Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 - 5	
6 - 7	
8 - 9	
10 - 11	
12 - 13	
14 - 15	
16	
TOTAL	

Certificate in Further Mathematics
Level 2

Further Mathematics 8360/2

Level 2

Specimen Paper 2

Calculator

For this paper you must have:	
• a calculator • mathematical instruments.	

Time allowed
2 hours

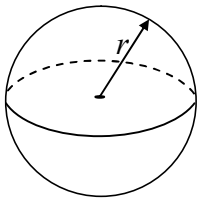
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book.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

Formulae Sheet

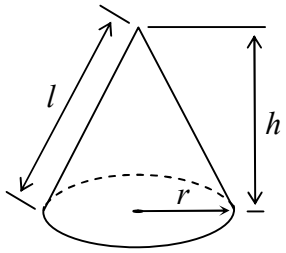
Volume of sphere $= \frac{4}{3}\pi r^3$

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



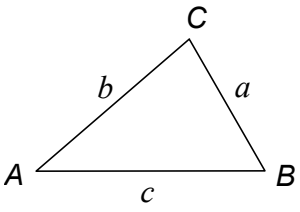
Volume of cone $= \frac{1}{3}\pi r^2 h$

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

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

Do not write outside the box

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

1 a, b, c and d are consecutive integers.

Explain why $ab + cd$ is always even.

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(3 marks)

2 Work out the distance between the point $A(1, 4)$ and the point $B(7, 12)$.

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Answer ..... units *(2 marks)*

3 The nth term of a sequence is given by $\dfrac{3n + 1}{6n - 5}$

3 (a) Write down the first, tenth and hundredth terms of the sequence.

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

3 (b) Show that the limiting value of $\dfrac{3n + 1}{6n - 5}$ is $\dfrac{1}{2}$ as $n \to \infty$

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(2 marks)

9

Do not write outside the box

4 The function f(x) is defined as $f(x) = x^2 + x$

4 (a) Write down the value of f(7)

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

4 (b) Solve $f(x) = 0$

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

4 (c) Write an expression for $f(x+1) - f(x)$

Give your answer in its simplest form.

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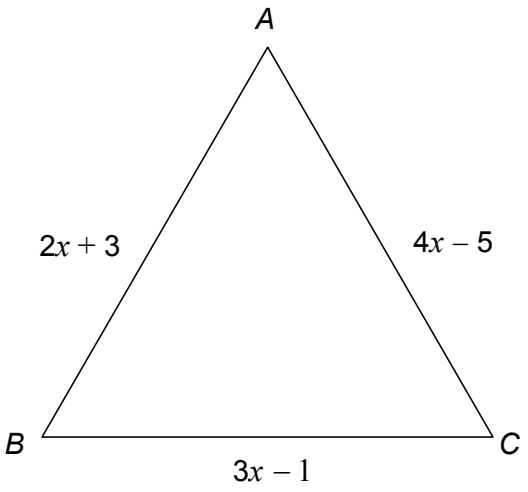
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Answer ..... *(3 marks)*

Do not write outside the box

5 The diagram shows triangle *ABC* with *AB* = *AC*.



Not drawn accurately

Show that triangle *ABC* is equilateral.

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(5 marks)

6 x, y and z are three quantities such that

$x : y = 3 : 2$ and $y : z = 5 : 4$

Express the ratio $x : z$ in its simplest form.

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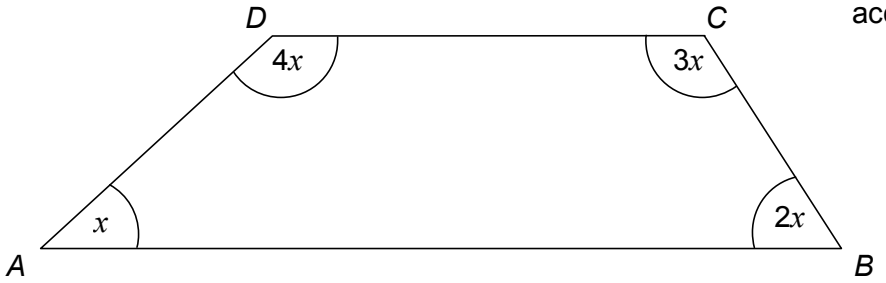
Answer ……..... : ……. *(3 marks)*

14

Do not write outside the box

7 *ABCD* is a quadrilateral.

Not drawn accurately



Prove that *AB* is parallel to *DC*.

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(5 marks)

Do not write outside the box

8 The function f(x) is defined as $f(x) = \dfrac{1}{x^2 - 3x - 10}$

f(x) has domain all x except $x = a$ and $x = b$

Work out a and b.

