Cambridge Assessment Admissions Testing

TEST OF MATHEMATICS FOR UNIVERSITY ADMISSION

D513/11

2024 PAPER 1

Morning

Practice paper

Time: 75 minutes

Additional Materials: Answer sheet

INSTRUCTIONS TO CANDIDATES

Please read these instructions carefully, but do not open the question paper until you are told that you may do so.

A separate answer sheet is provided for this paper. Please check you have one. You also require a soft pencil and an eraser.

There are 20 questions on this paper. For each question, choose the one answer you consider correct and record your choice on the separate answer sheet. If you make a mistake, erase thoroughly and try again.

There are no penalties for incorrect responses, only points for correct answers, so you should attempt all 20 questions. Each question is worth one mark.

Any rough work should be done on this question paper. No extra paper is allowed.

Question 1

Solve the equation

$$log_4(3x-1)^2 = \frac{log_4(12x-4)}{log_4(3x-1)}$$

- A. $x = \frac{3}{5}, x = \frac{2}{3}$
- B. $x = \frac{2}{3}, x = \frac{5}{3}$
- C. $x = \frac{5}{12}, x = \frac{1}{2}$
- D. $x = \frac{5}{3}, x = \frac{1}{2}$

Question 2

Find the number of real solutions to the equation $8 \cdot 3^{2x} + 27 \cdot 2^{2x} = 32 \cdot 6^x$.

- A. 1
- B. 2
- C. 4
- D. 0

Question 3

Which of the following is equal to $(\sqrt{3}+\sqrt{2})^6 - (\sqrt{3}-\sqrt{2})^6$

- A. $396\sqrt{6}$
- B. $192\sqrt{6}$
- C. $388\sqrt{2}$
- D. $132\sqrt{2}$
- E. $384\sqrt{6}$

Question 4

Given that $\theta^2 \leq 2\pi$ and $sin(\theta^2) = \frac{1}{2}$

find the product of all possible solutions for θ.

- A. $\frac{\pi\sqrt{5}}{6}$
- B. $\frac{5\pi^2}{36}$
- C. $-\frac{\pi}{6}$
- D. $\frac{7\pi^2}{24}$
- E. $\frac{11\pi^4}{1296}$
- F. $\frac{3\pi^2}{16}$

Question 5

Given

$$\frac{1}{1-sin\theta}=5$$

find

$$\sum_{r=1}^{\infty} cos^{r}(\theta+\frac{\pi}{2})$$

- A. 1
- B. $-\frac{1}{3}$
- C. 3
- D. $-\frac{4}{9}$
- E. $-\frac{2}{3}$

Question 6

A square with a side length of 1 contains an inscribed equilateral triangle.

Find the area of the equilateral triangle.

- A. $\frac{2\sqrt{3}-3}{4}$
- B. $\frac{\sqrt{3}}{4}$
- C. $\frac{\sqrt{3}}{2}$
- D. $2\sqrt{3}-3$
- E. $\frac{3-\sqrt{3}}{4}$
- F. $1-\frac{\sqrt{3}}{4}$

Question 7

Find the number of points (x, y) where x and y are integers, such that $y \geq |x|$ and $y+|x| \leq 20$

- A. 200
- B. 210
- C. 220
- D. 221
- E. 235
- F. 240

Question 8

Find the number of intersection points between $y^2 - x^2 = 0$ and $y = x^3 - x^2 - 8x + 14$

A. 1

B. 2

C. 4

D. 6

E. 8

Question 9

Let R be the set of all points (x, y) in the xy-plane such that: $\begin{cases} (x+y)^2 - 6(x+y) + 8 \leq 0 \\ (x-y)^2 + 4(x-y) + 3 \leq 0 \end{cases}$

(Note: The boundaries of the region are included in R.)

Find the area of R.

A. 1

B. 2

C. 4

D. 6

E. 8

Question 10

Given real numbers p, q, r such that $p + q + r = 0$ and $0 < r < p$, find the number of solutions of the equation $p\sin^2\theta + q\sin\theta + r = 0$ within the interval $0 < \theta < \pi$.

A. 0

B. 1

C. 2

D. 3

E. 4

F. 5

Question 11

Given a geometric sequence $S_n = \{a_n\}$ such that:

$$a_1 + a_2 + \cdots = 1$$

and

$$a_1 - a_2 + a_3 - a_4 + a_5 - \cdots = 2$$

find the value of the summation:

$$a_1 + a_2 - a_3 + a_4 + a_5 - a_6 + a_7 + a_8 - \cdots$$

- A. $\frac{4}{5}$
- B. $\frac{3}{5}$
- C. $\frac{5}{7}$
- D. $\frac{4}{7}$
- E. $\frac{3}{7}$

Question 12

Given the equations of two curves:

$$y = x^3 - x^2 - 7x + 19$$

and

$$y = x + 7$$

How many regions do these two curves divide the plane into?

