Surname	
Other Names	
Candidate Signature	

Centre Number						Candidate Number				

Examiner Comments	

Total Marks

PAPER 1

ADVANCED SUBSIDIARY

CM

Practice Paper A

Time allowed: 2 hours

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 11 questions in this question paper. The total mark for this paper is 100.

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.

1 0 3 3 2 2 1 1 8 0 0 0 4

1 Given that

$$y = 3x^{-4} + \sqrt{x} - 2x + 1,\ x > 0$$

find

(a) $\int y\,dx$ **(3)**

(b) $\frac{dy}{dx}$ **(3)**

(c) $\frac{d^2y}{dx^2}$ **(2)**

giving each term in its simplest form.

Question 1 continued

TOTAL 8 MARKS

2 The function f is defined such that

$$f(x) = 4x^2 - 5x - 6$$

(a) Express f(x) in the form $a(x+b)^2 + c$, where a, b and c are constants to be found. **(4)**

(b) Find the exact solutions to the equation f(x) = 0. **(2)**

(c) Solve the equation $4(x-1)^2 - 5(x-1) = 6$. **(2)**

Question 2 continued

TOTAL 8 MARKS

3 (a) Given that

$$\sqrt{2^{2x+1}} \times 8^{y-3} = \sqrt[3]{4^{y+x}} \times 2^{x-1}$$

express y in terms of x. **(3)**

(b) Solve the simultaneous equations

$$7x^2 + 42y = 130$$

$$\sqrt{2^{2x+1}} \times 8^{y-3} = \sqrt[3]{4^{y+x}} \times 2^{x-1}$$

(6)

Question 3 continued

TOTAL 9 MARKS

4 Prove, from first principles, that the derivative of a constant function is 0. **(4)**

Question 4 continued

TOTAL 4 MARKS

5 The curve C has the equation $y = f(x)$, where

$$f(x) = x^3 - 2x^2 + x + 4$$

(a) Using algebraic long division, find the remainder when $f(x)$ is divided by

(i) $x - 3$ **(2)**

(ii) $x + 1$ **(2)**

(b) Show that $f(x) = 0$ has only one real solution. **(2)**

(c) Find the coordinates of the turning points on the curve C. **(5)**

(d) Sketch the curve C.

On your sketch, you should show clearly the coordinates of any points where the curve crosses or meets the coordinate axes. **(2)**

The region R in the x-y plane is defined such that

$$R = \{y < x^3 - 2x^2 + x + 4\} \cap \{x \leq 1\}$$

(e) Sketch the region represented by R. **(3)**

Question 5 continued

Question 5 continued

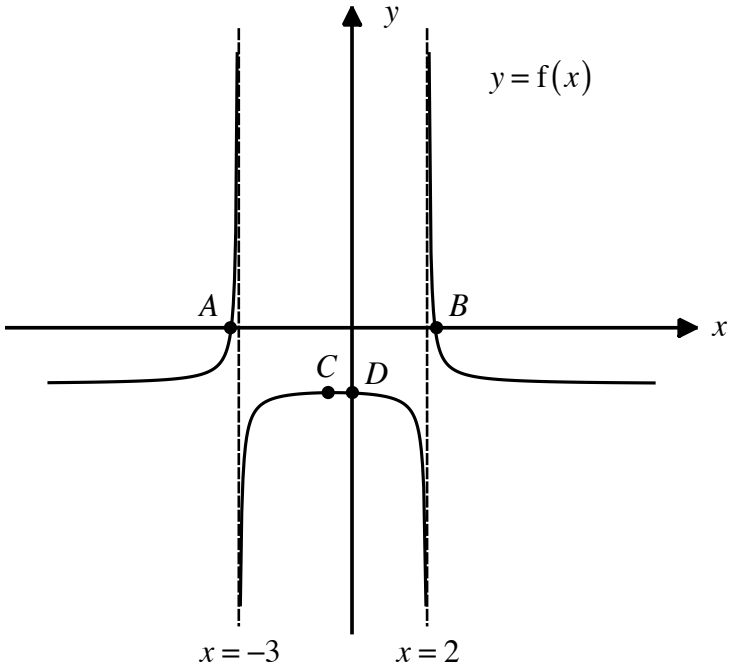
Question 5 continued

Question 5 continued

Question 5 continued

TOTAL 16 MARKS

6 The diagram below shows a sketch of the curve with equation $y = f(x)$.



The points A and B are where the curve intersects the x axis, the point C is a turning point on the curve and the point D is where the curve intersects the y axis. Given that

the x coordinate of A is –3.5

the x coordinate of B is 2.5

the x coordinate of C is –0.5

and the y coordinate of D is –1.5,

sketch the curves with equation

(i) $y = f(x - 3)$ **(2)**

(ii) $y = f'(x)$ **(2)**

On your sketches, you should show clearly the coordinates of any points where the curves cross or meet the x axis.

