Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number	Candidate Number

Sample Assessment Materials for first teaching September 2018

(Time: 1 hour 30 minutes) | Paper Reference **WMA12/01**

Mathematics

International Advanced Subsidiary/Advanced Level
Pure Mathematics P2

You must have:
Mathematical Formulae and Statistical Tables, calculator

Total Marks

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 9 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 ▶

S59755A

1/1/1/1/

S 5 9 7 5 5 A 0 1 3 0

Pearson

C2 Specimen 2018.

Leave blank

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

1. $$f(x) = x^4 + x^3 + 2x^2 + ax + b,$$

where a and b are constants.

When f(x) is divided by (x – 1), the remainder is 7

(a) Show that $a + b = 3$

(2)

When f(x) is divided by (x + 2), the remainder is –8

(b) Find the value of a and the value of b

(5)

(a) $f(1) = 7$.

$1+1+2+a+b=7$.

$a+b=3$.

b) $f(-2) = -8$.

$(-2)^4 + (-2)^3 + 2(-2)^2 + a(-2)$
$+b=-8$.

$16-2a+b=-8$.

$-2a+b=-24$.

$-$

$a+b=3$

$-3a=-27$

$a=9$

$b=3-9$.

$b=-6$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

2. The first term of a geometric series is 20 and the common ratio is $\frac{7}{8}$. The sum to infinity of the series is S_∞

(a) Find the value of S_∞

(2)

The sum to N terms of the series is S_N

(b) Find, to 1 decimal place, the value of S_{12}

(2)

(c) Find the smallest value of N, for which $S_\infty - S_N < 0.5$

(4)

(a) $a = 20$ $r = 7/8$.

$S_\infty = \frac{a}{1-r}$

$\frac{20}{1-7/8} = 160$

$N = 44$

(b) $\frac{20(1-(7/8)^{12})}{1-7/8}$ From the equation $S_N = \frac{a(1-r^n)}{1-r}$

$= 127.8$

(c) $160 - 160(1-7/8^N) < 0.5$

$-160(1-7/8^N) < -159.5$ From the previous 2 parts. as $S_\infty = 160$ and $\frac{20}{1-7/8} = 160$

$1 - 7/8^N > \frac{319}{320}$.

$\frac{1}{320} > 7/8^N$.

$\frac{\log(1/320)}{\log(7/8)} < N$.

$43.2 < N$.

Leave blank

3. $$y = \sqrt{(3^x + x)}$$

(a) Complete the table below, giving the values of y to 3 decimal places.

x	0	0.25	0.5	0.75	1
y	1	1.251	1.494	1.741	2

(2)

(b) Use the trapezium rule with all the values of y from your table to find an approximation for the value of

$$\int_0^1 \sqrt{(3^x + x)}\, dx$$

You must show clearly how you obtained your answer.

(4)

(c) Explain how the trapezium rule could be used to obtain a more accurate estimate for the value of

$$\int_0^1 \sqrt{(3^x + x)}\, dx$$

(1)

(b) Trapezium rule.

$\frac{1}{2} \times w \times (\text{ends} + 2(\text{middles}))$

$\frac{1}{2} \times 0.25 \times (1 + 2 + 2(1.251 + 1.494 + 1.741))$

$= 1.4965$

$= 1.50$ (3sf)

(c) decrease the widthe between values for example to 1/8.

Leave blank

DO NOT WRITE IN THIS AREA

4. Given $n \in \mathbb{N}$, prove, by exhaustion, that $n^2 + 2$ is not divisible by 4.

(4)

	n	n^2	n^2+2
odd	1	1	3
even	2	4	6
odd	3	9	11
even	4	16	18
odd	5	25	27
even	6	36	38

→ For all odd numbers, odd × odd gives you odd. If you add 2 to the (n^2) it still gives you an odd no. which is not divisible by 4, as all multiples of 4 are even.

→ For all even numbers, even × even gives you a multiple of 4, but once you add 2 to the multiple of 4 it is no longer divisible by 4.

∴ n^2+2 is not divisible by 4 for all values of n.

Leave blank

5. An arithmetic series has first term a and common difference d.

(a) Prove that the sum of the first n terms of the series is

$$\tfrac{1}{2}n[2a + (n - 1)d]$$

(4)

A company, which is making 200 mobile phones each week, plans to increase its production.

The number of mobile phones produced is to be increased by 20 each week from 200 in week 1 to 220 in week 2, to 240 in week 3 and so on, until it is producing 600 in week N.

(b) Find the value of N

(2)

The company then plans to continue to make 600 mobile phones each week.