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

9 (a) Expand and simplify $(x - 5)(x^2 + 4x - 2)$

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

9 (b) Factorise fully $(x^2 - 16) - (x - 4)(3x + 5)$

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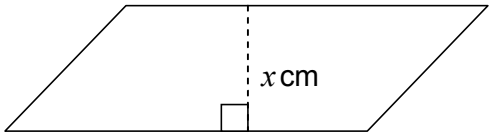
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Answer ..... *(4 marks)*

16

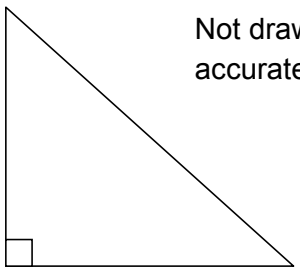
Do not write outside the box

10 Here are a parallelogram and an isosceles triangle.



$(x + 4)$ cm

Not drawn accurately



$2x$ cm

10 (a) The area of the triangle is greater than the area of the parallelogram.

Show that $x^2 - 4x > 0$

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(3 marks)

10 (b) Work out the least integer value for x.

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

11 Write $\dfrac{a^{\frac{1}{2}} \times a^{\frac{3}{2}}}{(a^3)^4}$ as a single power of a.

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

Do not write outside the box

12 n is an integer.

Prove that $(n-2)^2 + n(8-n)$ is always a multiple of 4.

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(3 marks)

13 Solve the simultaneous equations $y^2 = x + 3$ and $y = 2x$

Do **not** use trial and improvement.

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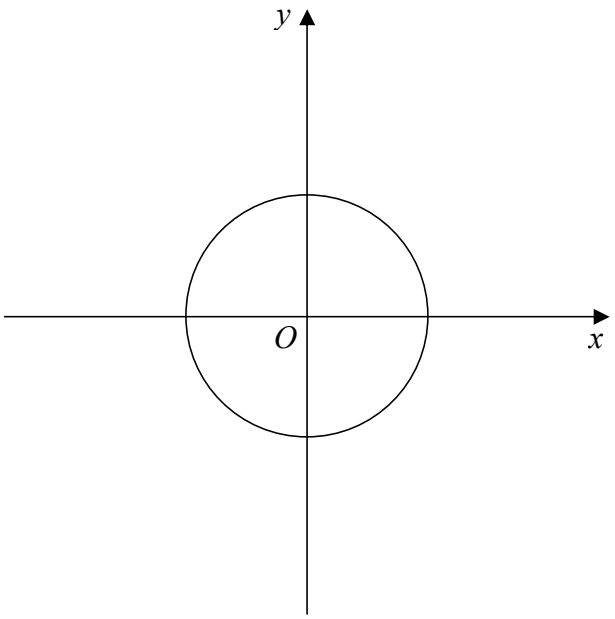
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Answer ..... *(5 marks)*

17

Do not write outside the box

14 On the axes below is a circle centre (0, 0) and passing through the point (3, 0).



14 (a) Write down the equation of the circle.

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

14 (b) Decide whether the point (2, 2) is inside or outside the circle.

Show how you decide.

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

14 (c) The circle above is translated so that the image of (3, 0) is (5, 4).

Write down the equation of the new circle.

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

Do not write outside the box

15 A triangle has sides 10.2 cm, 6.8 cm and 5.7 cm.

Work out the area of the triangle.

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Answer ..... cm^2 *(5 marks)*

16 Work out the equation of the perpendicular bisector of $P(3, -1)$ and $Q(5, 7)$.

Give your answer in the form $y = ax + b$

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Answer ..... *(5 marks)*

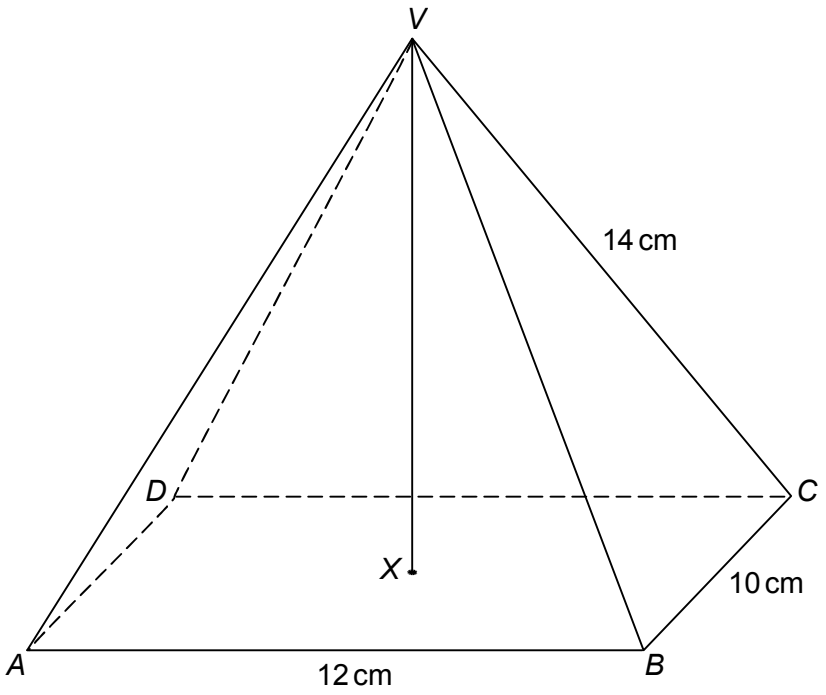
15

Do not write outside the box

17 *VABCD* is a rectangular based pyramid.

