Surname	
Other Names	
Candidate Signature	

Centre Number						Candidate Number				

Examiner Comments	

Total Marks

MATHEMATICS

AS LEVEL QUESTION COMPILATION

CM

Questions on: Indices, Surds, Quadratics, Simultaneous Equations and Inequalities

Instructions to candidates:

• In the boxes above, write your centre number, candidate number, your surname, other names and signature.

• Answer ALL of the questions.

• You must write your answer for each question in the spaces provided.

• You may use a calculator.

Information to candidates:

• Full marks may only be obtained for answers to ALL of the questions.

• The marks for individual questions and parts of the questions are shown in round brackets.

• There are 17 questions in this question paper. The total mark for this paper is 92.

Advice to candidates:

• You should ensure your answers to parts of the question are clearly labelled.

• You should show sufficient working to make your workings clear to the Examiner.

• Answers without working may not gain full credit.

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1 Express $\dfrac{x^2 + 4\sqrt{x}}{x}$ in the form $x^p + 4x^q$, where p and q are constants to be found. **(2)**

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Question 1 continued

TOTAL 2 MARKS

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2 (a) Express 8^{2x+1} in the form 2^y, giving y in terms of x. **(2)**

(b) Hence solve the equation

$$8^{2x+1} = 4^x$$

(3)

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Question 2 continued

TOTAL 5 MARKS

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3 (a) Simplify fully

$$\frac{\left(2x^{\frac{1}{2}}\right)^3}{4x^2}$$

giving your answer in the form ax^p, where a and p are constants to be determined. **(2)**

(b) Hence solve the equation

$$\frac{\left(2x^{\frac{1}{2}}\right)^3}{4x^2} = 8$$

(2)

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Question 3 continued

TOTAL 4 MARKS

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4 Using the substitution $y = 3^x$, or otherwise, solve the equation

$$3^{2x+2} - 244(3^x) + 27 = 0$$

(5)

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Question 4 continued

TOTAL 5 MARKS

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5 Express

(a) $(1-\sqrt{8})^2$ **(3)**

(b) $\dfrac{2-\sqrt{2}}{1+\sqrt{2}}$ **(4)**

giving your answers in the form $a+b\sqrt{2}$, where a and b are integers to be determined.

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Question 5 continued

TOTAL 7 MARKS

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6

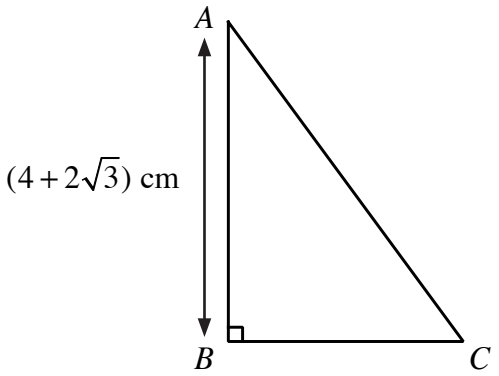

Figure 1

Figure 1 above shows a right-angled triangle ABC.

$AB = (4+2\sqrt{3})$ cm and the area of the triangle ABC is $(8+5\sqrt{3})$ cm^2.

Showing all of your working clearly, find the exact length of the hypotenuse of the triangle.

Give your answer in the form $(a+b\sqrt{3})^{\frac{1}{2}}$, where a and b are constants. **(6)**

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Question 6 continued

TOTAL 6 MARKS

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7 Solve the equation

$$a^{\frac{1}{2}} + \sqrt{4a} = 3$$

(3)

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Question 7 continued

TOTAL 3 MARKS

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8 Solve the simultaneous equations

$$x - 2y = 1$$
$$x^2 + y^2 = 29$$

(6)

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Question 8 continued

TOTAL 6 MARKS

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9 Solve the simultaneous equations

$$x^2 + 4y^2 = 1$$
$$2y = x + 1$$

(4)