(c) Find the total number of mobile phones that will be made in the first 52 weeks starting from and including week 1.

(5)

(a) $S_n = a + (a+d) + (a+2d) \ldots a + d(n-1)$

$+ \quad S_n = (a + d(n-1)) + (a + d(n-2)) + (a + d(n-3)) \ldots a$

$= 2S_n = [2a + d(n-1)] \times n$ times.

$S_n = \frac{n}{2}[2a + d(n-1)]$ as req.

(b) $a = 200 \quad d = 20$

$200 + 20(n-1) = 600$

$n - 1 = 20$

$n = 21$

(c) $\frac{21}{2}[2(200) + 20(20)]$

$= 8400$

$52 - 21 = 31$

$31 \times 600 = 18,600$

$18,600 + 8400 = 27000$

Leave blank

6. (i) Find the exact value of x for which

$$\log_2(2x) = \log_2(5x + 4) - 3$$

(4)

(ii) Given that

$$\log_a y + 3\log_a 2 = 5$$

express y in terms of a. Give your answer in its simplest form.

(3)

i) $\log_2 2 + \log_2 x = \log_2(5x+4) - 3$.

$4 = \log_2(5x+4) - \log_2 x$.

$4 = \log_2\left(\frac{5x+4}{x}\right)$.

$16 = \frac{5x+4}{x}$.

$16x = 5x + 4$.

$11x = 4$

$x = \frac{4}{11}$.

(ii) $\log_a y + \log_a 2^3 = 5$.

$\log_a(8y) = 5$.

$a^5 = 8y$.

$y = \frac{a^5}{8}$.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Leave blank

DO NOT WRITE IN THIS AREA

7.

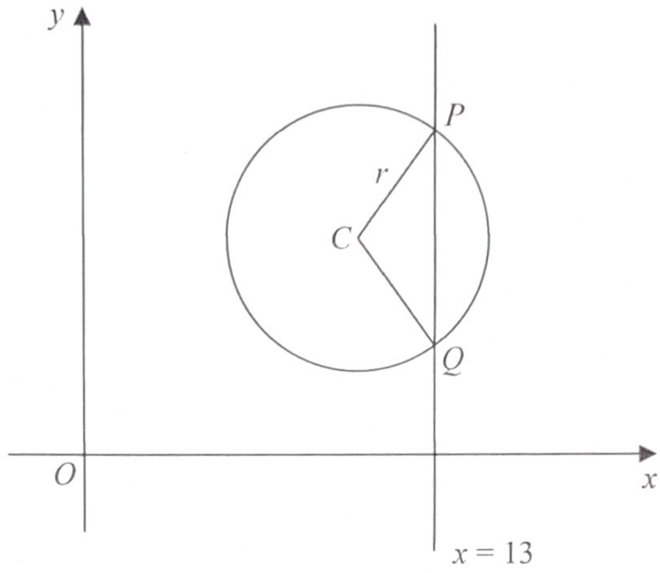

Figure 1

The circle with equation

$$x^2 + y^2 - 20x - 16y + 139 = 0$$

had centre C and radius r.

(a) Find the coordinates of C.

(2)

(b) Show that $r = 5$

(2)

The line with equation $x = 13$ crosses the circle at the points P and Q as shown in Figure 1.

(c) Find the y coordinate of P and the y coordinate of Q.

(3)

A tangent to the circle from O touches the circle at point X.

(d) Find, in surd form, the length OX.

(3)

(a) $x^2 - 20x + y^2 - 16y + 139 = 0$.

$(x-10)^2 - (10)^2 + (y-8)^2 - 8^2 + 139 = 0$.

$(x-10)^2 + (y-8)^2 = 25$.

centre $(10, 8)$

(b) radius $= \sqrt{25} = \underline{5}$

Leave blank

Question 7 continued

(c) $(13-10)^2+(y-6)^2=25.$

$(y-8)^2=16.$

$y-8=\pm 4.$

$y=8\pm 4.$

$P=12 \quad Q=4$

(d) Length OC

$(10,8) \quad (0,0)$

$\sqrt{(10-0)^2+(8-0)^2}$

$=\sqrt{164}.$

$\sqrt{164-25}$

$=\sqrt{139}$

Leave blank

8.

