Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 – 5	
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8 – 9	
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12 – 13	
14 – 15	
16	
TOTAL	

AQA

Level 2 Certificate in Further Mathematics

Further Mathematics Level 2

8360/1

Practice Paper Set 4

Paper 1

Non-Calculator

For this paper you must have:

- mathematical instruments.

You may **not** use a calculator.

Time allowed: 1 hour 30 minutes

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.

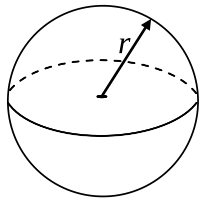
Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 70.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer booklet.

Formulae Sheet

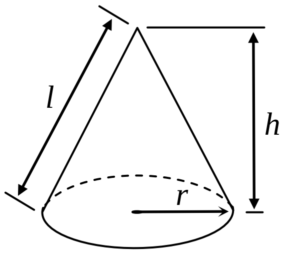
Volume of sphere $= \frac{4}{3}\pi r^3$

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



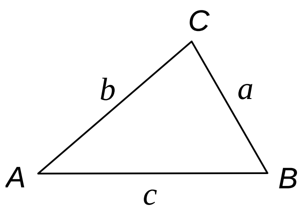
Volume of cone $= \frac{1}{3}\pi r^2 h$

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

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

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

1

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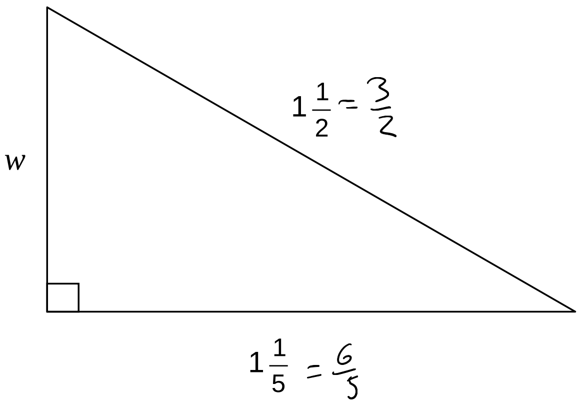


Work out the value of w.

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

$w = \sqrt{\frac{3}{2}^2 - \frac{6}{5}^2}$

$= \sqrt{\frac{9}{4} - \frac{36}{25}}$

$= \sqrt{\frac{225}{100} - \frac{144}{100}}$

$= \sqrt{\frac{81}{100}}$

$= \frac{9}{10}$

$36 \times 4 = 144$

$225 - 144 = 081$

$w = $ .... 0.9 **(4 marks)**

4

Do not write outside the box

2 In this identity, h and k are integer constants.

$$4(hx - 1) - 3(x + h) \equiv 5(x + k)$$

Work out the values of h and k.

$\equiv 4hx - 4 - 3x - 3h$

$= (4h - 3)x - (4 + 3h)$

$4h - 3 = 5$ | $4 + 3h = k$

$4h = 8$ | $4 + 6 = k$

$h = 2$ | $k = 10$

-2

$h =$ 2, $k =$ 10 *(4 marks)*

3 (a) $x : y = 3 : 2$

Write x in terms of y.

$\frac{x}{y} = \frac{3}{2}$

$3x = 2y$

$x = \frac{2}{3}y$

Or A

Answer $x = \frac{2}{3}y$ *(2 marks)* 1

3 (b) Use your answer to part (a) to simplify $2x + y : 3x - 2y$

$\frac{2}{3}y + y : \frac{3 \times 2}{3}y - 2y$

$\frac{5}{3}y : 2y - 2y$

$\frac{5}{3} : 0$

?

