WJEC LEVEL 2 ADDITIONAL MATHEMATICS

MATHS



EXAM QUESTION PACK

LEVEL 2 CERTIFICATE 9550 PAPERS

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Surname	Centre Number	Candidate Number
Other Names		0

WJEC LEVEL 2 CERTIFICATE

9550/01

S16-9550-01

ADDITIONAL MATHEMATICS

A.M. TUESDAY, 21 June 2016

2 hours 30 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**8**	
2.	**5**	
3.	**4**	
4.	**5**	
5.	**8**	
6.	**7**	
7.	**10**	
8.	**7**	
9.	**5**	
10.	**8**	
11.	**5**	
12.	**11**	
13.	**6**	
14.	**4**	
15.	**7**	
Total	**100**	

ADDITIONAL MATERIALS

A calculator will be required for this paper.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

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

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question **5**.

When you are asked to show your working you must include enough intermediate steps to show that a calculator has not been used.

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1. *(a)* (i) Factorise $21x^2 - 8x - 4$. [2]

(ii) **Hence** solve the equation $21x^2 - 8x - 4 = 0$. [2]

(b) (i) Use the method of completing the square to find the least value of

$$x^2 + 12x + 49.$$ [3]

Least value of $x^2 + 12x + 49$ is .....

(ii) What is the value of x when $x^2 + 12x + 49$ has its least value? [1]

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2. Find $\frac{dy}{dx}$ for each of the following.

(a) $y = 9x^4 + 4x^2 - 3$ [3]

(b) $y = x^{-8}$ [1]

(c) $y = x^{\frac{3}{4}}$ [1]

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3. Prove that $\frac{3x}{2} - \frac{x-6}{5} + \frac{2x+3}{7} \equiv \frac{111x+114}{70}$. [4]

4. Given that $y = x^2 + 3x$, find $\frac{dy}{dx}$ from first principles. [5]

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5. *You will be assessed on the quality of your written communication in this question.*

A cylindrical package is made with a radius of 4 cm and a height of 18 cm.
The net of the cylinder is drawn on a thin rectangular piece of card as shown in the sketch below.

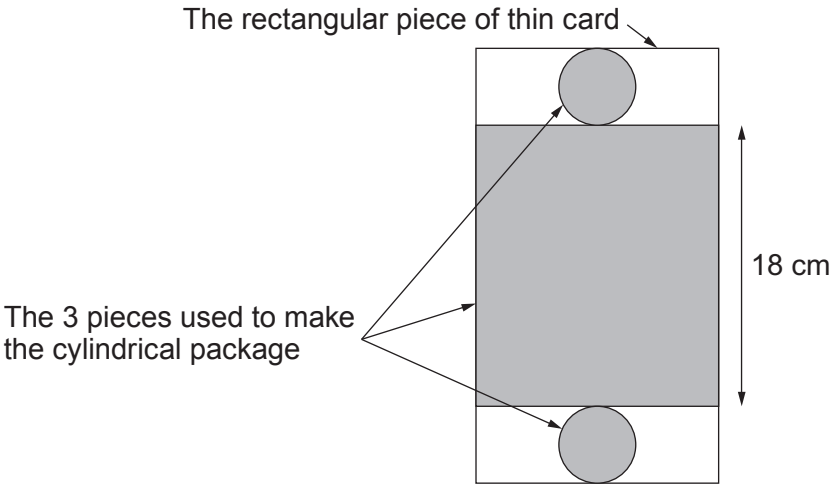


Diagram not drawn to scale

The circular ends of the package touch the rectangular piece of the net and the edges of the thin card exactly.

Calculate the area of the thin rectangular piece of card that is wasted in making this cylindrical package.
You must show all your working. [8]

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6. *(a)* Simplify $\frac{3}{5+\sqrt{2}}$, leaving your answer in surd form.

Do not use a calculator to answer this question.
You **must** show all your working. [3]

(b) Showing all your working, simplify each of the following.

(i) $\frac{x^{-\frac{2}{5}} \times x^{\frac{17}{5}}}{x^{\frac{1}{2}}}$ [2]

(ii) $\frac{8x^{\frac{1}{9}} + x^{\frac{2}{9}}}{x^{\frac{2}{9}}}$ [2]

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7. The coordinates of the points *F* and *G* are (–2, 14) and (4, 6) respectively.

(a) Calculate the length of the line *FG*. [2]

(b) Find the gradient of the straight line that passes through points *F* and *G*. [2]

(c) Find the equation of the straight line that
- passes through the mid-point of the line *FG*, and
- is perpendicular to the line *FG*.

Express your answer in the form $ax + by + c = 0$, where a, b and c are integers. [6]

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8. Find the coordinates and nature of each of the stationary points on the curve $y = x^3 - 3x^2 + 11$. You must show all your working. [7]

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9. Do **not** use a calculator to answer any part of this question.
You must show all your working.

(a) Simplify $\frac{\cos 45^\circ}{\sin 45^\circ}$. [1]

(b) Express $\frac{\sin 30^\circ}{\tan 60^\circ}$ in the form $\frac{\sqrt{a}}{b}$, where a and b are integers to be found. [2]

(c) $(\sin 60^\circ)^2$ is written $\sin^2 60^\circ$.
Simplify $\sin^2 60^\circ + \tan^2 45^\circ$. [2]

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10. *(a)* Find the remainder when $x^3 + 6x^2 - x - 30$ is divided by $x - 4$. [2]

(b) (i) Show that $x - 2$ is a factor of $x^3 + 6x^2 - x - 30$. [2]

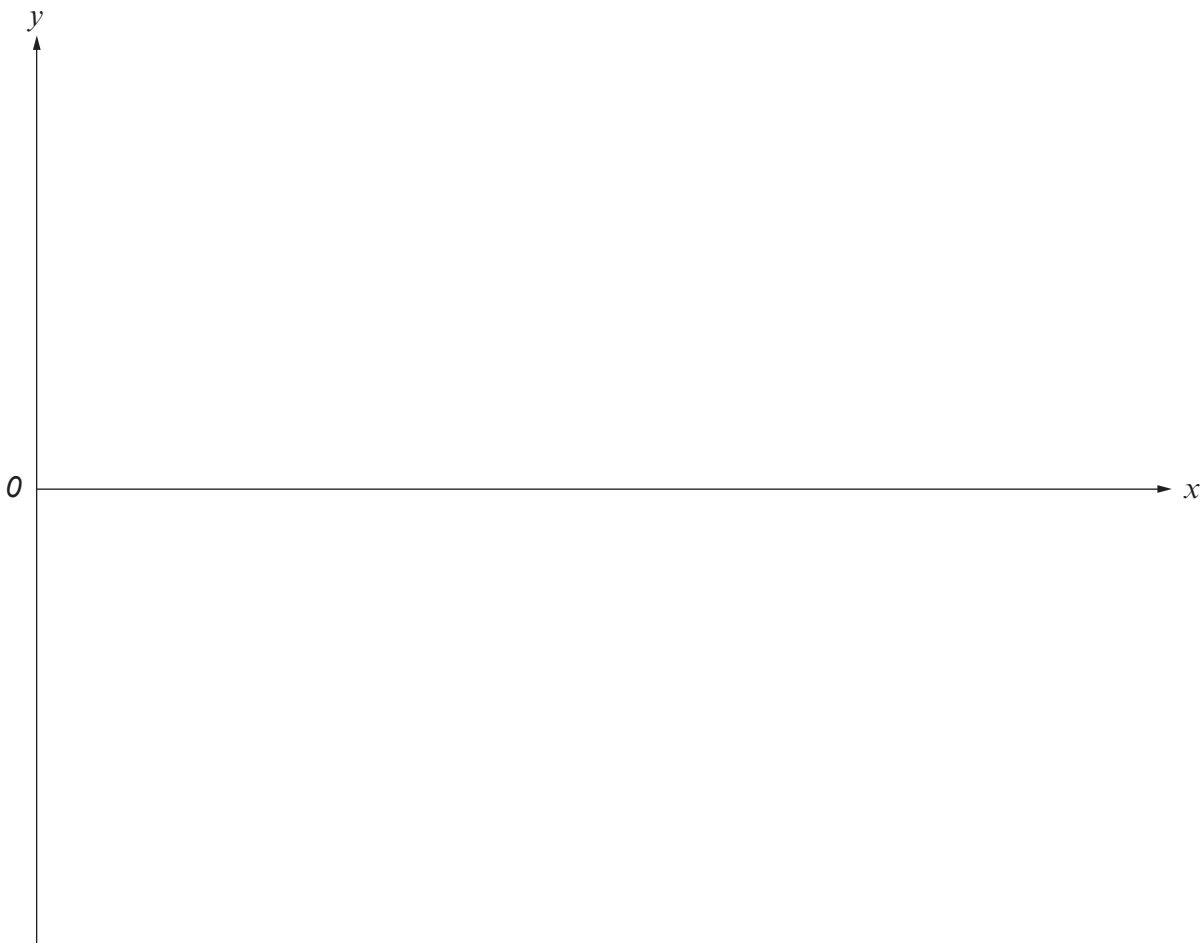
(ii) **Hence** factorise $x^3 + 6x^2 - x - 30$. [4]

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11. *(a)* Use the axes below to sketch the graph of $y = -3\cos x + 5$ for values of x from 0° to 360°. You must label any important values on the axes. [3]



(b) State the maximum and minimum values of $y = -3\cos x + 5$. [2]

Maximum value .....

