Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

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

Level 2 Certificate in Further Mathematics
January 2013

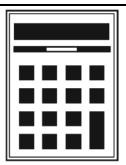
Further Mathematics 8360/2

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

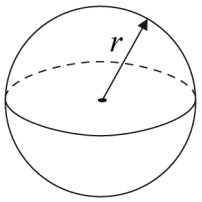
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this 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.

Formulae Sheet

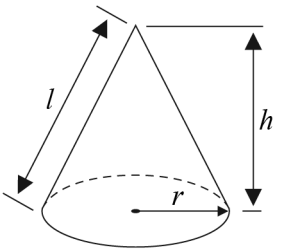
Volume of sphere $= \frac{4}{3}\pi r^3$

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



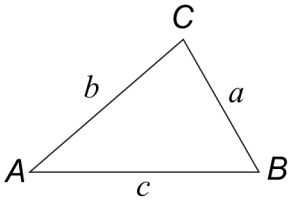
Volume of cone $= \frac{1}{3}\pi r^2 h$

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



In any triangle ABC

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



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

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

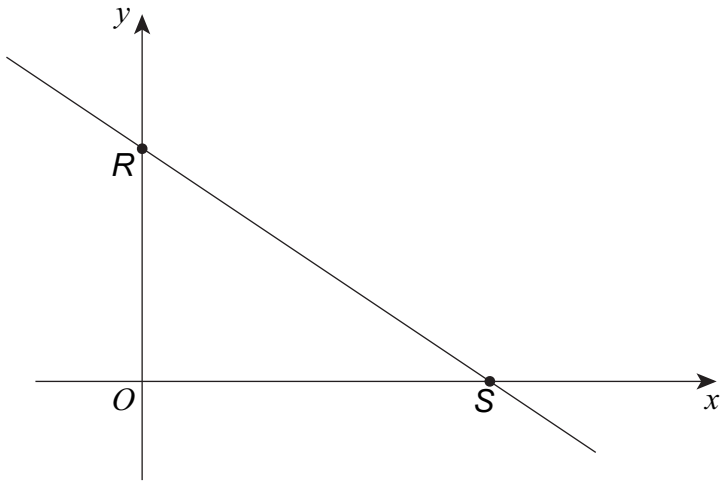
$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

Trigonometric Identities

$\tan\theta \equiv \dfrac{\sin\theta}{\cos\theta}$ $\qquad \sin^2\theta + \cos^2\theta \equiv 1$

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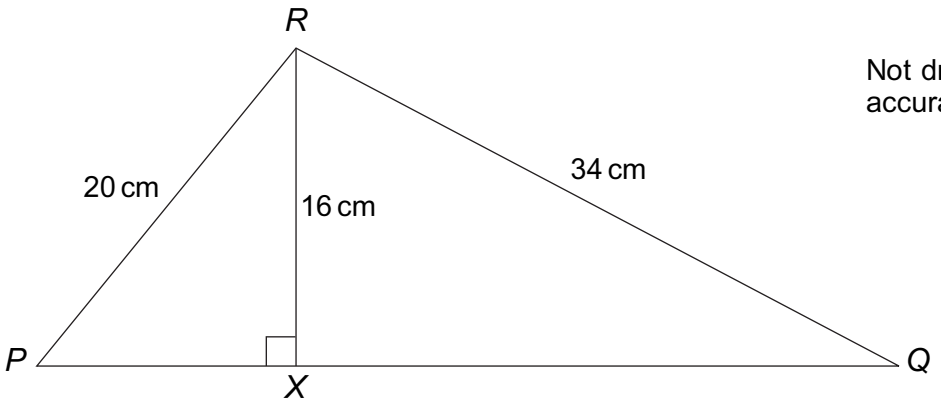
Answer (....., ...) *(2 marks)*

3

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



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 $(0, 0)$	$x^2 + y^2 = 10$
	$(x + 2)^2 + (y - 1)^2 = 1$
A curve passing through $(1, 0)$	$y = x^3$
A circle centre $(2, -1)$	$y = x^3 + x - 2$
	$(x - 2)^2 + (y + 1)^2 = 1$
A circle passing through $(3, 1)$	$y = x^2 - 2$