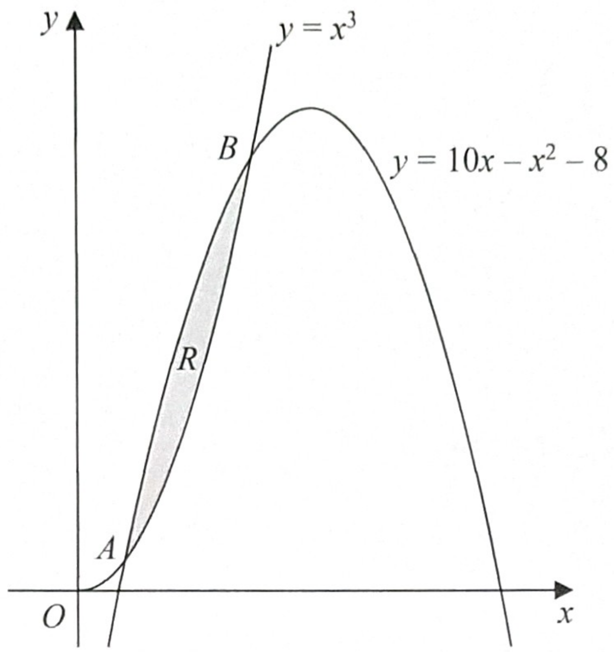

Figure 2

Figure 2 shows a sketch of part of the curves C_1 and C_2 with equations

$$C_1: y = 10x - x^2 - 8 \qquad x > 0$$

$$C_2: y = x^3 \qquad x > 0$$

The curves C_1 and C_2 intersect at the points A and B.

(a) Verify that the point A has coordinates (1, 1)

(1)

(b) Use algebra to find the coordinates of the point B

(6)

The finite region R is bounded by C_1 and C_2

(c) Use calculus to find the exact area of R

(5)

(a) $-x^2 + 10x - 8 = x^3$

$x^3 + x^2 - 10x + 8 = 0.$

$f(1) = 1 + 1 - 10 + 8 = 0$

$\therefore (x-1)$ is a factor.

OR

For C_1 when $x = 1$. $10(1) - (1)^2 - 8 = 1$

C_2 when $x = 1$ $(1)^3 = 1$ $\therefore$ they interesect at $(1, 1)$.

(b)

$$\begin{array}{r|l} & x^2 + 2x - 8 \\ \hline x - 1 & x^3 + x^2 - 10x + 8 \\ & -(x^3 - x^2) \\ \hline & 2x^2 - 10x \\ & -(2x^2 - 2x) \\ \hline & -8x + 8 \\ & -(-8x + 8) \\ \hline & 0 \end{array}$$

Leave blank

Question 8 continued

$(x-1)(x^2+2x-8)$.

$\Rightarrow (x-1)(x+4)(x-2)$.

But since $x>0$

The x co-ordinate for $B = 2$.

$(2,8)$

(c) $\int_1^2 -x^2+10x-8-x^3$

$\left[\frac{-x^3}{3}+\frac{10x^2}{2}-8x-\frac{x^4}{4}\right]_1^2$

$=\frac{-8}{3}+\frac{43}{12}$

$=\frac{11}{12}$ units^2

Leave blank

9. (i) Solve, for $0 \leqslant \theta < \pi$, the equation

$$\sin 3\theta - \sqrt{3}\cos 3\theta = 0$$

giving your answers in terms of π **(3)**

(ii) Given that

$$4\sin^2 x + \cos x = 4 - k, \quad 0 \leqslant k \leqslant 3$$

(a) find $\cos x$ in terms of k **(3)**

(b) When $k = 3$, find the values of x in the range $0 \leqslant x < 360°$ **(3)**

i) $\sin 3\theta = \sqrt{3}\cos 3\theta$.

$\tan 3\theta = \sqrt{3}$.

new range

$\Rightarrow \quad 0 \leq 3\theta \leq 3\pi$.

$\tan^{-1}(\sqrt{3})$

$3\theta = \frac{1}{3}\pi, \frac{4\pi}{3}, \frac{7\pi}{3}, \frac{13\pi}{3}, \frac{10\pi}{3}, \frac{16\pi}{3}$

$\theta = \frac{\pi}{9}, \frac{4\pi}{9}, \frac{7\pi}{9}$.

ii) a) $\sin^2 x = 1 - \cos^2 x$ (known identity)

$4 - 4\cos^2 x + \cos x = 4 - k$.

$4\cos^2 x - \cos x - k = 0$.

$\frac{1 \pm \sqrt{1^2 - 4(4 \times -k)}}{2 \times 4}$

$= \frac{1 + \sqrt{1 + 16k}}{8}$

$\cos x = \frac{1}{8} \pm \frac{\sqrt{1+16k}}{8}$

(b) when $k = 3$.

$\cos x = \frac{-3}{4}$ or 1.

when $\cos x = -3/4$

$x = 138.6, 221.4$

when $\cos x = 1$

$x = 0$ or 360.

$x = 0, 138.6, 221.4$.