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.

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 **11**.

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

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

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

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[2]

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

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[1]

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

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

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[2]

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

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[2]

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

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

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[3]

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

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

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[3]

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

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[1]

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

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[1]

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]

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

$$y = ax^3$$

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

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[4]

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

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

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[3]

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

(a) Calculate the length of the line RS.

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[2]

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

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[3]

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

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

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[4]

(c) Showing all your working, evaluate $\displaystyle\int_{2}^{4} 6x + 1 \; dx$.

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[5]

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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[3]

10. Solve the simultaneous equations

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

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[6]

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 $75\,\text{cm}$ and the perimeter is $180\,\text{cm}$.
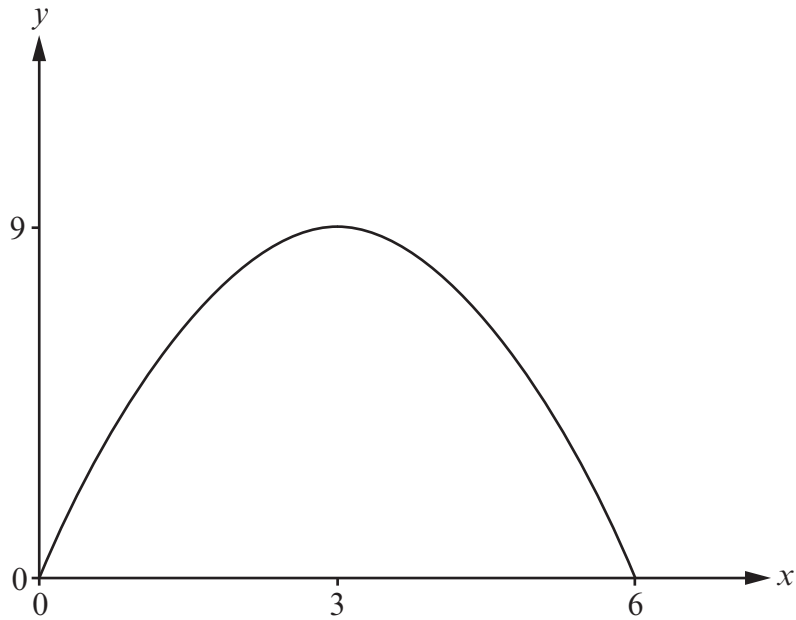Given that $AB = x$ cm and $BC = y$ cm, calculate the lengths of the sides AB and BC of the right-angled triangle.

[9]

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]

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]

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.

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[7]

15. *(a)* Given that $y = x^2 - 5x$, find $\dfrac{dy}{dx}$ 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]

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

$$y = 2\sin3x \qquad y = 3\sin3x \qquad y = 4\sin3x$$

$$y = 4\sin4x \qquad y = 3\sin4x \qquad y = 3\sin2x$$
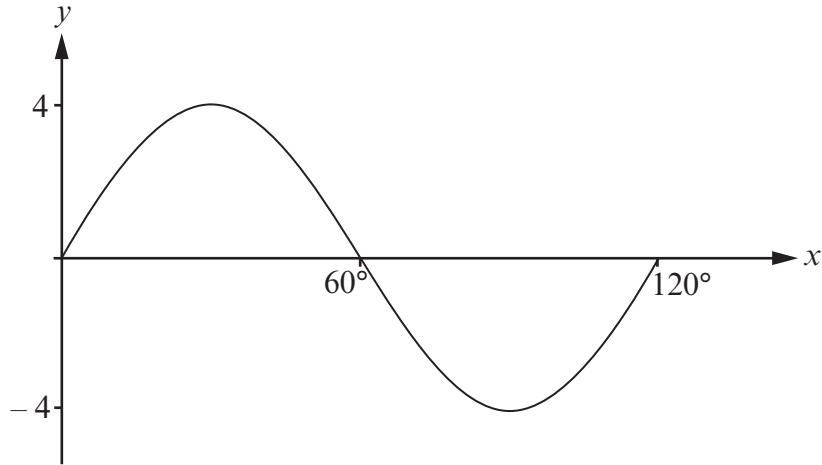
Equation ....

[1]

(b) (i) Write down the minimum value of $y = \sin5x$.

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[1]

(ii) Find all solutions of the equation $\sin5x = 1$ for values of x from 0° to 100°.

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