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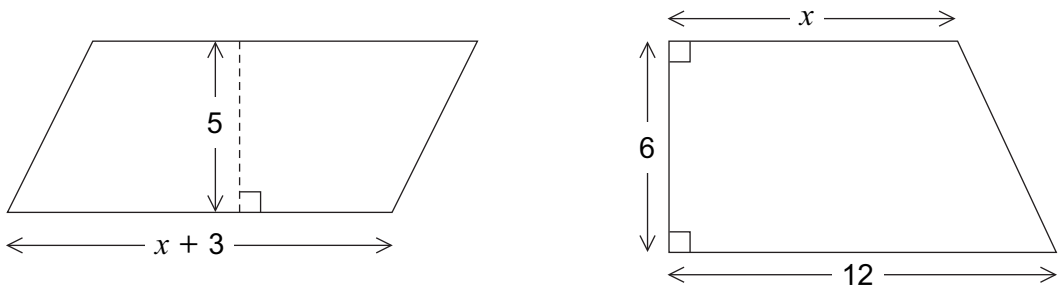
(3 marks)

9

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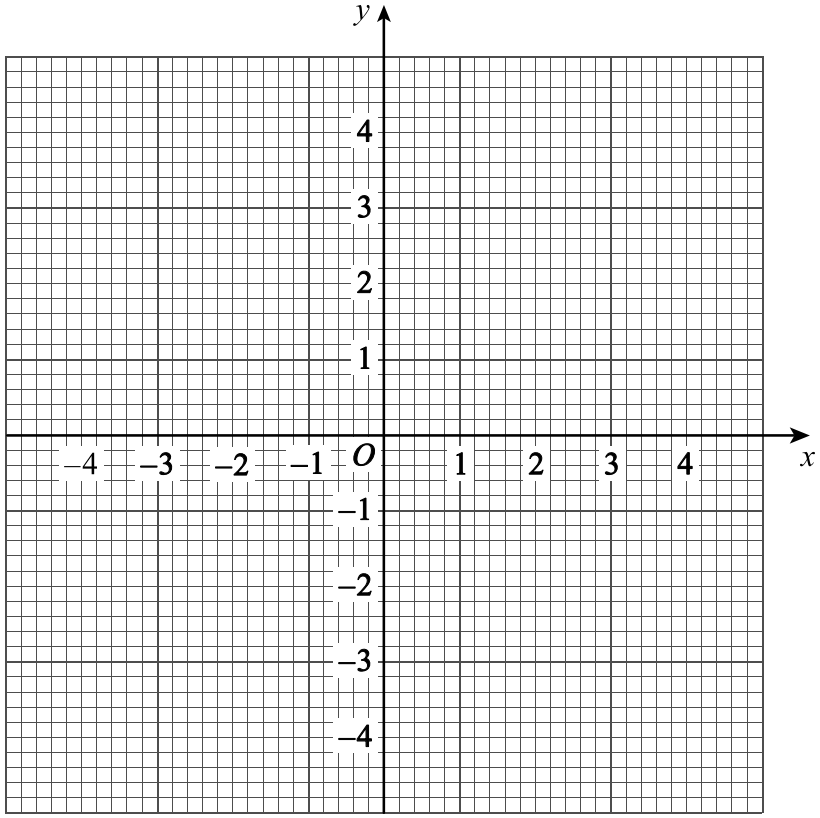
$x =$ ..... cm *(4 marks)*

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

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

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



(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 $f(x) = -10$

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

10

Turn over ▶

7 Here are the first four terms of a sequence.

$4a \qquad 9a \qquad 14a \qquad 19a$

The nth term of the sequence is $\dfrac{10n - 2}{3}$

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)

12

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

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

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(3 marks)

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

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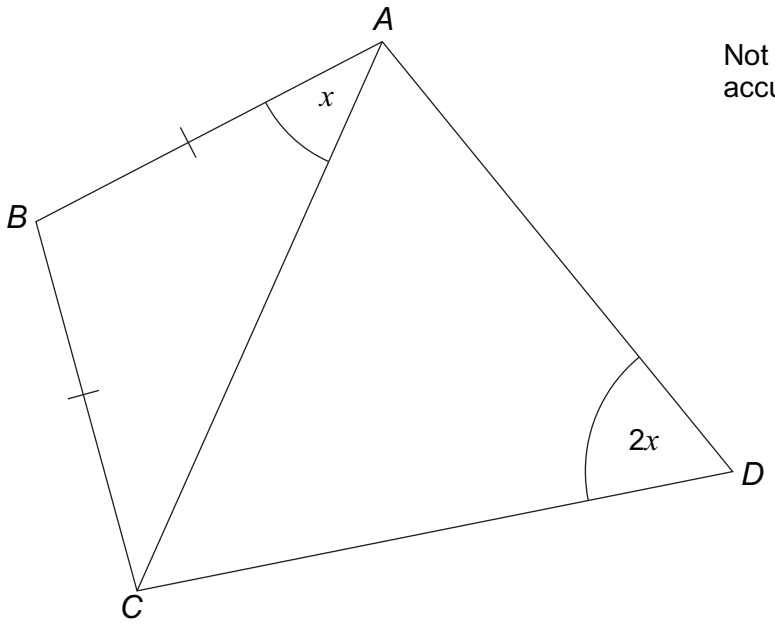
$r =$ ..... *(2 marks)*

11 In the diagram, $AB = BC$



Not drawn accurately

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

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(3 marks)

8

12 $f(x) = \sin x \quad 180° \leqslant x \leqslant 360°$

$g(x) = \cos x \quad 0° \leqslant x \leqslant \theta$

12 (a) Calculate the value of f(210°).