$2x + y = 3y + y$

$3x - 2y = 3\left(\frac{3y}{2}\right) - 2y$

$8 : 5$

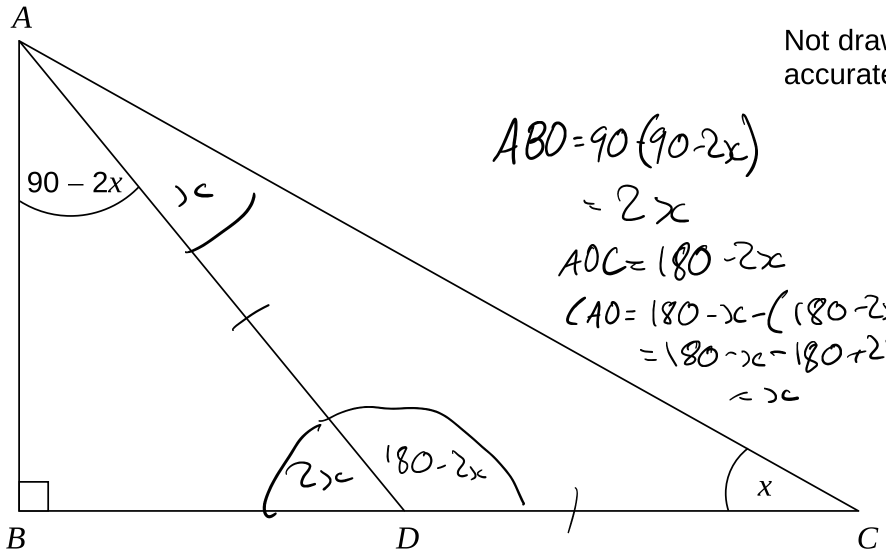
Answer .... *(2 marks)*

Do not write outside the box

4 ABC is a right-angled triangle.

Angle $ACB = x$

Angle $BAD = 90 - 2x$



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$ABD = 90 - (90 - 2x)$
$= 2x$
$ADC = 180 - 2x$
$CAD = 180 - x - (180 - 2x)$
$= 180 - x - 180 + 2x$
$= x$

Prove that ACD is an isosceles triangle. $CAD = ACD$, therefore isosceles

(3 marks)

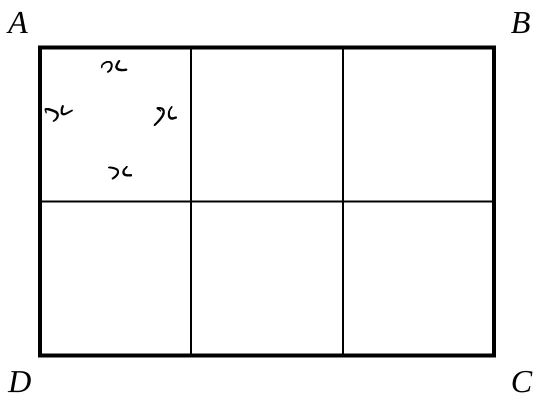
Turn over for the next question

11

Do not write outside the box

5 The rectangle $ABCD$ is divided into 6 identical squares.

The side of each square is x cm.



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When the perimeter and the area of $ABCD$ are given in cm and cm^2 respectively, they have the same numerical value.

Work out x.

$6x^2 = 10x$ (can just div by x, as $x > 0$)

$6x = 10$

$x = \frac{10}{6} = \frac{5}{3}$

$x =$ $1\frac{2}{3}$ *(4 marks)*

Do not write outside the box

6 $y = \dfrac{3x(2x^4 - 5x)}{x^2}$

$y = \dfrac{6x^5 - 15x^2}{x^2}$

Work out $\dfrac{dy}{dx}$

$= 6x^3 - 15$

$\dfrac{dy}{dx} = 18x^2$

$\dfrac{dy}{dx} =$ $18x^2$ .... *(3 marks)*

2

7 Given that $\dfrac{2}{h} - \dfrac{3}{k} = 4$

show that $h = \dfrac{2k}{4k+3}$, AKA re-arrange to set h as subject

$\dfrac{2 - 3h}{k} = 4h$

$2k - 3h = 4hk$

$2k = 4hk + 3h$

$h(4k+3) = 2k$

$h = 2k/4k+3$

(3 marks)

