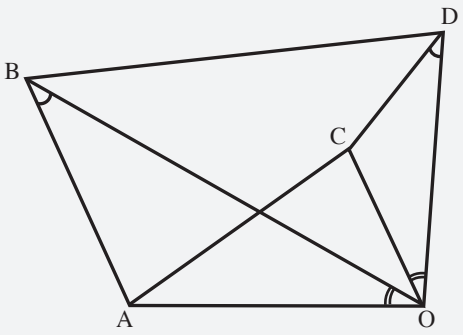
Appendix

Public Examination Questions 1951, 1960, 1970, 1980, 1990, 2000, 2006[97]

For each year, we have taken one geometry and one algebra question for comparison purposes. GCSE questions are from the higher tier, which was designed to be similar to O-level. For 1990 we also show new topics introduced.

July 1951 University of Cambridge
O-level Geometry Elementary Mathematics

12.



In the figure above, angle *ABO*=angle *CDO*, angle *AOB*= angle *COD*

(i) Complete the statements:

$$\frac{OA}{OC} = \frac{OB}{\quad}$$

$$\frac{\Delta OAB}{\Delta OCD} = \frac{OA^2}{\quad}$$

(ii) Prove that the triangles *OAC*, *OBD* are similar.

July 1951 University of Cambridge
O-level Algebra Elementary Mathematics

4. Solve the equation:

$$9\left(\frac{1-x^2}{1+x^2}\right) - 7\left(\frac{2x}{1+x^2}\right) = 3.$$

July 1960
O-level Algebra Elementary Mathematics

1. (i) If $x + 2 = 0$, find the value of the expression

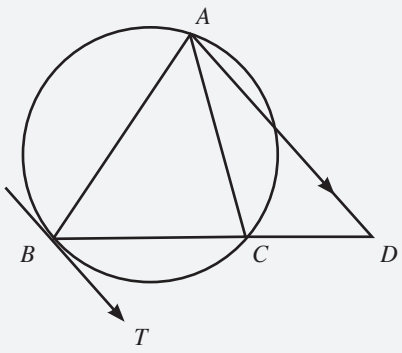
$$\frac{3(x+3)(x+1)}{x-1}$$

(ii) Divide $6a^3 - 5a^2 - 3a + 2$ by $2a - 1$

(iii) If the expression $9y^2 + kyz + 16z^2$ is a perfect square, find a value of k.

July 1960
O-level Geometry Elementary Mathematics

11.



In the figure above, *BT* is the tangent at *B* to the circle, and *AD* is parallel to *BT*. Prove that

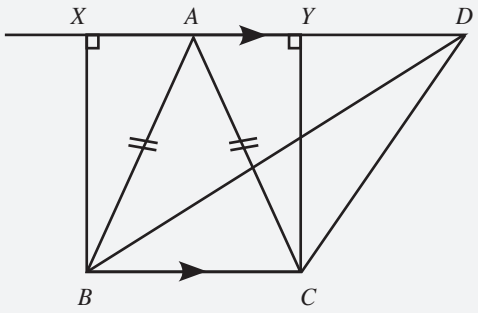
(i) the triangles *ABC*, *DBA* are similar;

(ii) $\frac{BC}{BD} = \frac{AC^2}{AD^2}$

97 With thanks to the Cambridge Assessment Archives Service

July 1970
O-level Geometry Elementary Mathematics

10.



Prove that the square on one side of an acute-angled triangle is less than the sum of the squares on the other two sides by twice the rectangle contained by one of these two sides and the projection on it of the other.

In the above figure, triangle ABC is isosceles with $AB = AC$. The lines AD, BC are parallel and X, Y are the feet of the perpendiculars drawn from B and C to AD. Complete the following statements
(i) $DC^2 = AD^2 + AC^2$ ……;
(ii) $DB^2 = AD^2 + AB^2$ ……..

Hence, or otherwise, prove that $DB^2 - DC^2 = 2AD.BC$.

July 1970
O-level Algebra Elementary Mathematics

8. (i) Solve the simultaneous equations

$x^2 - y^2 = 28$, $x - y = 7$.