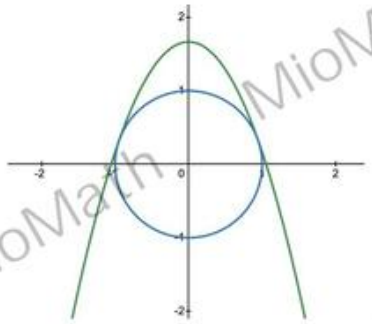
- A. 2
- B. 3
- C. 4
- D. 5
- E. 6
- F. 7

Question 13

Given the following equations: $y = ax^2 + b$ and $x^2 + y^2 = 1$.

Let P and Q be the intersection points of the circle and the quadratic function.

If $ab = -\frac{5}{2}$, find the value of $a + b$.



A. $\frac{5}{3}$

B. $\frac{1}{6}$

C. $\pm\frac{1}{6}$

D. $-\frac{3}{2}$

E. $\frac{9}{2}$

F. $\pm\frac{3}{2}$

Question 14

Circle C_1 has the equation $(x - 3\sqrt{2})^2 + (y - 3\sqrt{2})^2 = 18$. A new circle, C_2, is drawn so that it passes through the point $(0, 3\sqrt{2})$ and is internally tangent to C_1. The difference between the area of C_1 and C_2 is 32π. Which of the following is an equation for C_2?

A. $(x + 5\sqrt{2})^2 + (y - 3\sqrt{2})^2 = 25$

B. $(x + 5\sqrt{2})^2 + y^2 = 50$

C. $(x + 4\sqrt{2})^2 + (y - 3\sqrt{2})^2 = 32$

D. $x^2 + (y - 3\sqrt{2})^2 = 18$

E. $(x - 5\sqrt{2})^2 + (y - 3\sqrt{2})^2 = 50$

Question 15

Point S lies on the line $y = \frac{1}{2}x$ with $OS = 2\sqrt{15}$. Point T lies on the x-axis, with $ST = 4$, and $\angle OTS > \angle OST$. Find the area of $\triangle OST$.

A. $6 - \sqrt{3}$

B. $12 + 2\sqrt{3}$

C. 12

D. $8\sqrt{3} - 2$

E. $12 - 2\sqrt{3}$

Question 16

The curve C is defined as $y = x^3 - x + 17$. The tangent and the normal to C at the point where $x = -1$ form a triangle with the y-axis. Find the area of the triangle.

A. 1

B. $\frac{4}{5}$

C. $\frac{5}{4}$

D. $\frac{2}{3}$

E. $\frac{3}{2}$

F. $\frac{3}{4}$

G. $\frac{4}{3}$

Question 17

ABCD is a cyclic quadrilateral.

The lengths of its sides are $AB = x, BC = 2x + 1, CD = 3x + 8$, and $DA = 4x - 1$.

Angle DAB is a right angle.

Find the value of x.

A. 8

B. 12

C. 16

D. 18

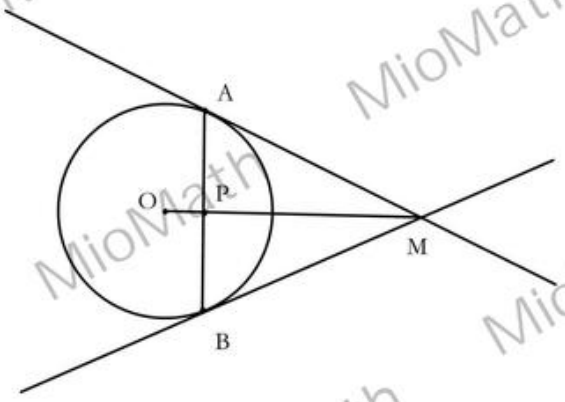
E. 22

F. 32

Question 18

Let O be the center of a circle, and M be a point outside the circle. Two tangents are drawn from M to the circle O, touching the circle at points A and B. The line segment AB is connected, and MO intersects AB at point P. It is given that $OP = y$, $OM = 10y$ and $AB = 2y + 6$.

Find the area of the S_{OBMA}.



A. 270

B. 120

C. 60

D. 135

E. $\frac{135}{2}$

Question 19

Find the area enclosed by the curves

$y = p|x| - p$ and $y = -\frac{1}{p}|x| + p$

when p is a positive constant.

A. $\frac{4p^3}{p^2+1}$

B. $\frac{2p^3}{p^2+1}$

C. $\frac{8p^3}{p^2+1}$

D. $\frac{4p^3}{p-1}$

Question 20

Let $f(x)$ be the greatest integer less than or equal to x

eg. $f(4) = f(4.9) = 4$

Evaluate $\int_0^{50} \lfloor \sqrt{x} \rfloor dx$.

A. 195

B. 203

C. 210

D. 217

Cambridge Assessment Admissions Testing

Test of Mathematics for University Admission (TMUA) 2024

Paper 1 - answer key

Question	Answer
1	D
2	B
3	A
4	B
5	D
6	D
7	D
8	C
9	B
10	D
11	C
12	D
13	B
14	E
15	E
16	C
17	C
18	E
19	A
20	C