Minimum value .....

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12. *(a)* Find $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$ when $y = 3x^7 + 4x$. [2]

(b) Find $\int \left(4x^3 + 2x + 4x^{-2}\right)\mathrm{d}x$. [4]

(c) Showing all your working, evaluate $\int_2^3 (8x + 2)\mathrm{d}x$. [5]

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13. Find the equation of the tangent to the curve $y = 3x^2 + 6$ at the point where $x = 3$. [6]

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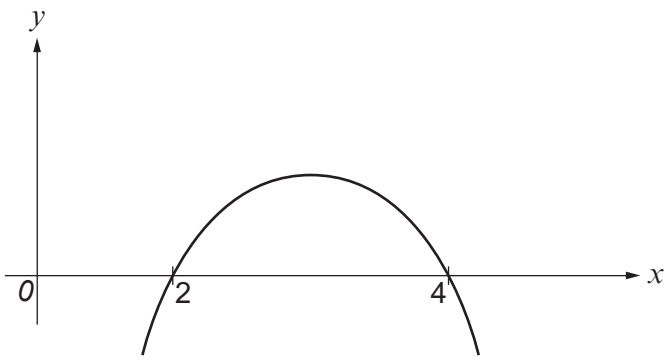
14. Find, using an algebraic method, the coordinates of the points of intersection of the curve $y = x^2 - 6x + 14$ and the straight line $x + y = 10$.
You must show all your working. [4]

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15. Millie has sketched the curve $y = -x^2 + 6x - 8$.



(a) Millie states that the points (2, 0) and (4, 0) lie on the curve $y = -x^2 + 6x - 8$.
Show that Millie is correct. [2]

(b) Calculate the area of the region bounded by the curve $y = -x^2 + 6x - 8$ and the x-axis.
You must show all your working. [5]

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WJEC LEVEL 2 CERTIFICATE

9550/01

S15-9550-01

ADDITIONAL MATHEMATICS

A.M. MONDAY, 22 June 2015

2 hours 30 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**3**	
3.	**5**	
4.	**11**	
5.	**10**	
6.	**6**	
7.	**8**	
8.	**5**	
9.	**10**	
10.	**5**	
11.	**7**	
12.	**5**	
13.	**6**	
14.	**7**	
15.	**3**	
16.	**1**	
17.	**4**	
Total	**100**	

ADDITIONAL MATERIALS

A calculator will be required for this paper.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

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

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

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When you are asked to show your working you must include enough intermediate steps to show that a calculator has not been used.

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1. Factorise $6x^2 - 11x - 10$ and **hence** solve the equation $6x^2 - 11x - 10 = 0$. [4]

2. The expression $x^2 + 14x + 9$ has a minimum value.

(a) By **completing the square**, find the value of x when $x^2 + 14x + 9$ has its minimum value. You must show your working. [2]

(b) Write down the minimum value of $x^2 + 14x + 9$. [1]

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3. Find $\frac{dy}{dx}$ for **each** of the following.

(a) $y = 5x^8 - 6x - 9$ [3]

(b) $y = x^{-8}$ [1]

(c) $y = x^{\frac{2}{5}}$ [1]

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4. The coordinates of the points *D* and *E* are (6, 22) and (–4, 14) respectively.

(a) Calculate the length of the line *DE*.
Express your answer as a surd in its simplified form $n\sqrt{m}$. [3]

(b) Find the equation of the straight line perpendicular to *DE* that passes through the mid-point of *DE*.
Express your answer in the form $ax + by + c = 0$, where a, b and c are integers. [8]

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5. *You will be assessed on the quality of your written communication in this question.*

The length of a solid rectangular block is x cm.
The width of the block is 4 cm less than its length.
The height is 1 cm more than the length.
The total surface area of the rectangular block is 124 cm^2.

By showing that $x^2 - 2x = 22$, find the length of the rectangular block, giving your answer in its simplest surd form.
You must use an algebraic method and show all your working. [10]

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6. Find the coordinates of the points of intersection of the curve $y = x^2 + 6x - 5$ and the straight line $y = 2x + 1$.
Use an algebraic method and give your answers correct to 2 decimal places. [6]

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7. *(a)* Find the remainder when $3x^3 - 2x^2 + 5x - 1$ is divided by $x + 2$. [2]

(b) (i) Show that $x - 2$ is a factor of $x^3 + 8x^2 + x - 42$. [2]

(ii) **Hence** factorise $x^3 + 8x^2 + x - 42$. [4]

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8. *(a)* Find $\frac{d^2y}{dx^2}$ when $y = 2x^{10}$. [2]

(b) Given the following facts, find the values of a, b and c.

- $y = ax^5 + bx + c$
- $\frac{d^2y}{dx^2} = 20x^3$
- when $x = 0$, $y = 5$
- when $x = 1$, $y = 9$ [3]

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9. *(a)* Find $\int 21x^6 - 3x^2 - \frac{1}{x^2} + 6 \, dx$. [5]

(b) Showing all your working, evaluate $\int_2^5 6x^2 + 4x \, dx$. [5]

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10. Do not use a calculator to answer this question.
All working must be shown.

(a) Use fractions and surds to show that $(\sin 30°)^2 + (\cos 30°)^2 = 1$.
You must show all your calculations. [2]

(b) Use fractions and surds to evaluate $5\tan 45° + 2\sin 60° + \tan 60°$.
You must show all your calculations and simplify your answer. [3]

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11. A right square-based pyramid has a perpendicular height of 12 cm.
The area of the square base of the pyramid is 64 cm^2.

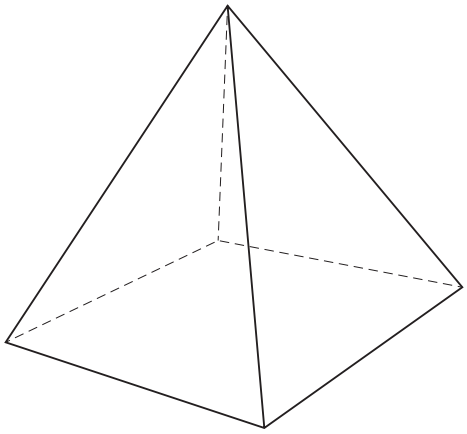


Diagram not drawn to scale

Calculate the angle between the diagonal of the base and one of the sloping edges of the pyramid. [7]

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12. Given that $y = x^2 - 3x$, find $\frac{dy}{dx}$ from first principles. [5]

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13. Find the equation of the tangent to the curve $y = 2x^2 - 8x$ at the point where $x = 3$.
Give your answer in the form $ax + by + c = 0$. [6]

