TMUA

COMMUNITY PAPERS

OxbridgeMind TMUA Paper 2

Recommended time: 75 minutes

Calculators: not permitted

Format: 15 multiple-choice questions

This community paper is presented in a clean, print-ready format. The wording, mathematics, answer choices, and diagrams are preserved from the source paper.

Paper guidance

- Attempt every question. Select the best answer from the choices given.
- If a diagram is shown, it is reproduced from the source material and may not be drawn to scale.
- This question paper does not include worked solutions or a marked answer key.

Best of luck, and enjoy the challenge!

Source credit: OxbridgeMind

tmua.me editorial edition: corrections applied; original question numbering retained.
15 active questions.
Credit remains with the original author. Editorial history: model-answers/ALTERED-QUESTIONS.md in the repository.

Question 1

How many real roots does the equation $x^4 - x^3 - 5x^2 - x - 6 = 0$ have?

A 0

B 1

C 2

D 3

E 4

Question 2

The terms of an infinite series S are formed by adding together the corresponding terms in two infinite geometric series, T and U.

The first term T and U are each 2.

In orders, first three terms of the continued series are $4, \frac{3}{2}, \frac{5}{8}$.

What is the sum to infinity of S?

A $\frac{1}{2}$

B 2

C $\frac{8}{3}$

D 4

E $\frac{20}{3}$

Question 3

The difference between the two possible values of a, when the gradient of the curve $y = (2x + a)(x - 2a)^2$ is zero at the point where $x = 1$, as a varies.

A $\frac{2}{3}$

B -1

C $-\frac{2}{3}$

D $-\frac{1}{3}$

E $\frac{5}{2}$

This page contains an editorial correction to the supplied paper. The source paper is credited to its original author. Question IDs on this page: p059-q003.

Question 4

Given the simultaneous equations:

$$8^y = 2^{(x-1)^2}$$

$$\log(y + 2 - 2x) = 0$$

The value of y are:

A $8 \pm 4\sqrt{3}$

B $4 \pm 2\sqrt{3}$

C $7 \pm 4\sqrt{3}$

D $9 \pm 2\sqrt{3}$

E $5 \pm 4\sqrt{3}$

Question 5

It is given that $y = (1 + 2\sin x)\sin 2x$ for $0 < x < \frac{3\pi}{2}$.

The complete set of values of x for which y is negative is

A $\frac{\pi}{2} < x < \frac{3\pi}{2}$

B $0 < x < \pi$

C $\frac{\pi}{2} < x < \pi$ or $\frac{7\pi}{6} < x < \frac{3\pi}{2}$

D $\frac{\pi}{2} < x < \frac{7\pi}{6}$

E $0 < x < \frac{\pi}{4}$ or $\frac{\pi}{2} < x < \frac{3\pi}{2}$

Question 6

The function $\frac{2+x}{\sqrt{x^3}}$ is defined for all $x > 0$.

The complete set of values of x for which the function is decreasing is

A $x > 0$

B $x \geq 2$

C $0 < x < 1$

D $x \geq 2$ or $0 < x < 1$

E $x > 1$

Question 7

The coefficient of x^2 in the expansion $(1+3x+2x^2)^5$ is equal to 5 times the coefficient of x^4 in the expansion of $(1+ax^2)^4$.

Find all possible value of the constant a.

A $\pm\sqrt{6}$

B $\pm\sqrt{3}$

C $\pm\sqrt{\frac{10}{3}}$

D ± 3

E $\pm\sqrt{\frac{5}{3}}$

Question 8

How many solutions does the equation $x \sin x = 1$ have in the interval $-2\pi < x < 2\pi$.

A 0

B 2

C 3

D 4

E 6

Question 9

The line segment joining the points $(2, 2)$ and $(6, 4)$ is a diameter of a circle.

This circle is translated by 2 units in the negative x-directions, then reflected in the x-axis and then enlarged by a scale factor of a $\frac{1}{2}$ about the center of the resulting circle.

A $(x+2)^2 + (y-3)^2 = 20$

B $(x-2)^2 + (y+3)^2 = \frac{5}{4}$

C $(x-2)^2 + (y-3)^2 = 5$

D $(x-2)^2 + (y+3)^2 = 80$

E $(x+2)^2 + (y-3)^2 = 25$

This page contains an editorial correction to the supplied paper. The source paper is credited to its original author. Question IDs on this page: p059-q009.

Question 10

Find the maximum angle x in the range $0^\circ \leq x \leq 360^\circ$ which satisfies the equation.

$$\sin^2(2x) + \sqrt{3}\cos(2x) - \frac{7}{4} = 0$$

A 270°

B 300°

C 330°

D 345°

E 360°

Question 11

60% of a sport's club members are men and remainder are women.

The sports club offers the opportunity to play football or rugby. Every member plays exactly one of the two sports.

2/3 of the male members play football

2/5 of rugby members are women

What is the probability that a member chosen at random is a women who plays football?

A $\frac{2}{5}$

B $\frac{1}{5}$

C $\frac{4}{15}$

D $\frac{2}{15}$

E $\frac{3}{15}$

Question 12

A line is drawn normal to the curve $y = \frac{3}{x^2}$ at the point on the curve where $x = 1$. This line cuts the x-axis at P and the y-axis at Q. The area of triangle OPQ where O is the origin is:

A $\frac{243}{12}$

B $\frac{289}{12}$

C $\frac{289}{6}$

D $\frac{289}{24}$

E $\frac{243}{6}$

Question 13

The expression $2x^3 + x^2 - 5x + a$, where a is a constant, has $(x + 2)$ as a factor. Which of the following is a complete factorization of the expression?

A $(x + 2)(2x^2 - 3x + 1)$

B $(x + 2)(2x + 1)(x + 1)$

C $(x + 2)(2x - 1)(x + 1)$

D $(x + 2)(2x - 1)(x - 1)$

E $(x - 2)(2x - 1)(x - 1)$

Question 14

The cross section of a triangular prism is an isosceles triangle with the 2 longer sides having length $2x$ cm and shorter side with length x cm. The length of the prism d cm. Let the total volume of the prism be $\frac{1}{2}T$ cm^3, and the total prism surface area be T cm^2, which one of the following is an expression for d in terms of x?

A $\frac{\sqrt{3x}}{\sqrt{30x-10}}$

B $\frac{2\sqrt{15}x}{2\sqrt{15x-5}}$

C $\frac{\sqrt{30}x}{\sqrt{30x-15}}$

D $\frac{\sqrt{15}x}{\sqrt{15x-10}}$

E $\frac{\sqrt{15}x}{\sqrt{15x-5}}$

Question 15

How many real roots does the equation have:

$$x^4 - 4x^3 + 5x^2 - 8x + 6 = 0$$

A 0

B 1

C 2

D 3

E 4