

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



Level 2 Certificate in Further Mathematics
January 2013

Further Mathematics

8360/2

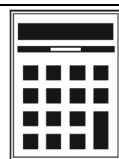
Level 2

Paper 2 Calculator

Tuesday 29 January 2013 1.30 pm to 3.30 pm

For this paper you must have:

- a calculator
- mathematical instruments.



Time allowed

- 2 hours

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 105.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.
- The use of a calculator is expected but calculators with a facility for symbolic algebra must **not** be used.

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20 – 21	
22 – 23	
TOTAL	

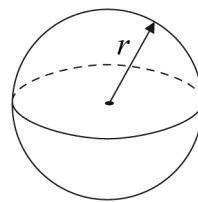


J A N 1 3 8 3 6 0 2 0 1

Formulae Sheet

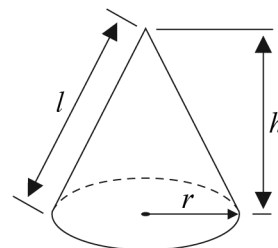
Volume of sphere $= \frac{4}{3}\pi r^3$

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



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

Curved surface area of cone $= \pi r l$



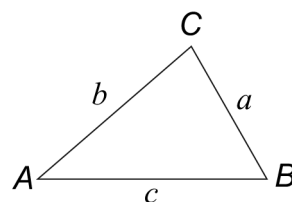
In any triangle ABC

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

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

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

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$



The Quadratic Equation

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

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

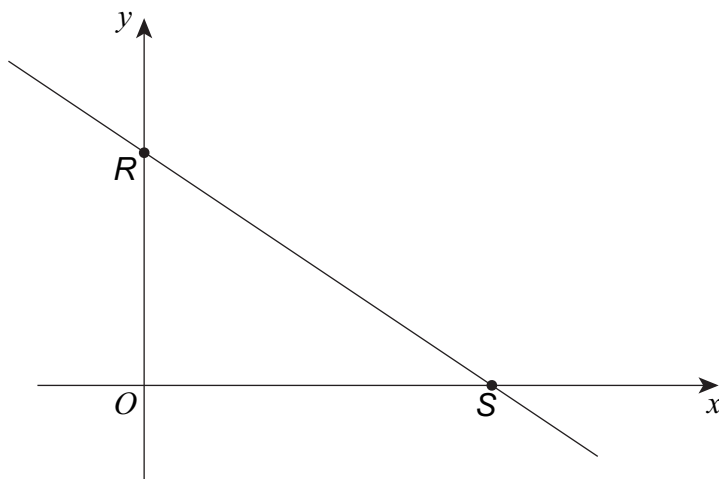
Trigonometric Identities

$$\tan \theta \equiv \frac{\sin \theta}{\cos \theta} \quad \sin^2 \theta + \cos^2 \theta \equiv 1$$



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

- 1** A sketch of $2x + 3y = 12$ is shown.



- 1 (a)** Work out the coordinates of R .

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Answer (..... ,) (1 mark)

- 1 (b)** Work out the coordinates of the midpoint of RS .

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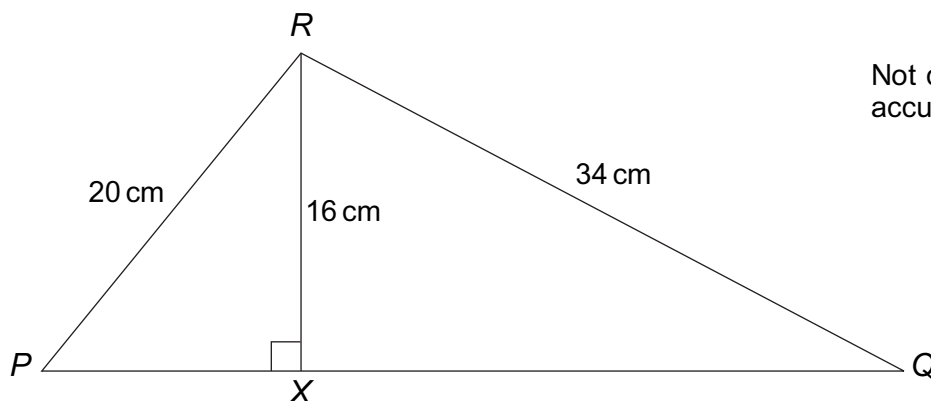
Answer (..... ,) (2 marks)

Turn over ►



2

In triangle PQR , X is a point on PQ .
 RX is perpendicular to PQ .