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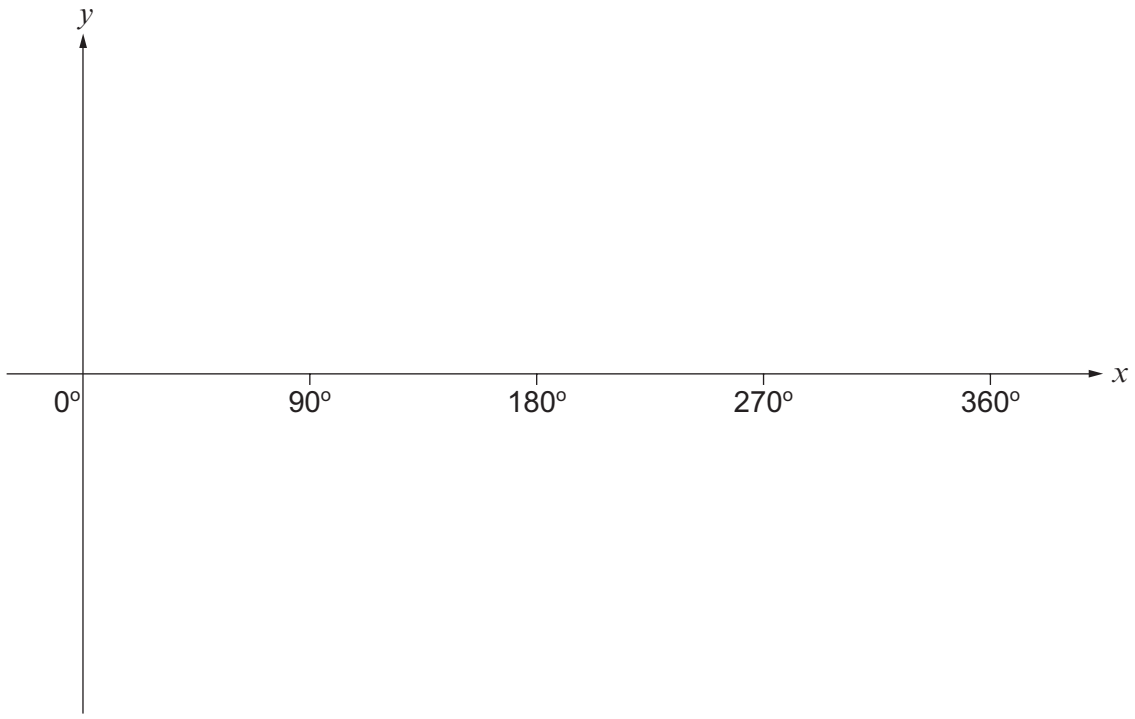
14. Find the coordinates and the nature of each of the stationary points on the curve $y = 2x^3 - 24x + 13$.
You must show all your working. [7]

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15. *(a)* On the axes below, sketch the graph of $y = 5\cos x$ for values of x from 0° to 360°. [2]



(b) Find all the solutions of the equation $5\cos x = 0$ for values of x from 0° to 360°. [1]

.....

.....

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16. Without using a calculator, find the value of $(12^{\frac{1}{2}})^4$.
Show all your working. [1]

.....

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17. Showing all your working, simplify each of the following.

(a) $\dfrac{5x^{\frac{5}{8}} \times 4x^{\frac{3}{8}}}{x^{\frac{2}{3}}}$ [2]

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(b) $\dfrac{6x^{\frac{1}{4}} + 3x^{\frac{3}{4}}}{3x^{\frac{1}{4}}}$ [2]

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Surname	Centre Number	Candidate Number
Other Names		0

WJEC LEVEL 2 CERTIFICATE

9550/01

ADDITIONAL MATHEMATICS

A.M. MONDAY, 23 June 2014

2 hours 30 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

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

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

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When you are asked to show your working you must include enough intermediate steps to show that a calculator has not been used.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**7**	
3.	**8**	
4.	**4**	
5.	**5**	
6.	**7**	
7.	**8**	
8.	**7**	
9.	**7**	
10.	**8**	
11.	**7**	
12.	**11**	
13.	**5**	
14.	**4**	
15.	**7**	
Total	**100**	

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1. Find $\frac{dy}{dx}$ for each of the following.

(a) $y = 6x^5 + 7x - 2$ [3]

(b) $y = \frac{1}{x^6}$ [1]

(c) $y = x^{\frac{5}{2}}$ [1]

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2. *(a)* Factorise $15x^2 - 14x - 8$. [4]

Hence solve the equation $15x^2 - 14x - 8 = 0$.

(b) Use the method of completing the square to find the least value of $x^2 + 10x + 3$. [3]

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3. *You will be assessed on the quality of your written communication in this question.*

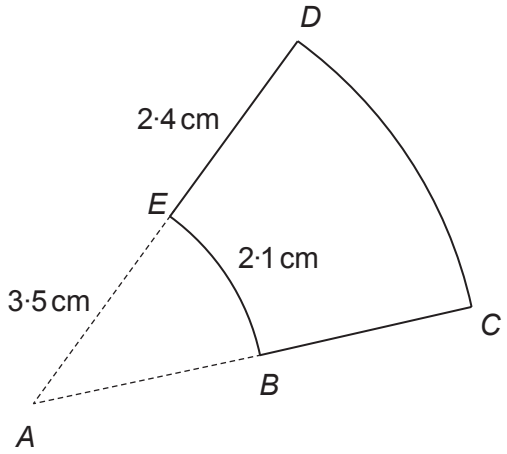


Diagram not drawn to scale

ADC is a sector of a circle, centre *A*.
AEB is a sector of another circle, also with centre *A*.
Calculate the perimeter of the shape *BCDE*.
You must show all your working. [8]

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4. Prove that $\frac{2x}{3} - \frac{x-7}{4} + \frac{3x+1}{5} \equiv \frac{61x+117}{60}$. [4]

5. Given that $y = x^2 + 8x$, find $\frac{dy}{dx}$ from first principles. [5]

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6. *(a)* Simplify $\frac{5}{3+\sqrt{2}}$, leaving your answer in surd form.

Do not use a calculator to answer this question.
You must show all your working. [3]

(b) Showing all your working, simplify each of the following.

(i) $\frac{3x^{-\frac{7}{4}} \times 2x^{\frac{17}{4}}}{x^{\frac{3}{2}}}$ [2]

(ii) $\frac{28x^{\frac{1}{7}} + 7x^{\frac{2}{7}}}{7x^{\frac{1}{7}}}$ [2]

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7. The coordinates of the points *D* and *E* are (–1, 13) and (5, 5) respectively.

(a) Calculate the length of the line *DE*. [2]

(b) Find the gradient of the straight line that passes through points *D* and *E*. [2]

(c) Find the equation of the straight line that passes through points *D* and *E*.
Express your answer in the form $ax + by = c$, where a, b and c are whole numbers. [4]

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8. Find the coordinates and nature of each of the stationary points on the curve $y = 4x^3 - 12x + 7$. You must show all your working. [7]

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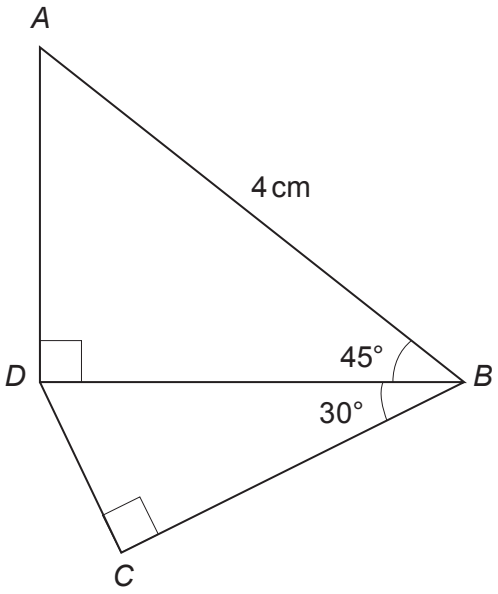


Diagram not drawn to scale

Calculate the length of *BC*.
Give your answer in surd form.
Do not use your calculator to answer this question.
You must show all your working. [7]

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10. *(a)* Find the remainder when $x^3 + 5x^2 + 2x - 8$ is divided by $x - 3$. [2]

(b) (i) Show that $x - 1$ is a factor of $x^3 + 5x^2 + 2x - 8$. [2]

(ii) **Hence** factorise $x^3 + 5x^2 + 2x - 8$. [4]

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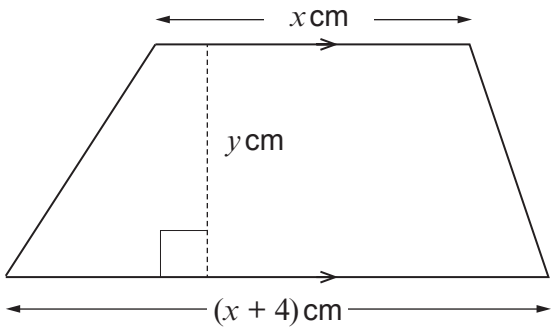


Diagram not drawn to scale

The area of the trapezium in the diagram is 28 cm^2.
A rectangle of length $(x + y)$ cm and width y cm has an area of 43 cm^2.