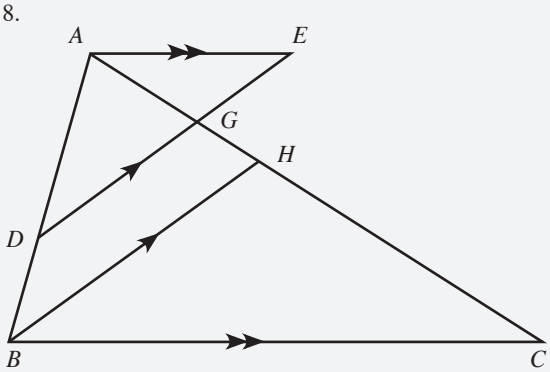
(ii) Show that $(x - 3)$ is a factor of

$x^3 - 5x^2 - 18x + 72$.

Without drawing a graph, find the values of x at the three points where the curve $y = x^3 - 5x^2 - 18x + 72$ meets the x-axis.

July 1980
O-level Geometry Elementary Mathematics Syllabus B

8.



In the diagram AE is parallel to BC and $AE = \frac{2}{7}BC$. The point D on AB is such that $BD = \frac{3}{7}BA$. The line DE meets AC at G and the line through B parallel to DE meets AC at H.

(i) Prove that $A\hat{G}E = B\hat{H}C$.
(ii) Prove that triangle AEG is similar to triangle CBH.

July 1980
O-level Algebra Elementary Mathematics Syllabus B

7. The following is an incomplete table of values for the graph of

$y = x^2 - 3x$

x	–2	–1	0	1	2	3	4	5
y		4		–2	–2	0	4	

(i) Calculate, and write down on your graph paper, the missing values of y.

(ii) Using a scale of 2 cm to one unit on the x-axis and 1 cm to one unit on the y-axis, draw a graph of

$y = x^2 - 3x$

for values of x from -2 to +5 inclusive.

(iii) Use your graph to solve the equation

$x^2 - 3x = 5$

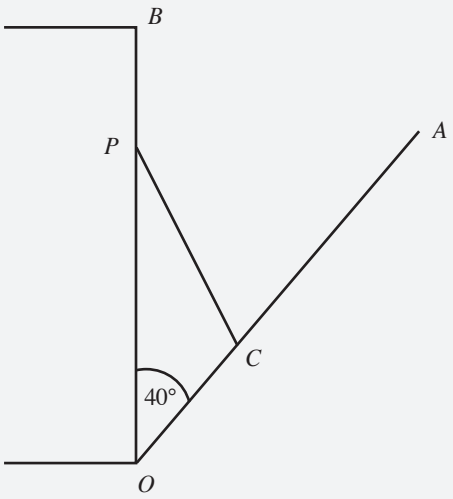
(iv) On the same diagram, draw the graph of

$y = x + 2$

(v) Write down and simplify the equation in x whose solutions are the values of x at the points of intersection of the two graphs.

May 1990
MEG Higher Tier Mathematics

20.



The diagram, which is drawn using a scale of 1 centimetre to represent 5 centimetres, shows the side view of a wall-cupboard with the door *OA* partly open. The door is hinged at *O* and when the cupboard is closed *A* is at *B*. The door will swing downwards until it is horizontal, when the cupboard is fully open. It is supported by a strut *PC*. *C* is fixed to the door and *P* is free to slide along *OB*.

(a) (i) Draw accurately the position of *OA* when the cupboard is fully open.

(ii) Draw accurately the locus of *A* as the door is opened.

(iii) Draw accurately the strut *PC* when the door is fully open.

(b) (i) Write down the actual length of the door, *OA*.

Answer (b) (i) _____ cm [1]

(ii) Taking $\pi = 3.14$. Calculate the distance, correct to the nearest centimetre, moved by *A* from the position in the diagram to the fully open position.

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.....

Answer (b) (ii) _____ cm [3]

May 1990
MEG Higher Tier Mathematics

2. (a) In a History examination, the marks range from 22 to 65. It is decided to scale the original marks using the formula

$y = 2x - 30$

where x is the original mark and y is the new mark.

(i) Calculate the lowest new mark and the highest new mark.

(ii) Express x in terms of y.

(b) In a Mathematics examination, the marks range from 24 to 84. The original marks are to be scaled so that the lowest new mark is 30 and the highest new mark is 120. The formula is to be of the type $y = ax + b$, where x is the original mark and y is the new mark. Write down two simultaneous equations for a and b. Hence find the required formula.

In 1990 new topics were introduced

May 1990
MEG Higher Tier Mathematics

21. Solve the inequality
$2x < 14 < 3x + 5$.

.....

