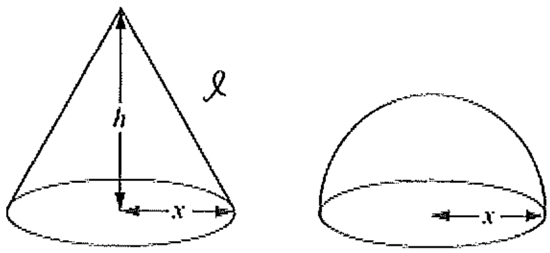


Diagram NOT accurately drawn

The diagram shows a solid cone and a solid hemisphere.

The cone has a base of radius x cm and a height of h cm.
The hemisphere has a base of radius x cm.
The surface area of the cone is equal to the surface area of the hemisphere.

Find an expression for h in terms of x.

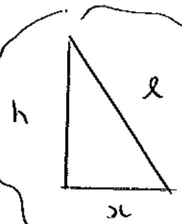
Surface area of cone $= \pi r l + \pi r^2$

Surface area of hemisphere $= \frac{1}{2}(4\pi r^2) + \pi r^2 = 2\pi r^2 + \pi r^2$

$\therefore \pi r l = 2\pi r^2$

$\div \pi r \quad l = 2r \leftarrow$ radius $= x$

$l = 2x$



$l = \sqrt{h^2 + x^2}$

$\sqrt{h^2 + x^2} = 2x$

$^2 \quad h^2 + x^2 = (2x)^2$

$h^2 + x^2 = 4x^2$

$-x^2 \quad h^2 = 3x^2$

$h\sqrt{\ } \quad h = \sqrt{3x^2} = \sqrt{3}\,x$

....

(Total 4 marks)

[*Full marks on this question was achieved by 0.9% of students*]

18. Umar thinks $(a+1)^2 = a^2 + 1$ for all values of a.

(a) Show that Umar is wrong.

If $a = 3$

$(a+1)^2 = (3+1)^2 = 4^2 = 16$

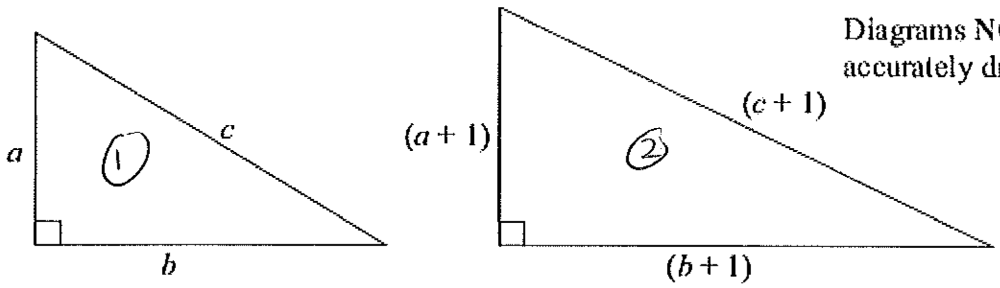
$a^2+1 = 3^2+1$

$= 9+1 = 10$

∴ not true!

(2)

Here are two right-angled triangles.
All the measurements are in centimetres.



Diagrams NOT accurately drawn

(b) Show that $2a + 2b + 1 = 2c$

1 $c^2 = a^2 + b^2$

2 $(c+1)^2 = (a+1)^2 + (b+1)^2$

$c^2 + 2c + 1 = a^2 + 2a + 1 + b^2 + 2b + 1$

From 1, $c^2 = a^2 + b^2$

$\rightarrow$ $a^2 + b^2 + 2c + 1 = a^2 + 2a + 1 + b^2 + 2b + 1$

$-a^2$ $b^2 + 2c + 1 = 2a + 2b + b^2 + 2$

$-b^2$ $2c + 1 = 2a + 2b + 2$

-1 $2c = 2a + 2b + 1$

$\rightarrow$ $2a + 2b + 1 = 2c$

(3)

a, b and c cannot all be integers.

(c) Explain why.

$2a$ = even

$2b$ = even

$2c$ = even

even + even + 1 = odd

$2a + 2b + 1 = 2c$

2c can't be odd, so a, b, c can't be integers!

(1)

(Total 6 marks)

[Full marks on this question was achieved by 0.2% of students]

TOTAL FOR PAPER = 69 MARKS

END

Practice Paper 1A (Set N)

Question	Date of original linear paper	Original question number
1	June 2011	14
2	November 2011	8
3	November 2011	17(b)
4	June 2011	23
5	November 2011	22
6	June 2011	27
7	November 2012	17
8	March 2012	23
9	June 2012	21
10	June 2012	24
11	November 2012	24
12	November 2011	14(b)
13	November 2012	26
14	June 2012	25
15	November 2012	27
16	November 2012	28
17	June 2011	25
18	March 2012	24