(a) Show that $xy = 28 - 2y$ and $xy = 43 - y^2$. [3]

(b) Hence write down a quadratic equation in terms of y to calculate the lengths of the parallel sides of the trapezium.
You must use an algebraic method, **not** a trial and improvement method. [4]

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12. *(a)* Find $\frac{d^2y}{dx^2}$ when $y = 2x^6 + 3x$. [2]

(b) Find $\int 3x^4 + 6x + 8x^{-2}\,dx$. [4]

(c) Showing all your working, evaluate $\int_2^5 4x + 1\,dx$. [5]

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13. The following equations represent straight lines.

$$2x + 4y = 7$$
$$2x + 5y = 7$$
$$x + 2y = 7$$
$$4x - 2y = 7$$
$$2x - 4y = 7$$

(a) Which equations represent lines that are parallel?
You must explain how you know that these lines are parallel. [2]

(b) Write down any two of the equations that represent lines that are perpendicular.
You must explain how you know that these lines are perpendicular. [3]

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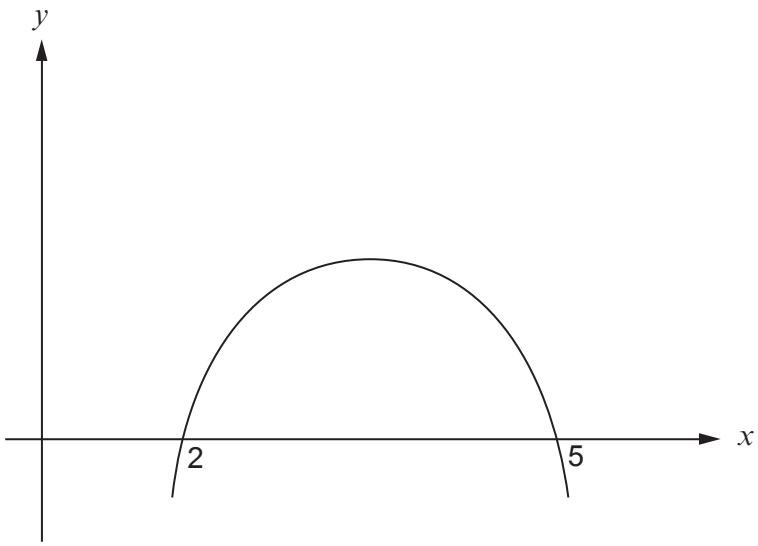
14. Find the coordinates of the points of intersection of the curve $y = x^2 - 7x + 12$ and the straight line $x + y = 4$. [4]

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15. Dan has sketched the curve $y = -x^2 + 7x - 10$.



He has indicated two points on the curve, (2, 0) and (5, 0).

(a) Show that these points lie on this curve. [2]

(b) Showing all your working, calculate the area of the region bounded by the curve $y = -x^2 + 7x - 10$ and the x-axis. [5]

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Surname	Centre Number	Candidate Number
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9550/01

ADDITIONAL MATHEMATICS

A.M. MONDAY, 24 June 2013

$2\frac{1}{2}$ hours

ADDITIONAL MATERIALS

A calculator will be required for this paper.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

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

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question **4***(b)*.

When you are asked to show your working you must include enough intermediate steps to show that a calculator has not been used.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	**5**	
2	**7**	
3	**7**	
4	**13**	
5	**5**	
6	**6**	
7	**11**	
8	**8**	
9	**7**	
10	**5**	
11	**5**	
12	**7**	
13	**6**	
14	**5**	
15	**3**	
TOTAL MARK		

9550 010001

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1. Find $\frac{dy}{dx}$ for **each** of the following.

(a) $y = 7x^5 - 5x - 2$

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[3]

(b) $y = x^{-6}$

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[1]

(c) $y = x^{\frac{3}{5}}$

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[1]

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2. *(a)* Factorise $8x^2 - 10x - 3$.

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Hence solve the equation $8x^2 - 10x - 3 = 0$.

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[4]

(b) Use the method of completing the square to find the least value of $x^2 + 12x + 5$.

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[3]

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3. Consider two squares of different sizes.
The perimeter of the larger square is 12 cm greater than the perimeter of the smaller square.
The area of the larger square is 30 cm^2 greater than the area of the smaller square.

Calculate the dimensions of each square.
You must use an algebraic method, **not** a trial and improvement method.

[7]

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4. The coordinates of the points A and B are (3, 9) and (–5, 7) respectively.

(a) Calculate the length of the line AB.
Express your answer as a surd in its simplified form $a\sqrt{b}$.

[3]

(b) *You will be assessed on the quality of your written communication in this part of the question.*
Find the equation of the straight line perpendicular to AB that passes through the midpoint of AB. Express your answer in the form $y = mx + c$.

[10]

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5. Solve $(3x - 1)(3x + 1) - (1 - x)(1 + x) + 3(1 - 2x)(1 + 2x) = -199$.

[5]

6. Find the coordinates of the points of intersection of the curve with equation $y = x^2 + 2x - 3$ and the straight line with equation $y = x + 1$.
Give your answers correct to 2 decimal places.

[6]

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7. *(a)* Find $\frac{d^2y}{dx^2}$ when $y = 6x^9$.

[2]

(b) Find $\int 3x^4 + \frac{1}{x^3} + 4 \, dx$.

[4]

(c) Showing all your working, evaluate $\int_2^3 6x^5 + 5 \, dx$.

[5]

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8. *(a)* Find the remainder when $7x^3 - 4x^2 + x - 2$ is divided by $x - 2$.

[2]

(b) (i) Show that $x + 3$ is a factor of $x^3 + 4x^2 - 17x - 60$.

[2]

(ii) **Hence**, factorise $x^3 + 4x^2 - 17x - 60$.

[4]

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9. A pyramid stands on a horizontal surface.
The base of the pyramid is in the shape of a kite.
The base of the pyramid is shown below.

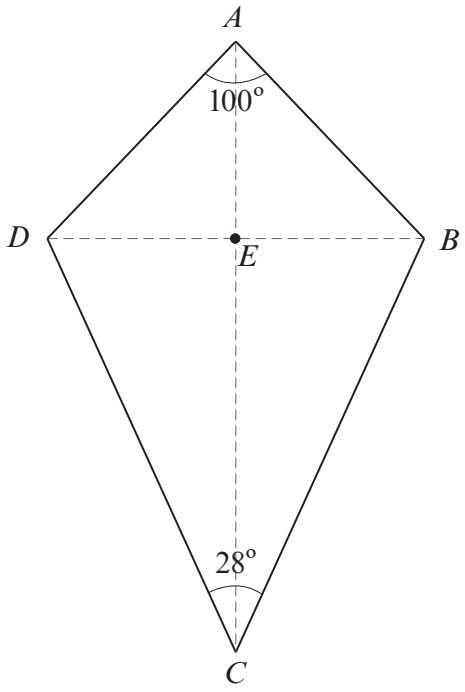


Diagram not drawn to scale

The apex (top vertex) of the pyramid is vertically above E.
The vertical height of the pyramid is 17·3 cm.
The length of BD is 12·6 cm and the angles are as shown on the diagram.
Use the line EC to calculate the angle of elevation of the apex of the pyramid from the point C.

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[7]

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10. Given that $y = x^2 - 4x$, find $\frac{dy}{dx}$ from first principles.

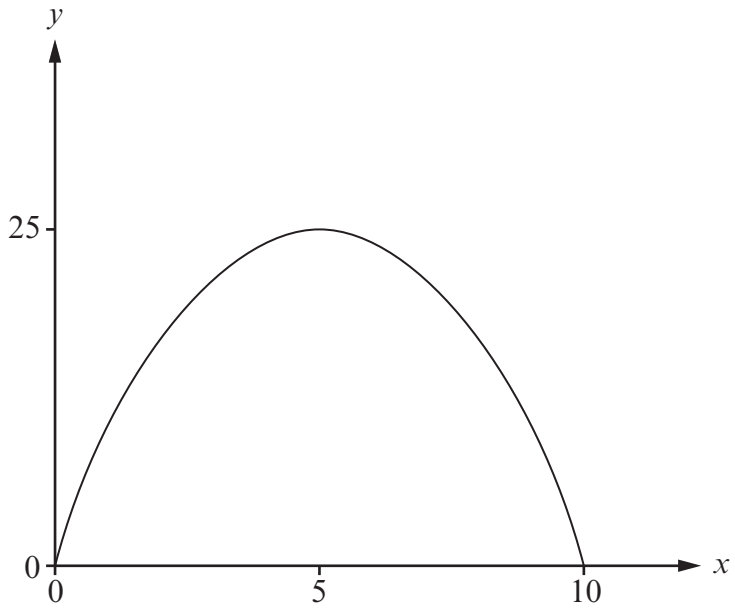
[5]

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11. The diagram shows the curve $y = 10x - x^2$.



Showing all your working, calculate the area of the region bounded by the curve $y = 10x - x^2$ and the x-axis.

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[5]

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12. Find the coordinates and the nature of each of the stationary points on the curve $y = 3x^3 - 36x + 11$. You must show all your working.

[7]

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13. Find the equation of the tangent to the curve $y = 3x^2 + 4x$ at the point where $x = 2$.
Give your answer in the form $ax + by + c = 0$.