10

$\frac{dy}{dx}$

8 Work out the gradient of the curve $y = (3x - 4)(x + 2)$ at the point (2, 8)

$y = 3x^2 + 2x - 8$

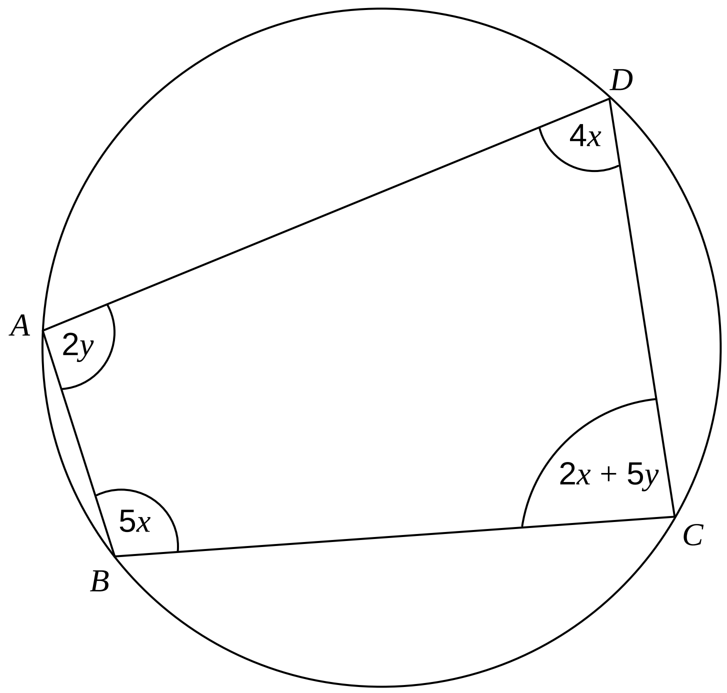
$\frac{dy}{dx} = 6x + 2$, $x = 2$, $\frac{dy}{dx} = 12 + 2 = 14$

Answer 14 *(3 marks)*

Do not write outside the box

9 $ABCD$ is a cyclic quadrilateral.

Not drawn accurately



Prove that $x = y$

$4x + 5y = 180$

$4x = 180 - 5y$

$x = \frac{180-5y}{4}$

$2y + 2x + 5y = 180$

$2x + 7y = 180$

$\frac{180-5y}{2} + 7y = 180$

$180 - 5y + 14y = 360$

$9y = 180$

$y = 20°$

$x = \frac{180-5y}{4}$

$= \frac{180-100}{4}$

$= \frac{80}{4}$

$x = 20°$

$x = y$

(4 marks)

7

Do not write outside the box

10 $y = 10 - 8x - x^3$ for all values of x.

Show that y is a decreasing function for all values x.

$\frac{dy}{dx} = -8 - 3x^2$

$-8 - 3x^2 > 0$

$-3x^2 > 8$

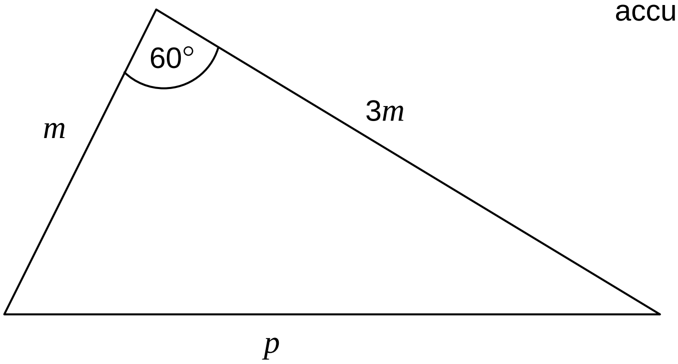
$3x^2 < -8$

$x^2 < -\frac{8}{3}$, cannot square root ∴ no solutions

∴ decreasing

(3 marks)

11



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Use the cosine rule to show that $p = m\sqrt{7}$

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

$p = \sqrt{m^2 + 9m^2 - 2 \times m \times 3m \times \cos 60}$

$= \sqrt{10m^2 + 3m^2}$

$= \sqrt{9m^2}$

$= m\sqrt{9}$?