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

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

Answer ..... $\leqslant f(x) \leqslant$ ..... *(2 marks)*

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

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)*

11

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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$\frac{t}{w} =$ ..... *(4 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 $\frac{dy}{dx}$.

$\frac{dy}{dx} =$ ..... *(5 marks)*

Turn over for the next question

12

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 $\begin{pmatrix} \ldots\ldots\ldots & \ldots\ldots\ldots \\ \ldots\ldots\ldots & \ldots\ldots\ldots \end{pmatrix}$ *(2 marks)*

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

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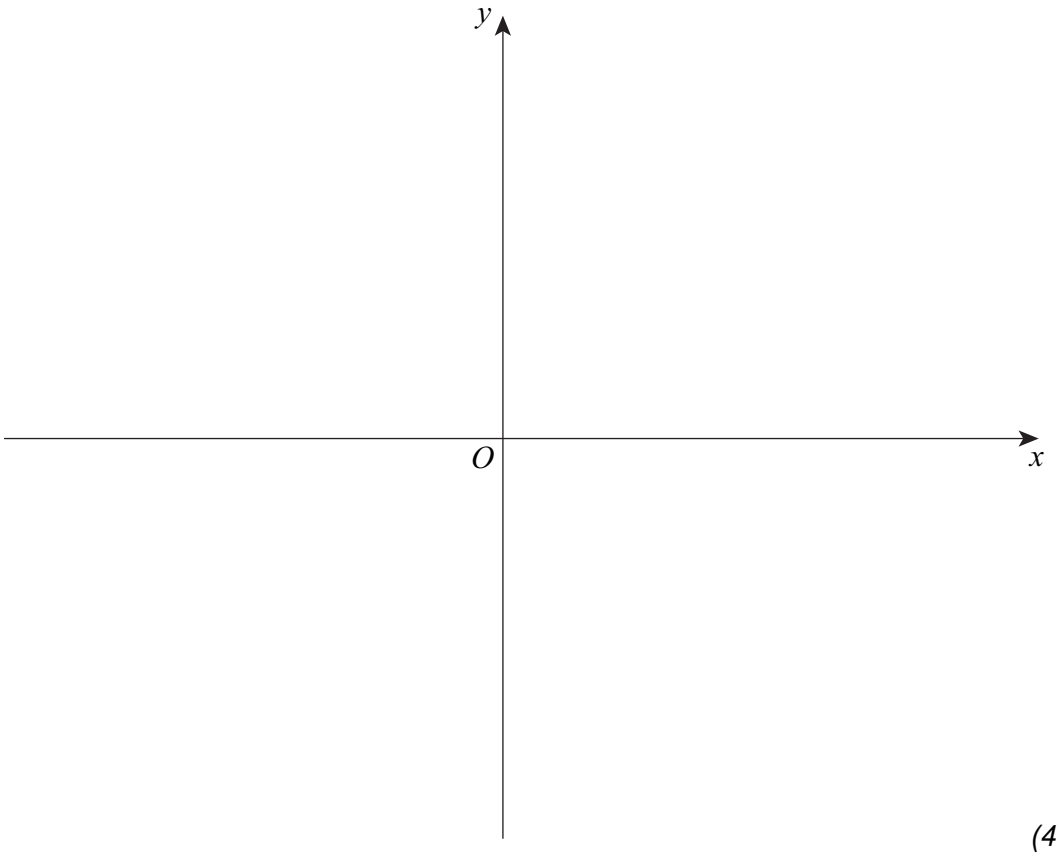
Answer ..... *(3 marks)*