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[6]

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Examiner only

14. *(a)* Showing all your working, find the value of $(50^{\frac{1}{2}})^4$.

.....

.....

.....

[1]

(b) Showing all your working, simplify each of the following.

(i) $\dfrac{3x^{-\frac{5}{4}} \times 4x^{\frac{7}{4}}}{x^{\frac{3}{2}}}$

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[2]

(ii) $\dfrac{12x^{\frac{1}{6}} + 4x^{\frac{2}{6}}}{4x^{\frac{1}{6}}}$

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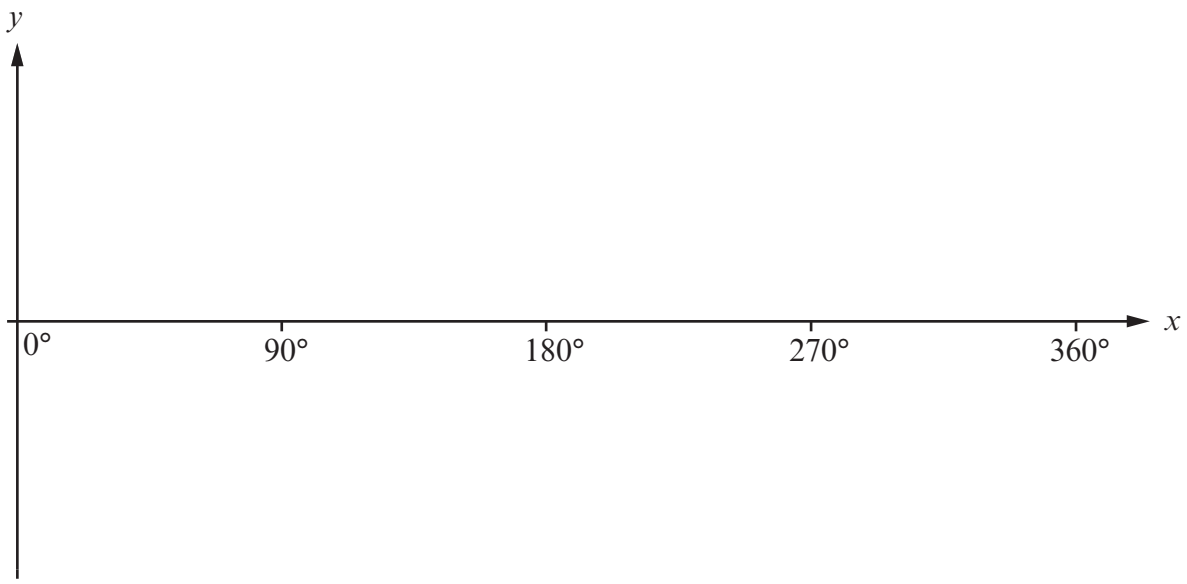
[2]

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15. *(a)* On the axes below, sketch the graph of $y = 4\sin x$ for values of x from 0° to 360°.



[2]

(b) Find all the solutions of the equation $4\sin x = 0$ for values of x from 0° to 360°.

.....

.....

[1]

END OF PAPER

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MARKING SCHEME

LEVEL 2 CERTIFICATE IN ADDITIONAL MATHEMATICS

SUMMER 2013

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2013 examination in LEVEL 2 CERTIFICATE IN ADDITIONAL MATHEMATICS. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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LEVEL 2 CERTIFICATE IN ADDITIONAL MATHEMATICS
Mark Scheme - Summer 2013

Q	Additional Mathematics Summer 2013	Marks	Final
1	(a) $35x^4$ - 5 (+0)	B3	B1 for $35x^4$ (not $5\times7x^4$), B1 for -5, and B1 for +0 (or blank) provided at least one other mark awarded.
	(b) $-6x^{-7}$ (or $-6/x^7$)	B1	CAO. Index needs to be simplified
	(c) $3/5x^{-2/5}$ or equivalent	B1	CAO. Index needs to be simplified.
		5	ISW once simplified to stages shown in (b) and (c)
2	(a)(4x +1)(2x - 3)	B2	B1 (4x - 1)(2x + 3). Ignore sight of "=0"
	-1/4 or 3/2	B2	Must be from factorising. MUST FT for their factors
			FT for their factors. B1 for each answer
	(b) $(x+ 6)^2 \pm \ldots$	B1	Sight of $(x+6)^2$
	…….. – 31	B1	Accept - 36 + 5 if not evaluated, otherwise mark final value
	Least value -31	B1	FT their value but not -36 or +5. Accept 'least is x=-31'
		7	
3	4y = 4x + 12 or y = x + 3	B1	The variables maybe reversed (or different), check that
	$x^2 + 30 = y^2$	B1	they are used consistently, otherwise max B1 here
	$x^2 + 30 = (x + 3)^2$ or $(y – 3)^2 + 30 = y^2$	M1	Correct equate implies previous B2
			FT for their equate equivalent level of difficulty provided B1 awarded.
	$x^2 + 30 = x^2 + 6x + 9$ or $y^2 -6y + 9 + 30 = y^2$	A1	For correct expansion
	6x = 21 or 6y = 39	A1	
	x = 3.5 (cm) or y = 6.5 (cm)	A1	CAO
	y = 6.5 (cm) or x = 3.5 (cm)	A1	CAO
			Trial and improvement methods are not accepted.
		7	*No marks for an unsupported correct answer*
4	(a) $(AB^2 =)$ $(3 – -5)^2 + (9 - 7)^2$ $(=8^2 + 2^2)$	M1	Or $(-5 – 3)^2 + (7 – 9)^2$. Allow 1 slip in sign
	AB = √68	A1	CAO
	= 2√17	B1	FT 'their AB' of equivalent difficulty expressed correctly
			Sight of 2√17 implies previous √68
	(b) Grad. AB (9 – 7) / (3 - - 5)	M1	Or (7 -9)/(-5 -3)
	= 2/8 (= 1/4)	A1	CAO. Mark final answer and then FT
	Grad. perpendicular -8/2 (= -4)	B1	FT -1/grad AB
	(3+-5)/2 , (9 + 7)/2	M1	Accept (-1, …) or (… , 8)
	Mid point AB (-1 , 8) or equivalent	A1	CAO
	Use of $y=mx+c$ or $y-y_1= m(x-x_1)$	M1	Method to find the equation
			FT their mid-point (not A or B) & their perpend. grad.
	y – 8 = -8/2 (x – -1)	A1	Unsimplified form
	y =-4x + 4	A1	Form y=mx+c . Accept factorised form
	QWC2: Candidates will be expected to present work clearly, with words explaining process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer	QWC 2	QWC2 Presents material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar.
	QWC1: Candidates will be expected to • present work clearly, with words explaining process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their final answer	13	QWC1 Presents material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.

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Q	Additional Mathematics Summer 2013	Marks	Final
5	$9x^2 - 1 - 1 + x^2 + 3 - 12x^2$ (= -199) $-2x^2 + 1$ (= -199) $2x^2 = 200$ or $2x^2 - 200 = 0$ ($x^2 = 100$ or $2(x^2 - 100) = 0$) $x = (\pm)\sqrt{100}$ or (2) $(x + 10)(x - 10) = 0$ Both $x = 10$ AND $x = -10$	M1 A1 M1 m1 A1 5	Allow 1 error. Allow with sight of compensating x terms CAO FT **quadratic** provided $\leq$2 errors in simplification An answer from working of x=10 implies M1 m1 Do not FT to m1 if $\sqrt{}$ of negative value, if quadratic formula used then b^2-4ac must be simplified CAO
6	$x+1 = x^2 + 2x - 3$ $x^2 + x - 4 = 0$ $x = \{-1 \pm\sqrt{(1^2 - 4\times1\times-4)}\}/2$ $x = \{-1 \pm\sqrt{17}\}/2$ $x = 1.56$ and $x = -2.56$ $x = 1.56$, $y = 2.56$ and $x = -2.56$, $y = -1.56$	M1 A1 m1 A1 A1 A1 6	 Must be equate to zero FT provided their quadratic does not factorise and equivalent level of difficulty Use of quadratic formula, allow 1 slip in substitution Alternative using $x = y - 1$: M1 $y = (y-1)^2 + 2(y-1) - 3$ or $y = y^2 - 4$ A1 $y^2 - y - 4 = 0$ (equate to zero) m1 $y = \{1\pm\sqrt{(1^2 - 4\times1\times-4)}\}/2$ A1 $y = (1\pm\sqrt{17})/2$ A1 $y = 2.56$ and $y = -1.56$ A1 $x = 1.56$, $y = 2.56$ and $x = -2.56$, $y = -1.56$
7	(a) $432x^7$ (b) $3/5\ x^5 - 1/(2x^2) + 4x$ $+ c$ (constant) (c) $6x^6/6 + 5x$ $[\ 6x^6/6 + 5x\ ]^3_2$ $=(3^6 + 15) - (2^6 + 10)$ $= 670$	B2 B3 B1 B2 M1 A1 A1 11	B1 for sight of $54x^8$. FT to 2nd B1 from $dy/dx = kx^n$ B1 for each term. Accept unsimplified $+x^{-2}/-2$ ISW Awarded if at least B1 for integration B1 for $6x^6/6$ or $5x$ FT their integration, not original. Intention to use 3, 2 **and** subtract FT for correct use of limits CAO, not FT. *Answer only, no working shown M0 A0 A0*
8	(a) $7(2)^3 - 4(2)^2 + (2) - 2$ (= 56 -16 +2 -2) = 40 (b)(i) Substitute $x = -3$ Showing $f(-3) = 0$ (ii) $(x+3)(x^2 + bx + c)$ or intention to divide by $(x+3)$ with x^2 shown ($(x+3)$) $(x^2 + x - 20)$ ($(x+3)$) $(x - 4)(x + 5)$	M1 A1 M1 A1 M1 A2 A1 8	Or division method giving $7x^2 + 10x$ … Or division method giving $x^2 + x$ … Accept sight of substitution with equate to zero A1 for +1x or -20. Or use of factor theorem A1 $(x-4)$, A1 $(x+5)$ CAO. Final answer, but ignore sight of "=0"