Not drawn
accurately

Work out the ratio $PX:XQ$
 Give your answer in its simplest form.

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Answer :

(4 marks)



3 Solve $5d - 3 > d + 17$

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Answer (2 marks)

4 Match each statement with an equation.
You will **not** use all of the equations.

One has been done for you.

A curve passing through (0, 0)

A curve passing through (1, 0)

A circle centre (2, -1)

A circle passing through (3, 1)

$$x^2 + y^2 = 10$$

$$(x + 2)^2 + (y - 1)^2 = 1$$

$$y = x^3$$

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

$$(x - 2)^2 + (y + 1)^2 = 1$$

$$y = x^2 - 2$$

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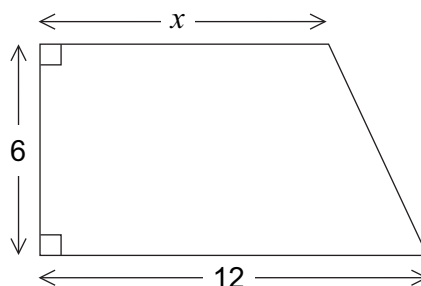
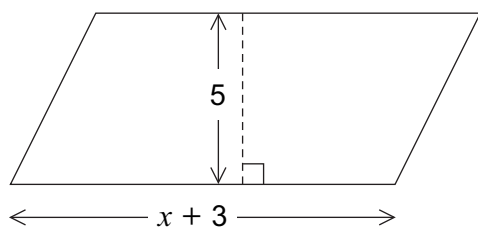
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(3 marks)

Turn over ►



- 5 A parallelogram and a trapezium are shown.
All lengths are in centimetres.



Not drawn
accurately

The area of the parallelogram is equal to the area of the trapezium.

Work out the value of x .

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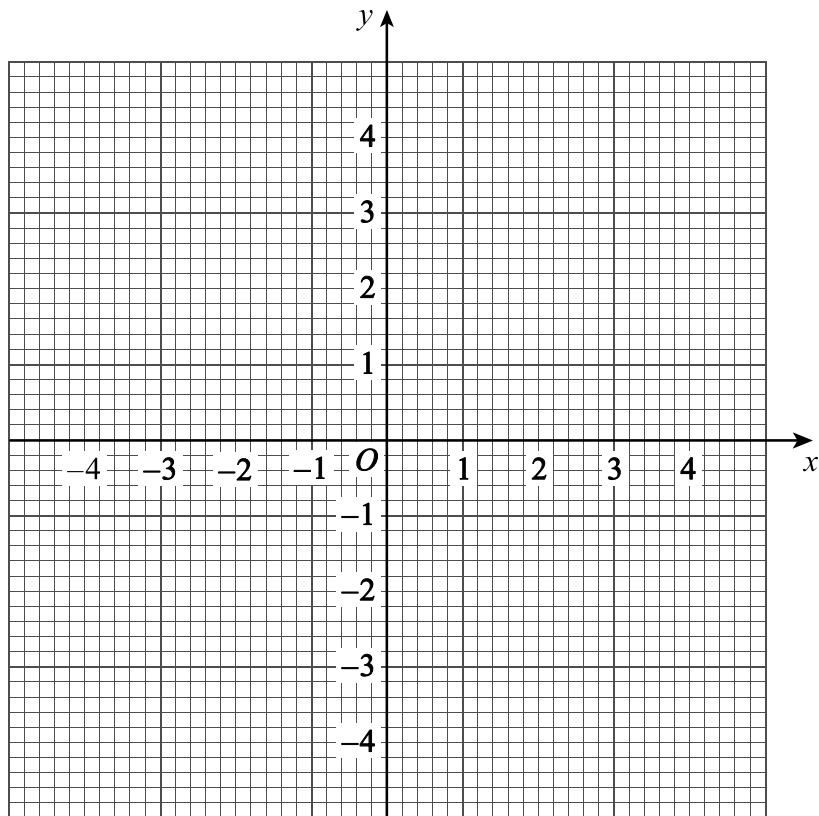
$x =$ cm (4 marks)