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Question 9 continued

TOTAL 4 MARKS

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10 Find the **set** of values of x that satisfy

$$4x^2 - 11x - 3 > 0$$ **(5)**

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Question 10 continued

TOTAL 5 MARKS

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11 (a) Solve $5 - 4x > 1$. **(2)**

(b) Find the range of values of x that satisfy

$$x^2 + 5x + 6 > 0$$ **(4)**

(c) Hence write down the set of values of x that satisfy **both**

$$5 - 4x > 1 \quad \textbf{and} \quad x^2 + 5x + 6 > 0$$ **(1)**

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Question 11 continued

TOTAL 7 MARKS

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12 Find the set of values of x that satisfy

$$\frac{3+x}{x} > 3$$

(4)

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Question 12 continued

TOTAL 4 MARKS

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13 The curve C has the equation $y = \mathrm{f}(x)$, where

$$\mathrm{f}(x) = x^2 + 2x + 5$$

(a) Express $\mathrm{f}(x)$ in the form $(x + a)^2 + b$, where a and b are constants to be found. **(2)**

(b) Calculate the discriminant of $\mathrm{f}(x)$. **(2)**

(c) Sketch the curve C. **(3)**

On your sketch, show clearly the coordinates of any points where the curve crosses or meets the coordinate axes.

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Question 13 continued

TOTAL 7 MARKS

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14 (a) Express $5x^2 - 15x + 6$ in the form $a(x + b)^2 + c$, where a, b and c are constants to be found. **(3)**

(b) Hence,

(i) write down the coordinates of the turning point on the curve $y = 5x^2 - 15x + 6$, **(1)**

(ii) solve the equation $5x^2 - 15x + 6 = 0$, giving your answers as exact values. **(3)**

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Question 14 continued

TOTAL 7 MARKS

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15 Consider the equation

$$kx^2 + (3 - k)x - 4 = 0$$

where k is a constant.

(a) Given that the equation has two equal real roots, find possible values of k. **(3)**

(b) Given that the equation has two distinct real roots, find the set of possible values of k. **(3)**

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Question 15 continued

TOTAL 6 MARKS

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16 The equation

$$\frac{x^2+2x+1}{x^2+4}=k, \quad \text{where } k \text{ is a constant}$$

has no real roots.

(a) Show that $4k^2 - 5k > 0$. **(5)**

(b) Hence, find the set of possible values of k. **(3)**

The curve C has the equation

$$y = x^2 - 2x + 7$$

(c) Using your answer to part (b), write down the number of intersections C has with the x axis. **(1)**

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Question 16 continued

TOTAL 9 MARKS

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17

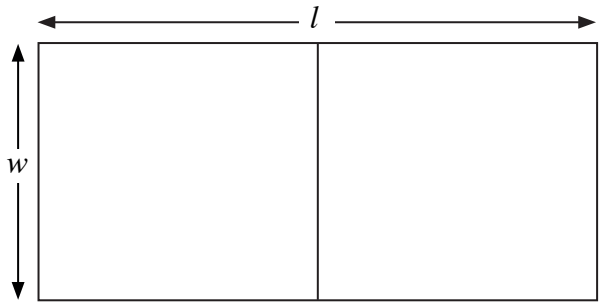

Figure 2

A rectangular barn is to be made out of fence in an open field. The fence must enclose the barn and also split the barn in half, in order to separate the cattle from the chicken. The barn has length l metres and width w metres. Figure 2 above shows an outline of the barn.

Given that there is only 270 metres of fence in total,

(a) show that $w = 90 - \frac{2}{3}l$. **(2)**

(b) Hence, find an expression for the area of the barn, A m^2, in terms of l. **(1)**

(c) By completing the square, or otherwise, find

(i) the maximum area of the barn **(3)**

(ii) the length and width of the barn for which the area is maximum. **(2)**

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Question 17 continued

TOTAL 8 MARKS