(3 marks)

Do not write outside the box

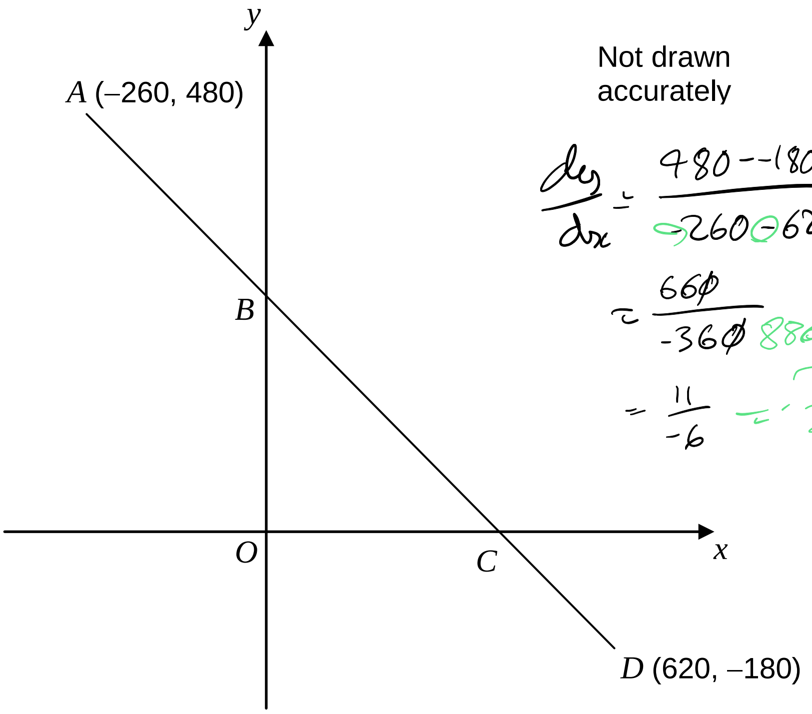
12 The diagram shows a straight line $ABCD$.

A is the point (–260, 480)

D is the point (620, –180)

The line cuts the y-axis at B and the x-axis at C.

$$\begin{array}{r} 11 \\ \times\ 260 \\ \hline 260 \\ +\ 2600 \\ \hline 2860 \end{array}$$



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$$\frac{dy}{dx} = \frac{480 - -180}{-260 - 620}$$

$$= \frac{660}{-360}\ 880$$

$$= \frac{11}{-6} \quad = -\frac{3}{4}$$

Work out the coordinates of B and C.

$$y = \frac{11x}{-6} + c$$

$$480 = \frac{11 \times -260}{-6} + c$$

$$480 = 2860 + c$$

??

B = (.........., ...) C = (.........., ...) *(6 marks)*

12

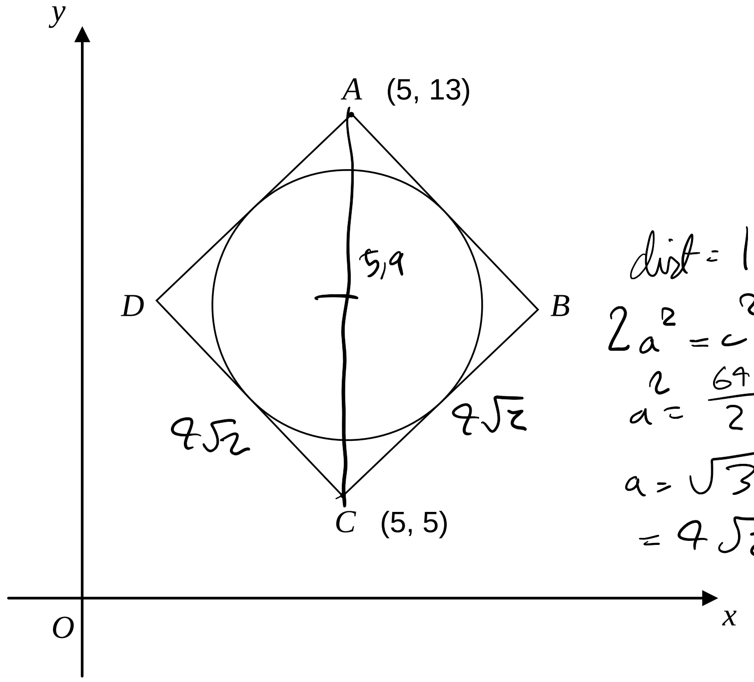
Turn over ▶

13 $ABCD$ is a square.