Question 6 continued

TOTAL 4 MARKS

7 (a) Prove that

$$a^2 + b^2 \geq 2ab$$

for all values of a and b. **(2)**

(b) By choosing suitable values of a and b in the inequality in (a), prove that

$$9^x + 9^{-x} \geq 2$$

(3)

(c) For the inequality in (b), find the value(s) of x for which equality holds. **(2)**

Question 7 continued

TOTAL 7 MARKS

8 The points A and B have the coordinates $(-2, 2)$ and $(5, -5)$ respectively.

(a) Find the equation of the perpendicular bisector of A and B. **(4)**

A circle C passes through the points A and B.

The line l has the equation $3x - 4y = 35$ and is the tangent to C at B.

(b) Find

(i) the centre of C **(6)**

(ii) the radius of C **(3)**

(c) Hence, write down the equation of the circle C. **(2)**

Question 8 continued

Question 8 continued

Question 8 continued

TOTAL 15 MARKS

9 The function p is defined such that

$$\mathrm{p}(\theta) = \frac{9 + 16\cos^2\theta}{5 + 4\sin\theta}, \quad 0 \leq \theta \leq 360°$$

(a) Express $\mathrm{p}(\theta)$ in the form $a + b\sin\theta$. **(3)**

(b) Solve the equation $10\,\mathrm{p}(\theta - 30°) = 54$.

Give your answers to two decimal places where appropriate. **(5)**

(c) Find the maximum value of p and the value(s) of θ at which it occurs. **(3)**

Question 9 continued

Question 9 continued

Question 9 continued

TOTAL 11 MARKS

10 Josh is a gamer. He records his gaming footage and uploads it to an online platform. The platform pays Josh earnings for the amount of views his videos attracts. Josh uploads a new video that becomes popular. After t hours since uploading this video, Josh's earnings per hour are £E, where E is modelled by

$$E = 2^t \, e^{\left(\frac{t+4}{10}\right)}, \quad t \geqslant 0$$

(a) How much money was Josh earning from his channel when he first released the video? **(2)**

(b) Find the exact value of t when Josh's earnings are £1024.

Give your answer in the form $t = \dfrac{a \ln 2 + b}{c \ln 2 + d}$, where a, b, c and d are integers to be found. **(5)**

After 10 hours, Josh's earnings begin the fall as his video loses its popularity.

(c) Explain why the model will then no longer be valid. **(1)**

Question 10 continued

Question 10 continued

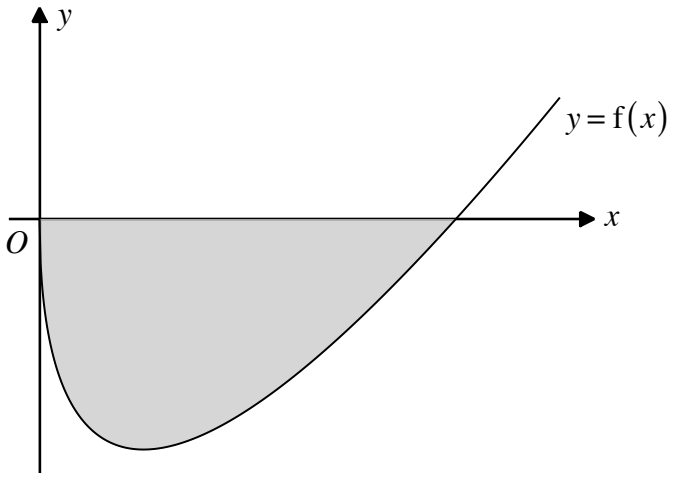
Question 10 continued

TOTAL 8 MARKS

11 The curve C has the equation $y = f(x)$, where

$$f'(x) = 2 - \frac{2}{\sqrt{x}}, \quad x > 0$$

The diagram below shows a sketch of the curve C.



The region R, shown shaded in the diagram, is bounded by C and the x axis.

Given that the curve passes through the point $(1, -2)$, find the area of R. **(10)**

Question 11 continued

Question 11 continued

Question 11 continued

Question 11 continued

END OF PAPER **TOTAL 10 MARKS**