6 A function $f(x)$ is defined as

$$\begin{aligned} f(x) &= 4 & x < -2 \\ &= x^2 & -2 \leq x \leq 2 \\ &= 12 - 4x & x > 2 \end{aligned}$$

6 (a) Draw the graph of $y = f(x)$ for $-4 \leq x \leq 4$



(3 marks)

6 (b) Use your graph to write down **how many** solutions there are to $f(x) = 3$

Answer (1 mark)

6 (c) Solve $f(x) = -10$

.....

$x =$ (2 marks)



7 Here are the first four terms of a sequence.

$$4a$$

$$9a$$

$$14a$$

$$19a$$

The n th term of the sequence is $\frac{10n - 2}{3}$

Work out the value of a .

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$a =$ (2 marks)

8 (a) Factorise fully $5m^2 - 20p^2$

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Answer (3 marks)

8 (b) You are given that $p = 15$ and $5m^2 - 20p^2 = 0$

Using your answer to part (a), or otherwise, work out the values of m .

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Answer (2 marks)



9 (a) Expand $(x + m)(x + n)$

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Answer (1 mark)

9 (b) $x^2 + qx + r \equiv (x + m)(x + n)$

Use your answer to part (a) to write q and r in terms of m and n .

$q =$

$r =$ (2 marks)

9 (c) r is an odd integer.

Use your answer to part (b) to explain why q is an even integer.

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(2 marks)

Turn over ►



10 $S = \frac{a}{1-r}$

10 (a) Show that $r = \frac{S-a}{S}$

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(3 marks)

10 (b) Work out the value of r when $S = 10a$

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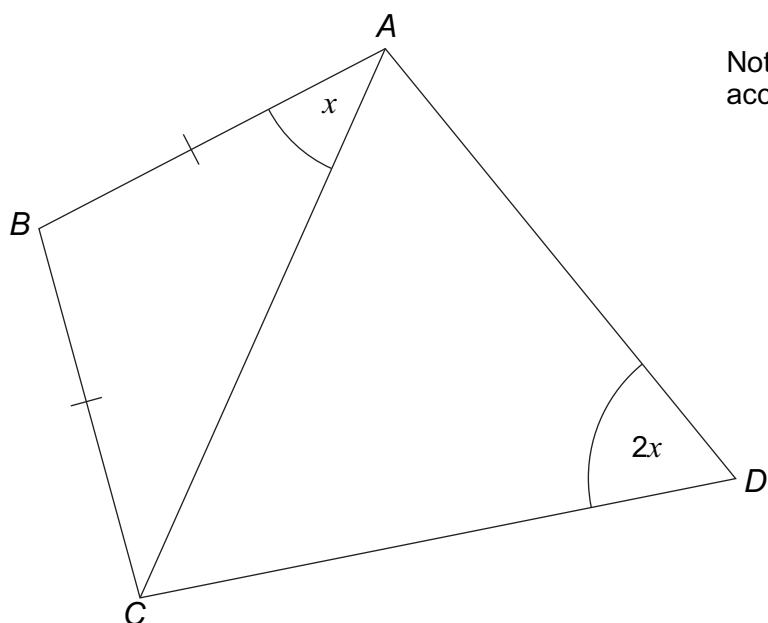
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$r = \dots\dots\dots$ (2 marks)



In the diagram, $AB = BC$



Not drawn accurately

Prove that $ABCD$ is a cyclic quadrilateral.
Give reasons for any statements you make.

[illegible]

(3 marks)



12 $f(x) = \sin x$ $180^\circ \leq x \leq 360^\circ$
 $g(x) = \cos x$ $0^\circ \leq x \leq \theta$

12 (a) Calculate the value of $f(210^\circ)$.

Answer (1 mark)

12 (b) Complete this inequality for the range of $f(x)$.

Answer $\leq f(x) \leq$ (2 marks)

12 (c) You are given that $0 \leq g(x) \leq 1$

Work out the value of θ .