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Q	Additional Mathematics Summer 2013	Marks	Final
9	Strategy: e.g. need to use 14° and 6.3cm AND 3D visualised EC = 6.3/tan14 EC = 25(.2679…cm) Tan ECH = 17.3/EC <ECH = $\tan^{-1}$ 0.68… 34(.39...°)	S1 M2 A1 M1 M1 A1 7	Properties of a kite and visualising where height is M1 for Tan14 = 6.3/EC *OR Alternative method* *M1 for 12.6/sin28 = DC/sin76 (DC = 26(.04..cm)* *and then M1 for sin76 = EC/their DC* If 12.6 allow SC1 for answer 50.5 FT their EC *If 12.6 used then max mark is SC1, M1,M1,A1(18.9)* *NOTES for other alternative methods:* *Do not credit $17.3^2+6.3^2$ until seen as part of an overall strategy.*
10	$y+\delta y = (x+\delta x)^2 - 4(x+\delta x)$ Intention to subtract (y=) $x^2 - 4x$ to find δy $\delta y = 2x\delta x + (\delta x)^2 - 4\delta x$ Dividing by δx **and** (lim) $\delta x \to 0$ $dy/dx = \lim_{\delta x \to 0} \delta y/\delta x = 2x - 4$	B1 M1 A1 M1 A1 5	Or alternative notation. Allow if final bracket omitted Accept δx^2 as meaning $(\delta x)^2$ FT equivalent level of difficulty CAO. Must follow from correct working *Use of dy/dx throughout max 4 marks only, final A0*
11	$\int (10x - x^2)dx$ $= 5x^2 - x^3/3$ Use of correct limits 10 & 0 in correct order 500/3 or equivalent	M1 A2 m1 A1 5	**Intention** to integrate A1 for each. Accept 10/2 as 5 CAO. Accept 166.6(66..) or 166.7 *Answer only gets no marks* *No marks for use of the trapezium rule.*

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Q	Additional Mathematics Summer 2013	Marks	Final
12	(dy/dx=) $9x^2 - 36$	B1	
	dy/dx = 0 or $9x^2 - 36 = 0$	M1	FT their dy/dx form $ax^2 + b$
	$x = 2$ and $y = -37$	A1	
	$x = -2$ and $y = 59$	A1	*Answer only, no working shown M0 A0 A0*
			Method for determining min or max MUST be shown, final answer only is M0 here, then A0,A0
	$d^2y/dx^2 = 18x$	M1	Or first derivative test, interpretation of first derivative test. Or alternative.
	At (2, -37) $d^2y/dx^2 > 0$, point is a minimum	A1	FT for their x value
	At (-2, 59): $d^2y/dx^2 < 0$, point is a maximum	A1	FT for their other x value provided this does not have the same interpretation as the first x value
		7	*SC1 for correct FT from $d^2y/dx^2 = ax$, $a>0$*
13	When x = 2, finding y = 20	B1	
	dy/dx = 6x + 4	M1	
	when x = 2 gradient is 16	A1	
	Use of $y - y_1 = m(x - x_1)$ or $y = mx + c$	M1	Method to form equation FT their y value, but not y=16 and their derived gradient
	$y - 20 = 16(x-2)$ or $20 = 16\times2 + c$, $c = -12$	A1	
	$16x - y - 12 = 0$ or $-16x + y + 12 = 0$	A1	CAO. Must be in this form, accept equivalents written as 3 terms not with whole number coefficients
		6	
14	(a) 2500	B1	*e.g.$(\sqrt{50})^4 = 50^2 = 2500$, or $50^2 = 2500$* *Answer only, no working shown, B0*
	(b)(i) $(12)x^{2/4}/x^{3/2}$ or equivalent first stage of work evaluated correctly with simplification of indices	B1	
	$12x^{-1}$ or $12/x$	B1	CAO. Mark final answer
	(ii) **Correctly** extracting a factor of $x^{1/6}$ (numerator), OR correct alternative method with one **correct** step towards simplification	M1	Must be correct, but could be $4x^{1/6}$, $2x^{1/6}$ or $x^{1/6}$. For an alternative method, need sight of the two terms and $3 + \ldots$ or $\ldots + x^{1/6}$ for M1
	$3 + x^{1/6}$	A1	CAO. Mark final answer
		5	
15	(a) General sine curve through (0,0), (180,0) and (360,0) only	B1	
	Correct, sketch with 4 and -4 on y-axis	B1	
	(b) 0°, 180° and 360° only	B1	
		3	

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Surname	Centre Number	Candidate Number
Other Names		0

WJEC LEVEL 2 CERTIFICATE

9550/01

ADDITIONAL MATHEMATICS

A.M. MONDAY, 25 June 2012

$2\frac{1}{2}$ hours

ADDITIONAL MATERIALS

A calculator will be required for this paper.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

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

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

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The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question **11**.

When you are asked to show your working you must include enough intermediate steps to show that a calculator has not been used.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	**7**	
2	**3**	
3	**5**	
4	**7**	
5	**4**	
6	**6**	
7	**5**	
8	**11**	
9	**7**	
10	**6**	
11	**9**	
12	**5**	
13	**7**	
14	**7**	
15	**7**	
16	**4**	
TOTAL MARK		

9550 010001

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1. *(a)* Showing all your working, find the value of each of the following.

(i) $64^{-\frac{1}{2}} \times 36^{\frac{3}{2}}$

.....

.....

.....

[2]

(ii) $\left(100^{\frac{1}{2}}\right)^4$

.....

.....

.....

[1]

(b) Showing all your working, simplify each of the following.

(i) $\dfrac{5x^{-\frac{5}{4}} \times 4x^{\frac{13}{4}}}{x^{\frac{3}{2}}}$

.....

.....

.....

[2]

(ii) $\dfrac{18x^{\frac{1}{5}} + 6x^{\frac{2}{5}}}{6x^{\frac{1}{5}}}$

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[2]

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2. Express as a single fraction in its simplest form.

$$1 - \frac{3x - y}{x + 2y}$$

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[3]

3. Find $\frac{dy}{dx}$ for each of the following.

(a) $y = 8x^7 + 2x - 23$

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[3]

(b) $y = x^{-8}$

.....

.....

[1]

(c) $y = x^{\frac{3}{2}}$

.....

.....

[1]

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4. *(a)* Given that $f(x) = x^3 - 2x^2 - 9x + 18$, evaluate $f(-3)$.

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Write down what this tells you about $f(x)$.

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[3]

(b) Factorise $x^3 - 2x^2 - 9x + 18$.

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[4]

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5. Use the facts below to find the value of the constant a.

$$y = ax^3$$

$$\frac{dy}{dx} = 135 \text{ when } x = 3$$

[4]

6. *(a)* Simplify $\frac{3}{2+\sqrt{5}}$, leaving your answer in surd form.

[3]

(b) Simplify $(\sqrt{3}+2)^2 - (\sqrt{3}-2)^2$, leaving your answer in surd form.

[3]

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7. The coordinates of the points R and S are (5, 7) and (15, 31) respectively.

(a) Calculate the length of the line RS.