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

The curve $y = f(x)$

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

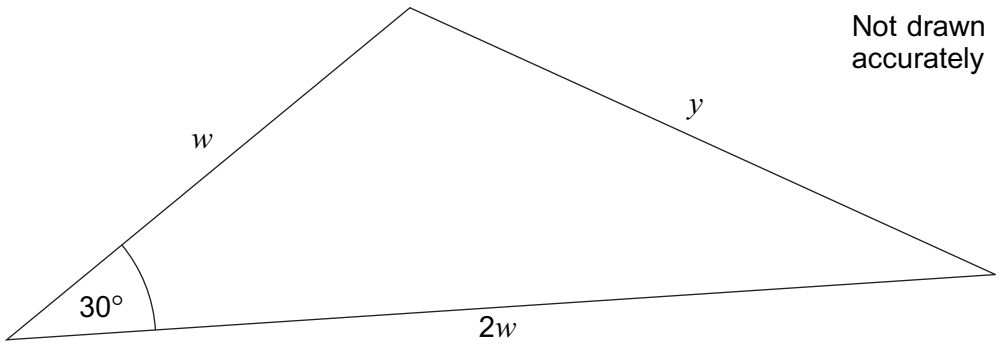
Sketch the graph of $y = f(x)$ on these axes.
Label any points where the graph meets the x-axis.



(4 marks)

9

20 The area of this triangle is $18\,cm^2$.



Work out y.

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$y =$ ..... 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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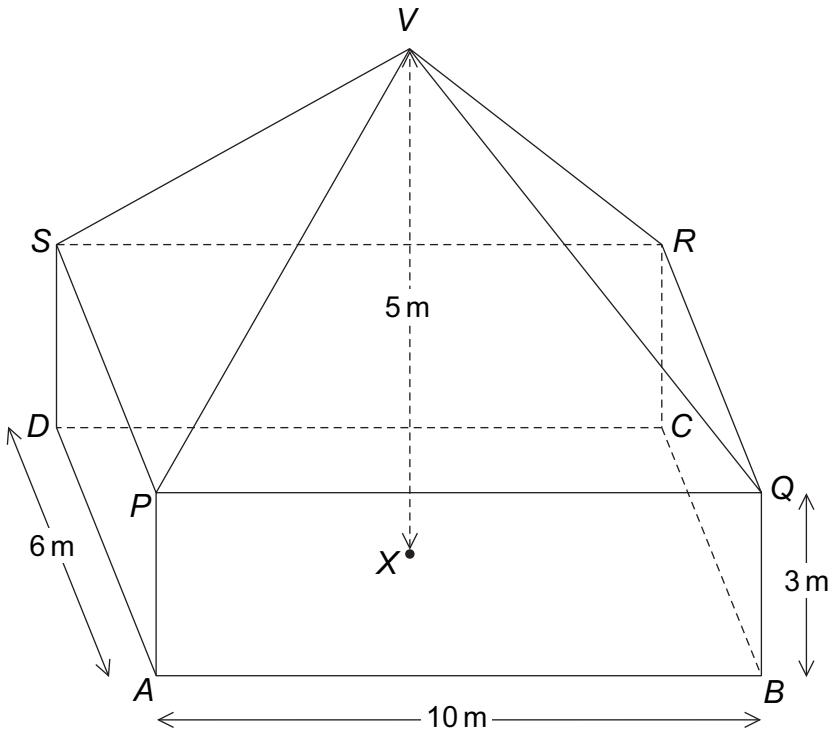
$a =$ ..... $b =$ ..... *(5 marks)*

15

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)*

6

24 Solve $3\cos^2\theta - 1 = 0$ for $0° \leqslant \theta \leqslant 180°$

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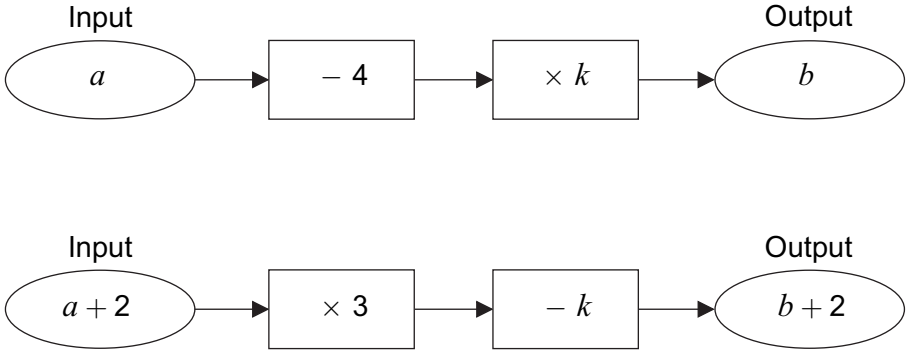
Answer ..... *(4 marks)*

25 Here are two number machines.



Work out a in terms of k.

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$a =$ ..... *(6 marks)*

END OF QUESTIONS

10

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED