Candidate surname		Other	names
Pearson Edexcel	Centre	e Number	Candidate Number
Tuesday 18 J	une	2019	
Morning (Time: 1 hour 30 minut	es)	Paper Referen	ce WMA12/01
AA .1			
Mathematics International Advance Pure Mathematics P2	ed Suk	osidiary/Ad	vanced Level

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
 there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 10 questions in this question paper. The total mark for this paper is 75.
- The marks for each question are shown in brackets
 - use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

 Turn over







Answer all questions. Write your answers in the spaces provided.

1. A sequence a_1, a_2, a_3, \dots is defined by

$$a_{n+1} = 4 - a_n$$
$$a_1 = 3$$

Find the value of

- (a) (i) a_2
 - (ii) a₁₀₇

(2)

(b)
$$\sum_{n=1}^{200} (2a_n - 1)$$

(2)

2. A circle C has equation

$$x^2 + y^2 + 4x - 10y - 21 = 0$$

Find

- (a) (i) the coordinates of the centre of C,
 - (ii) the exact value of the radius of C.

(3)

The point P(5, 4) lies on C.

(b) Find the equation of the tangent to C at P, writing your answer in the form y = mx + c, where m and c are constants to be found.

(4)

Leave blank

3. (i) Use algebra to prove that for all re	l values of x
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$$(x-4)^2 \geqslant 2x-9$$

$(-4)^{3} \geqslant 2x - 9$	
6 (6)	(3)

(ii) Show that the following statement is untrue.

$$2^{n} + 1$$
 is a prime number for all values of $n, n \in \mathbb{N}$

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4. (a) Find the first four terms, in ascending powers of x, of the binomial expansion of

$$\left(2-\frac{1}{4}x\right)^6$$

(4)

(b) Given that x is small, so terms in x^4 and higher powers of x may be ignored, show

$$\left(2 - \frac{1}{4}x\right)^6 + \left(2 + \frac{1}{4}x\right)^6 = a + bx^2$$

where a and b are constants to be found.

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5. A company makes a particular type of watch.

The annual profit made by the company from sales of these watches is modelled by the equation

$$P = 12x - x^{\frac{3}{2}} - 120$$

where P is the annual profit measured in thousands of pounds and £x is the selling price of the watch.

According to this model,

(a) find, using calculus, the maximum possible annual profit.

(6)

(b) Justify, also using calculus, that the profit you have found is a maximum.

(2)

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6. $f(x) = kx^3 - 15x^2 - 32x - 12$ where k is a constant

Given (x - 3) is a factor of f(x),

(a) show that k = 9

- **(2)**
- (b) Using algebra and showing each step of your working, fully factorise f(x).
- (4)

(c) Solve, for $0 \le \theta < 360^{\circ}$, the equation

$$9\cos^3\theta - 15\cos^2\theta - 32\cos\theta - 12 = 0$$

giving your answers to one decimal place.

(2)

- 7. Kim starts working for a company.
 - In year 1 her annual salary will be £16200
 - In year 10 her annual salary is predicted to be £31 500

Model A assumes that her annual salary will increase by the same amount each year.

(a) According to model A, determine Kim's annual salary in year 2.

(3)

Model B assumes that her annual salary will increase by the same percentage each year.

(b) According to model B, determine Kim's annual salary in year 2. Give your answer to the nearest £10

(3)

(c) Calculate, according to the two models, the difference between the total amounts that Kim is predicted to earn from year 1 to year 10 inclusive. Give your answer to the nearest £10

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(i) Find the exact solution of the equation $8^{2x+1} = 6$ giving your answer in the form $a + b \log_2 3$, where a and b are constants to be found. (ii) Using the laws of logarithms, solve $\log_5(7 - 2y) = 2\log_5(y + 1) - 1$ (5)



Leave blank

9. (a) Show that the equation

$$\cos \theta - 1 = 4 \sin \theta \tan \theta$$

can be written in the form

$$5\cos^2\theta - \cos\theta - 4 = 0$$

(4)

(b) Hence solve, for $0 \le x < \frac{\pi}{2}$

$$\cos 2x - 1 = 4\sin 2x \tan 2x$$

giving your answers, where appropriate, to 2 decimal places.

(4)

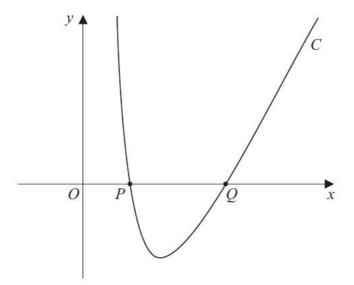


Figure 1

Figure 1 shows a sketch of part of the curve C with equation y = f(x) where

$$f(x) = \frac{36}{x^2} + 2x - 13 \qquad x > 0$$

Using calculus,

(a) find the range of values of x for which f(x) is increasing,

(4)

(b) show that
$$\int_{2}^{9} \left(\frac{36}{x^2} + 2x - 13 \right) dx = 0$$

(4)

(3)

The point P(2, 0) and the point Q(6, 0) lie on C.

Given
$$\int_{2}^{6} \left(\frac{36}{x^2} + 2x - 13 \right) dx = -8$$

(c) (i) state the value of
$$\int_{6}^{9} \left(\frac{36}{x^2} + 2x - 13 \right) dx$$

(ii) find the value of the constant
$$k$$
 such that $\int_{2}^{6} \left(\frac{36}{x^2} + 2x + k \right) dx = 0$