[2]

(b) Find the gradient of a straight line perpendicular to RS.

[3]

8. *(a)* Find $\frac{d^2y}{dx^2}$ when $y = 6x^4 + 4x$.

[2]

(b) Find $\int 3x^2 + \frac{4}{x^3} + 8x \, dx$.

[4]

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(c) Showing all your working, evaluate $\int_2^4 6x + 1 \, dx$.

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[5]

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Turn over.

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9. *(a)* Factorise $15x^2 - x - 6$.

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Hence solve the equation $15x^2 - x - 6 = 0$.

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[4]

(b) Use the method of completing the square to find the least value of $x^2 + 10x + 15$.

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.....

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[3]

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10. Solve the simultaneous equations

$$2x + y = 13,$$
$$x^2 + xy - 30 = 0.$$

[6]

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11. *You will be assessed on the quality of your written communication in this question.*

A right-angled triangle, ABC, has an area of $1350\,\text{cm}^2$.
The hypotenuse of the right-angled triangle, AC, is 75 cm and the perimeter is 180 cm.
Given that $AB = x$ cm and $BC = y$ cm, calculate the lengths of the sides AB and BC of the right-angled triangle.

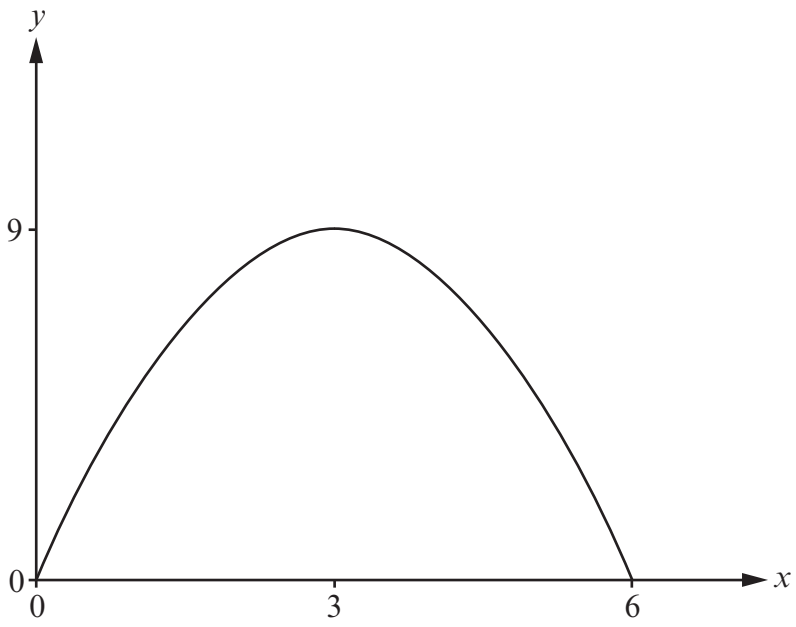
[9]

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12. The diagram shows the curve $y = 6x - x^2$.



Showing all your working, calculate the area of the region bounded by the curve $y = 6x - x^2$ and the x-axis.

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[5]

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13. Each edge of the base of a square based pyramid has a length of 4 cm. The length of each of the other edges of the pyramid is 6 cm. Calculate the perpendicular height of the pyramid, giving your answer in the form $a\sqrt{b}$.

[7]

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14. The curved surface area of a cylinder of radius x cm and length $(3x + 2)$ cm is 32π cm^2. Form an equation in terms of x and solve it to find the length of the cylinder.

[7]

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15. *(a)* Given that $y = x^2 - 5x$, find $\frac{dy}{dx}$ from first principles.

[5]

(b) Find the x-coordinate of the point on the curve $y = x^2 - 5x$ where the gradient of the tangent to the curve is 15.

[2]

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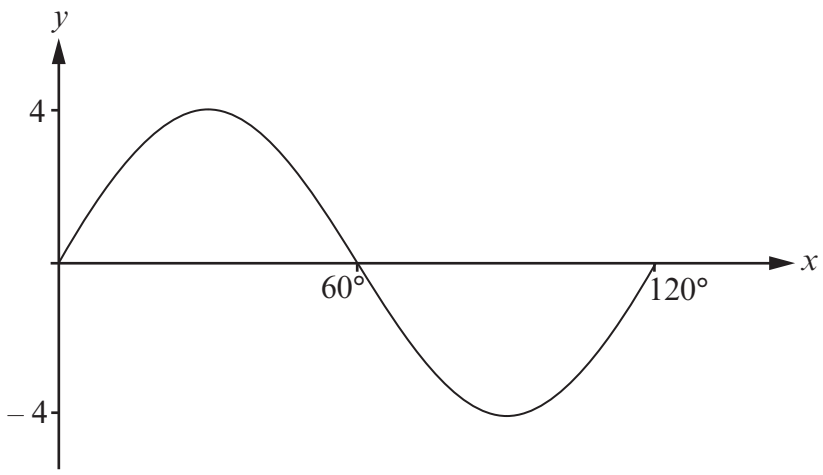
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16. *(a)* Select one of the following equations to match the sketch shown below.

$y = 2\sin 3x$ $y = 3\sin 3x$ $y = 4\sin 3x$

$y = 4\sin 4x$ $y = 3\sin 4x$ $y = 3\sin 2x$



.....

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Equation .....

[1]

(b) (i) Write down the minimum value of $y = \sin 5x$.

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[1]

(ii) Find all solutions of the equation $\sin 5x = 1$ for values of x from 0° to 100°.

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[2]

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MARKING SCHEME

LEVEL 2 CERTIFICATE IN ADDITIONAL MATHEMATICS

SUMMER 2012

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2012 examination in LEVEL 2 CERTIFICATE IN ADDITIONAL MATHEMATICS. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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	Additional Mathematics Summer 2012		Final Mark Scheme
1	(a)(i) 27	B2	B1 for either 1/8 or 216 *Answer only, no working shown, B0*
	(ii) 10 000	B1	*e.g.$(\sqrt{100})^4 = 10^4 = 10\,000$, or $10^4 = 10\,000$, or $100^2 = 10\,000$. Do not accept $\sqrt{100^4} = 10\,000$* *Answer only, no working shown, B0*
	(b)(i) $(20)x^{8/4}/x^{3/2}$ or equivalent first stage of work evaluated correctly with simplification of indices	B1	
	$20x^{1/2}$ or $20\sqrt{x}$	B1	CAO. Mark final answer
	(ii) **Correctly** extracting a factor of $x^{1/5}$ (numerator), OR correct alternate method with one **correct** step towards simplification	M1	Must be correct, but could be $6x^{1/5}$, $3x^{1/5}$ or $x^{1/5}$. For an alternative method, need sight of $3 + x^{2/5}/x^{1/5}$ for M1
	$3 + x^{1/5}$	A1 7	CAO. Mark final answer
2	Common denominator x + 2y	B1	
	$\frac{x + 2y - (3x - y)}{x + 2y}$ OR $\frac{x + 2y - 3x + y}{x + 2y}$	B1	Brackets must be shown or implied by correct further working Must be seen or implied as a quotient
	$\frac{-2x + 3y}{x + 2y}$	B1	FT from B1, B0 for one error in sign leading to an answer of $(y - 2x)/(x + 2y)$ to give final B1 Do not ignore further working. Mark final answer
		3	
3	(a) $56x^6 + 2$ (+0)	B3	B1 for each term. Accept 8×7 as 56. Only award B1 for '(+0)' provided at least one other B mark awarded. ISW ISW
	(b) $-8x^{-9}$	B1	Index needs to be simplified. ISW
	(c) $3/2\ x^{1/2}$	B1 5	
4	(a) $(-3)^3 - 2(-3)^2 - 9(-3) + 18$	M1	
	$= 0$	A1	
	(x+3) is a factor OR divisible by x+3	E1	Depends on M1, A1. Do not accept contradictions
	(b) $(\mathbf{x+3})(ax^2 + bx + c)$ or intention to ÷ (x+3)	M1	Division method needs to show x^2 and attempt to find the next term May be division by x-3 or x-2, mark in the same way as described for division by x+3
	$(\mathbf{x+3})(x^2 - 5x + 6)$	A2	A1 for -5x or +6. Or use of factor theorem A1 for each factor
	((x+3)) (x – 3)(x – 2)	A1	CAO. Mark final answer. Do not ignore continuing to solve.
		7	*An answer of $(x-2)(x^2 - 9)$ is awarded M1, A2*
5	$(dy/dx =)\ 3ax^2$	M1	
	Strategy to substitute x=3 into dy/dx	m1	
	Equating 'their $3a3^2$' to 135	m1	
	a = 5	A1	Depends on all previous marks *N.B. No marks awarded for a = 5 from an incorrect method, e.g. $135 = a \times 3^3$, then a = 135/27 = 5*
		4	
6	(a) Multiplier $(2-\sqrt{5}) / (2-\sqrt{5})$	M1	
	Denominator $4 + 2\sqrt{5} - 2\sqrt{5} - 5$ OR $4 - 5$ OR -1	A1	
	$3\sqrt{5} - 6$ or $(6 - 3\sqrt{5})/-1$	A1	CAO. Mark final answer
	(b) $\{3+2\sqrt{3}+2\sqrt{3}+4\} - \{3-2\sqrt{3}-2\sqrt{3}+4\}$ OR $\{(\sqrt{3}+2)+(\sqrt{3}-2)\}\{(\sqrt{3}+2)-(\sqrt{3}-2)\}$	B2	B1 for 1 slip *'$3+2\sqrt{3}+2\sqrt{3}+4-3-2\sqrt{3}-2\sqrt{3}+4$' is 3 slips, unless brackets were intended as implied by further working*
	$8\sqrt{3}$	B1 6	CAO. Mark final answer
7	(a) $RS^2 = (31-7)^2 + (15-5)^2$ $(= 24^2 + 10^2)$	M1	Or equivalent. Allow 1 slip or error
	$RS = \sqrt{676}$ (=26)	A1	CAO
	(b) Gradient RS (31-7)/(15-5)	M1	
	=12/5 or equivalent	A1	Do not ignore incorrect cancelling in (b)
	Perpendicular gradient -5/12 or equivalent	B1 5	FT -1/'their gradient RS'. Do not accept fraction of a (decimal) fraction