A is the point (5, 13)

C is the point (5, 5)

The circle touches the sides of the square.



dist $= 13 - 5 = 8$

$2a^2 = c^2$

$a^2 = \frac{64}{2}$

$a = \sqrt{32}$

$= 4\sqrt{2}$

$a = 4\sqrt{2}$

$r = 2\sqrt{2}$

Work out the equation of the circle.

Answer $(x-5)^2 + (y-9)^2 = 8$ **(5 marks)**

Do not write outside the box

14 (a) Show that $(x-2)$ is a factor of $x^3 + 8x^2 + x - 42$

$f(x) = x^3 + 8x^2 + x - 42$

$f(2) = 8 + 32 + 2 - 42$

$= 42 - 42$

$= 0$

(2 marks)

14 (b) Hence, or otherwise, work out **all** solutions of $x^3 + 8x^2 + x - 42 = 0$

$42 \div 2 = 21$

$x^3 \div x = x^2$

$= (x-2)(x^2 + kx + 21)$

$= x^3 + kx^2 + 21x - 2x^2 - 2kx - 42$

$= x^3 + (k-2)x^2 + (21-2k)x - 42$

$k - 2 = 8$

$k = 10$

OR

$21 - 2k = 1$

$-2k = -20$

$k = 10$

$= (x-2)(x^2 + 10x + 21)$

$= (x-2)(x+7)(x+3)$

Answer $2, -7, -3$ *(4 marks)*

11

15 Rationalise the denominator and simplify $\dfrac{5\sqrt{5}-2}{2\sqrt{5}-3}$

$= \dfrac{5\sqrt{5}-2}{-3+2\sqrt{5}} \times \dfrac{-3-2\sqrt{5}}{-3-2\sqrt{5}} = \dfrac{-15\sqrt{5}-50+6+9\sqrt{5}}{9-20}$

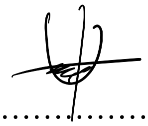
$= \dfrac{-11\sqrt{5}-44}{-11}$

$= \dfrac{11\sqrt{5}+44}{11} = \sqrt{5}+4 = 4+\sqrt{5}$

Answer $4+\sqrt{5}$ *(4 marks)*

Do not write outside the box

16 Prove that, for **all** values of x, $2x^2 - 8x + 9 > 0$



$2x^2 - 8x + 9 < 0$

$2(x^2 - 4x) < -9$

$2((x-2)^2 - 4) < -9$

$2(x-2)^2 - 8 < -9$

$2(x-2)^2 < -1$ no real roots

$(x-2)^2 < -\frac{1}{2}$, is negative, so no possible solutions where $x = 0$,

so all solutions are > 0

(5 marks)

Turn over for the next question

9

17 $\begin{pmatrix} 2 & a \\ 1 & -3 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$

Work out **all** possible pairs of values of a and b.

$\begin{pmatrix} 2a+ab \\ a-3b \end{pmatrix} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$

$a-3b=2$

$-3b=2-a$

$3b=a-2$

$b=\frac{a-2}{3}$

$2a+ab=-1$

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

$6a+a^2-2a=-3$

$a^2+4a+3=0$

$(a+3)(a+1)=0$

$a=-3,\ -1$

$b=\frac{a-2}{3}$

$a=-3$

$b=\frac{-3-2}{3}$

$=\frac{-5}{3}$

$=-1\frac{2}{3}$

$a=-1$

$b=\frac{-1-2}{3}$

$=\frac{-3}{3}$

$=-1$

Answer $a=-3,\ b=-1\frac{2}{3}$ OR $a=-1,\ b=-1$ (6 marks)

END OF QUESTIONS

6

PP4/8360/1