$AB = 12\,\text{cm}$, $BC = 10\,\text{cm}$ and $VC = 14\,\text{cm}$

The base *ABCD* is horizontal and the vertex *V* is directly above *X*, the centre of the base.



17 (a) Work out the height of the pyramid, *VX*.

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

17 (b) Calculate the angle between *VC* and the plane *ABCD*.

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

Do not write outside the box

17 (c) Calculate the angle between the planes *VBC* and *ABCD*.

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

18 Solve the equation $\cos^2 x = 0.8$ for $0° \leqslant x \leqslant 360°$

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

19 $y = x^4(2x + 5)$

Work out the rate of change of y with respect to x when $x = 2$

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Answer ..... *(5 marks)*

17

20 (a) Matrix $\mathbf{A} = \begin{pmatrix} 4 & 3 \\ 1 & 1 \end{pmatrix}$

Work out the image of point $P(2, -1)$ using transformation matrix **A**.

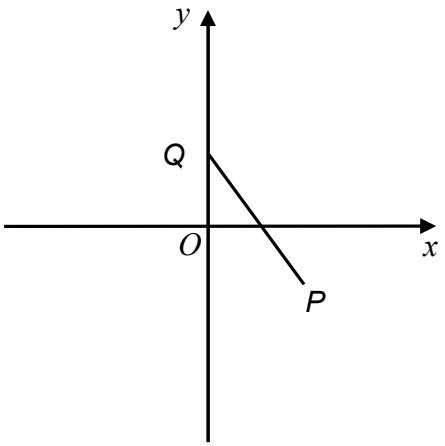
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Answer (....., ...) *(2 marks)*

20 (b) Point Q is (0, 1)

Line PQ is transformed to line $P'Q'$ using matrix **A**.



Work out the length of $P'Q'$.

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Answer ..... units *(2 marks)*

21 Factorise fully $x^3 - 4x^2 - 11x + 30$

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Answer ..... *(6 marks)*

Turn over for the next question

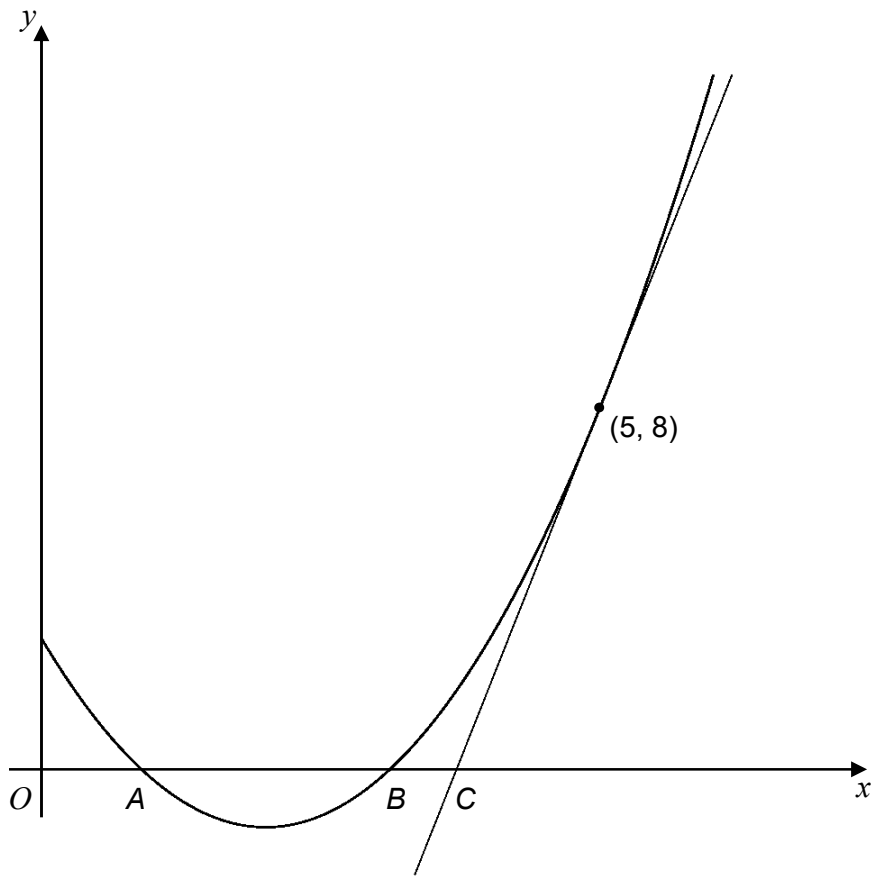
10

Do not write outside the box

22 The diagram shows the graph of $y = x^2 - 4x + 3$

The curve cuts the x-axis at the points A and B.

The tangent to the curve at the point (5, 8) cuts the x-axis at the point C.



Show that $AB = 3BC$

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(7 marks)

END OF QUESTIONS

7