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	Additional Mathematics Summer 2012		Final Mark Scheme
8	(a) $24x^3+4$ $72x^2$ (b) $(3/3)\ x^3 + 4/(-2x^2) + (8/2)\ x^2$ $+ c$ (constant) (c) $6x^2/2 + x$ $[6x^2/2 + x\ ]^4_2$ $=(3\times4^2 + 4) - (3\times2^2+ 2)$ $= 38$	B1 B1 B3 B1 B2 M1 A1 A1 11	 FT to 2nd B1 from $dy/dx = kx^n + a$, equivalent level of difficulty B1 for each term. Accept unsimplified. ISW Award if at least B1 given for integration B1 for $6x^2/2$ or x FT their integration not use of 6x + 1. Intention to use 4, 2 **and** subtract FT for correct use of limits CAO, not FT. *Answer only, no working shown, M0 A0 A0*
9	(a)$(5x +3)(3x - 2)$ $-3/5$ or $2/3$ (b) $(x+ 5)^2$ -10 Least value -10	B2 B2 B1 B1 B1 7	B1 (5x … 3)(3x … 2). Ignore sight of "=0" Strict FT from (a) if (5x..3)(3x..2) or (5x..2)(3x..3). B1 for each answer Sight of $(x+5)^2$ or $(x+10/2)^2$ or (x+5)(x+5) Accept 15 - 25 if not evaluated, otherwise mark final value FT their value but not 25 or 15
10	$y = 13 – 2x$ $x^2 +x(13 – 2x) – 30 = 0$ $x^2-13x+30 = 0$ or $-x^2+13x-30 = 0$ or equivalent in y $(x - 10)(x - 3)$ {=0} x = 10 and x = 3 y = -7 and y = 7	B1 M1 A1 M1 A1 A1 6	*OR equivalent using x = ….* FT their y, attempt to substitute Must equate to 0 (maybe implied by answer) FT equivalent level of difficulty *OR correct use of formula with $b^2 – 4ac$ evaluated correctly* FT from M1, A0 *Answer x=3 and y=7* ***OR*** *x=10 and y=-7 from a trial and improvement method, award SC1. Also possible B1, M1, A1 with SC1* *Alternative method:* *B1 $2x^2 + xy = 13x$* *M1 Intention to subtract, using $x^2 +xy - 30 = 0$ then as original method*

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	Additional Mathematics Summer 2012		Final Mark Scheme
11	Any two of the equations: ½ xy = 1350, $x^2 + y^2 = 75^2$, x + y + 75 = 180	B2	Or equivalents. B1 for any one of the three equations. FT provided B1 awarded for possible M, A and m, not final A1, A1
	Attempt to solve the simultaneous equations	M1	Accept a trial & improvement method for at least one correct trial
	x^2 -105x +2700 = 0 OR y^2-105y +2700=0	A1	Must equate to zero. FT a trial & improvement method for at least one correct trial either side or including of '0'
	Reasonable attempt to factorise, or use of quadratic formula, or completing the square	m1	FT a trial & improvement method, depends on M1 and A1, for working towards a correct answer, narrowing search further
	Sides: 45(cm) 60(cm)	A1 A1	CAO CAO
			If no marks, award SC1 if the sum of their AB and their BC is 105 Correct answers 45(cm) and 60(cm) are awarded 7 marks, but if unsupported, or use of only one of the statements, then QWC0
	QWC2 requires some text connected to equations as well as good mathematical notation with units in the final answer. QWC2: Candidates will be expected to • present work clearly, with clear process or steps shown AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar • QWC1: Candidates will be expected to • present work clearly, with clear process or steps shown explaining process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar	QWC 2 9	QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.
12	Intention to integrate $6x - x^2$	M1	
	$3x^2 - x^3/3$	A2	A1 for each. Accept 6/2 as 3
	Use of correct limits 6 & 0 in correct order with the intention to subtract	m1	Depends on previous M1, A1
	36	A1 5	CAO. *Answer only gets no marks* *No marks for use of the trapezium rule.*

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	Additional Mathematics Summer 2012		Final Mark Scheme
13	Strategy: Idea of 3D-ness and Pythagoras' Theorem (Base diagonal)^2 = $4^2 + 4^2$ Base diagonal = $\sqrt{32}$ (Or ½ base diagonal = ½ $\sqrt{32}$ (Perpendicular height)^2 = 6^2 – (½ base diagonal)^2 = 36 – ¼ ×32 Perpendicular height = $\sqrt{28}$ $2\sqrt{7}$	S1 M1 A1 M1 A1 A1 B1 7	E.g. suitable diagram & attempt Pythagoras' Theorem once Or for (½ diagonal)^2 equation FT their (½ diagonal)^2 Depends on M1 only FT provided at least M2 awarded *Alternative:* *S1 Strategy: Idea of 3D-ness, Pythagoras' Theorem once* *M1 (sloping perpendicular bisector)^2 =6^2-2^2* *A1 sloping perpendicular bisector =$\sqrt{32}$* *M1 (Perpendicular height)^2* *=(sloping perpendicular bisector)^2– 2^2* *(FT their perpendicular bisector)* *A1 (Perpendicular height)^2 =$(\sqrt{32})^2$– 2^2* *A1 Perpendicular height $\sqrt{28}$ (Depends on M1 only)* *B1 $2\sqrt{7}$ (FT provided at least M2 awarded)*
14	C = 2πx Surface area = length × C 2πx(3x +2) = 32π $3x^2 + 2x - 16 = 0$ or equivalent (3x +8)(x – 2) = 0 (x=-8/3) x = 2 Height is 8 (cm)	B1 B1 M1 A1 M1 A1 A1 7	Do not accept embedded within an incorrect equation FT their linear C. Allow intention Must be correct. Accept numerical value for π Intention of brackets must be clear in working Needs to have eliminated π and equate to zero *Equate to zero maybe implied by solving* FT their quadratic provided B2 awarded OR correct substitution into the formula, or use of completing the square *Unsupported correct answers, award 7 marks, otherwise **correct** working needs to support answers, use of πx^2 is incorrect*
15	(a) (y+δy =) $(x+\delta x)^2 - 5(x+\delta x)$ Intention to subtract (y=) $x^2 - 5x$ to find δy (δy =) $2x\delta x + (\delta x)^2 - 5\delta x$ Dividing by δx and letting $\delta x \to 0$ $dy/dx = \lim_{\delta x \to 0} \delta y/\delta x = 2x - 5$ (b) 2x -5 = 15 x = 10	B1 M1 A1 M1 A1 M1 A1 7	Or alternative notation. Allow if final bracket omitted Accept δx^2 as meaning $(\delta x)^2$ CAO. Notation needs to be accurate *Use of dy/dx throughout max 4 marks only, final A0* FT from their response in (a) into (b)
16	(a) (y =) 4sin3x selected (b)(i) -1 (ii) 18(°) and 90(°) with no other angles given	B1 B1 B2 4	 CAO B1 for either 18(°) or 90(°). Accept embedded answers

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