$\theta =$ degrees (1 mark)



13 (a) Show that $\frac{4}{x} + \frac{2}{x-1}$ simplifies to $\frac{6x-4}{x(x-1)}$

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(2 marks)

13 (b) Hence, or otherwise, solve $\frac{4}{x} + \frac{2}{x-1} = 3$

Give your solutions to 3 significant figures.

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Answer (5 marks)



- 14** The value of x is 50% **more** than the value of t .
The value of y is 10% **less** than the value of w .

$$x = y$$

Work out $\frac{t}{w}$

Give your answer as a decimal.

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$$\frac{t}{w} = \dots\dots\dots (4 \text{ marks})$$

- 15** Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$

(3 marks)



16

$$y = (x^3 - 1)^2 + (\sqrt{x})^8$$

Work out $\frac{dy}{dx}$.

$$\frac{dy}{dx} = \dots\dots\dots (5 \text{ marks})$$

Turn over for the next question



17

 $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ represents a reflection in the y -axis. $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ represents a reflection in the line $y = x$

Work out the matrix that represents a reflection in the y -axis followed by a reflection in the line $y = x$

Answer $\begin{pmatrix} \dots\dots\dots & \dots\dots\dots \\ \dots\dots\dots & \dots\dots\dots \end{pmatrix}$ (2 marks)



18 Express $1 - \tan \theta \sin \theta \cos \theta$ in terms of $\cos \theta$.

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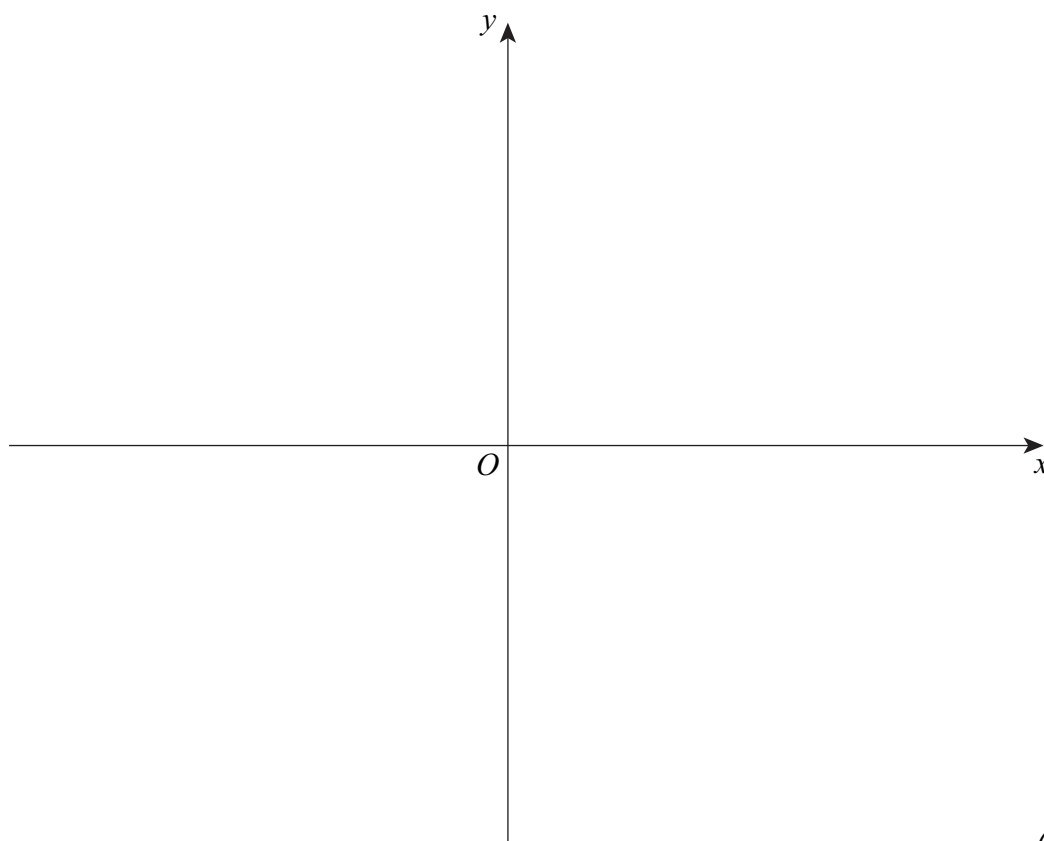
Answer (3 marks)

19 A cubic function $f(x)$ has domain $-4 \leq x \leq 4$

The curve $y = f(x)$

- has a minimum point at $(-2, 0)$
- has a maximum point at $(1, 4)$
- meets the x -axis at $(4, 0)$.