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Answer _____ [2]

22. The position vector of the point A is $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$
that of the point B is $\begin{pmatrix} 4 \\ 4 \end{pmatrix}$ and 0 is the origin.

(a) Find $\overrightarrow{AB}$

.....

.....

Answer (a) _____ [2]

(b) $\overrightarrow{BC} = 3\overrightarrow{OA}$

Find the coordinates of C

.....

.....

Answer (b) _____ [2]

(c) The point P has coordinates (x, y). If $BP = 5$, find an equation connecting x and y.

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Answer (c) _____ [2]

May 1990
MEG Higher Tier Mathematics

6. You must use graph paper for this question.

The matrix A = $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ represents the transformation T, where

$$\text{T: } \begin{pmatrix} x \\ y \end{pmatrix} \longrightarrow \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

(a) Taking 2 cm to represent 1 unit on each axis and marking each axis from -3 to 3, draw and label the triangle PQR whose vertices are $P(3,0)$, $Q(1,2)$ and $R(3,-1)$.

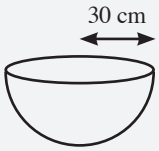
(b) The triangle PQR is mapped onto triangle $P_1Q_1R_1$ by the transformation T. Draw and label triangle $P_1Q_1R_1$ on your diagram.

(c) Describe the transformation T fully in geometrical terms.

(d) (i) Find the inverse matrix A^{-1} and the matrix A^3.
(ii) Explain the relationship between A^{-1} and A^3 in terms of transformations.

June 2000
OCR Higher Tier Mathematics

10.



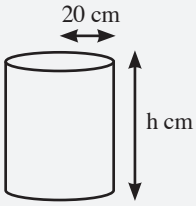
A hemispherical bowl has a radius of 30 cm.

(a) (i) Calculate the volume of the bowl. Leave your answer as a multiple of π.

……

……

Answer (a)(i) _____ cm3 [2]



(ii) A cylinder of radius 20 cm and height h cm has the same volume as the bowl.

Calculate the value of h.

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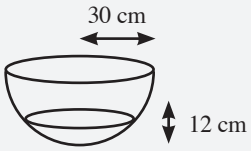
……

Answer (a)(ii) _____ [2]



Water is poured into the bowl to a depth of 12cm.

(b) Calculate the radius of the surface of the water.

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Answer (b) _____ cm [3]

June 2000
OCR Higher Tier Mathematics

4. (a) Simplify $t^4 \times t^2$.

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Answer (a) _____ [1]

(b) Solve
(i) $3(x - 1) = x + 4$,

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……

……

Answer (b)(i) x = _____ [3]

(ii) $8x + 5 > 25$.

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Answer (b)(ii) _____ [2]

(c) Factorise $4x^2 - 25$.

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Answer (c) _____ [2]

(d)(i) Factorise $x^2 + 7x + 6$.

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Answer (d)(i) _____ [2]

(ii) Hence solve the equation
$x^2 + 7x + 6 = 0$.

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Answer (d)(ii) x = _____ [1]

June 2006
OCR Higher Tier Mathematics

18. (a) Simplify

$$\frac{x^2 - 3x}{x^2 - 6x + 9}$$

……

……

(b) (i) Find a and b when

$x^2 + 8x + 21 = (x + a)^2 + b$

……

……

(b)(i) $a =$ _____ $b =$ _____

(ii) Use your answer to (b)(i) to find the minimum value of

$x^2 + 8x + 21$.

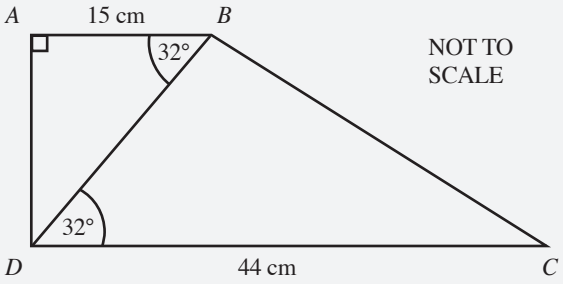
……

……

(b)(ii) _____

June 2006
OCR Higher Tier Mathematics

12.



ABCD is a trapezium.
Angle *BAD* = 90°
Angle *BDC* = angle *ABD* = 32°
AB = 15 cm and *DC* = 44 cm.

Calculate the length of *BC*.

Give your answer to a suitable degree of accuracy.

……

……

_____ cm [6]