Sketch the graph of $y = f(x)$ on these axes.
Label any points where the graph meets the x -axis.

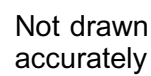


(4 marks)

Turn over ►



The area of this triangle is 18 cm^2 .

[illegible]

$y = \dots\dots\dots$ cm (5 marks)



21

Work out the equation of the normal to the curve $y = x^2 + 4x + 5$ at the point where $x = -3$

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Answer (5 marks)

22

$f(x) = x^3 + ax^2 + bx + 24$ for all values of x .

Two of the factors of $f(x)$ are $(x - 2)$ and $(x + 3)$.

Work out the values of a and b .

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$a =$ $b =$ (5 marks)

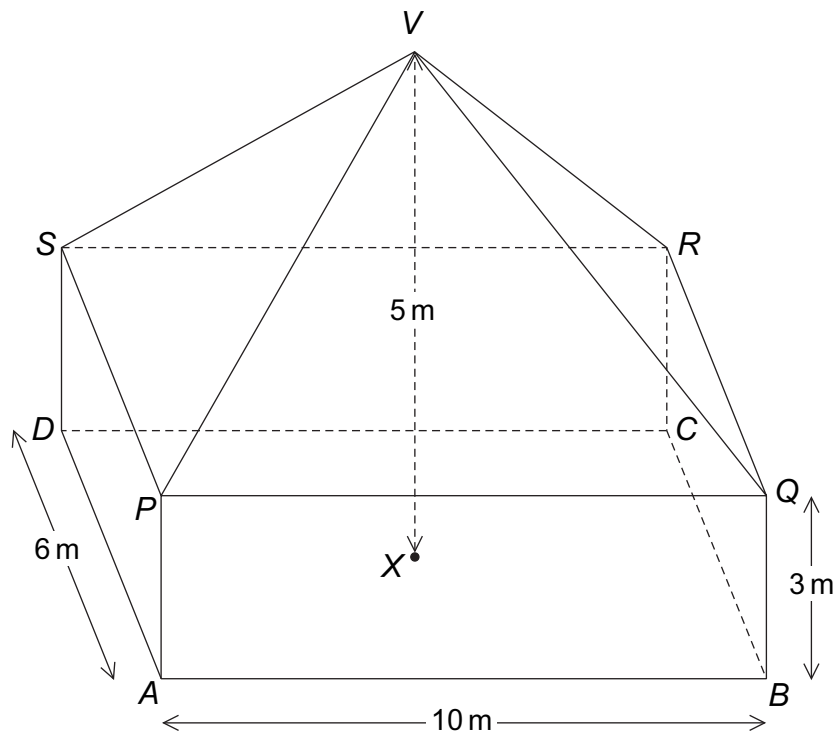
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Turn over ►



23

The diagram shows a cuboid $ABCDPQRS$ and a pyramid $PQRSV$.
 V is directly above the centre, X , of $ABCD$.



The total height, VX , is 5 metres.



23 (a) Work out the angle between the line VA and the plane $ABCD$.

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Answer degrees (4 marks)

23 (b) Work out the angle between the planes VQR and $PQRS$.

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Answer degrees (2 marks)



24 Solve $3 \cos^2 \theta - 1 = 0$ for $0^\circ \leq \theta \leq 180^\circ$

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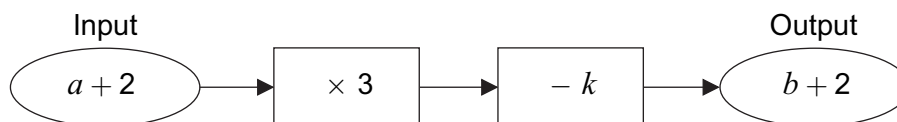
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Answer (4 marks)



Here are two number machines.



Work out a in terms of k .

[illegible]

$a = \dots\dots\dots$ (6 marks)

END OF QUESTIONS



There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

