



Unattributed TMUA Mock Set B Paper 1

Recommended time: 75 minutes

Calculators: not permitted

Format: 20 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: Unattributed

Question 1

Find

$$\int_1^2 \left(3x + \frac{1}{x}\right)^2 dx$$

- A** 13.5
- B** 14.75
- C** 21.5
- D** 26.5
- E** 27.5
- F** 28.75

Question 2

The equation of a curve C is given by

$$y = \frac{x^2 - 2}{\sqrt{x}}$$

Find the gradient of C at the point $(2, \sqrt{2})$.

A $\sqrt{2}$

B $\frac{5}{4}\sqrt{2}$

C $\frac{7}{4}\sqrt{2}$

D $\frac{7}{2}\sqrt{2}$

E $4\sqrt{2}$

F $\frac{9}{2}\sqrt{2}$

G $8\sqrt{2}$

Question 3

The coefficient of x^3 in the expansion of $(2\sqrt{p} + 3x)^5$ is 8640.

What is the value of p ?

A 4

B 8

C 16

D 72

E 80

Question 4

R is the sum to infinity of the geometric progression $1, \sqrt{0.3}, 0.3, 0.3\sqrt{0.3}, \dots$

S is the sum to infinity of the geometric progression $1, -\sqrt{0.3}, 0.3, -0.3\sqrt{0.3}, \dots$

What is the value of $R - S$?

A $-\frac{20}{7}$

B $-\frac{2\sqrt{30}}{7}$

C $-\frac{2\sqrt{3}}{7}$

D $\frac{2\sqrt{3}}{7}$

E $\frac{2\sqrt{30}}{7}$

F $\frac{20}{7}$

Question 5

P is the area of the region bounded by the curve $y = 5x - x^2$ and the x -axis.

Q is the area of the region between the curve $y = 5x - x^2$ and the line $y = 2x$.

What is the ratio $Q : P$?

A 27 : 125

B 54 : 125

C 81 : 125

D 27 : 250

E 81 : 250

Question 6

Find the sum of the real roots of the equation

$$49^x - 7^{x+1} + 12 = 0$$

A 1

B 7

C $\log_{10} 12$

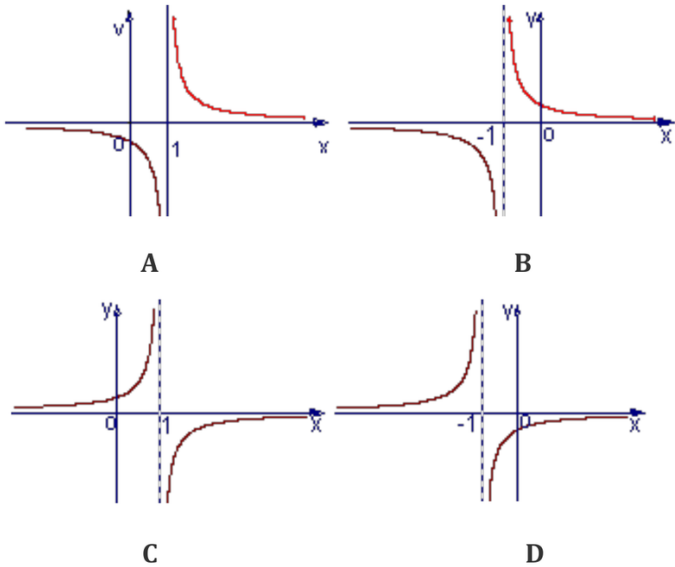
D $\log_{10} \left(\frac{12}{49} \right)$

E $\frac{\log_{10} 12}{\log_{10} 7}$

Question 7

Which of the following graphs is the image of the inverse function of

$$y = \frac{1 - x}{x} \quad (x \neq 0)?$$



- A A
- B B
- C C
- D D

Question 8

The function f is given by

$$f(x) = 2x^3 + px^2 + qx + 6$$

where p and q are real constants.

When $f(x)$ is divided by $(x + 1)$, the remainder is 12.

When $f(x)$ is divided by $(x - 1)$, the remainder is -6 .

Find the remainder when $f(x)$ is divided by $(2x - 1)$.

- A** 0
- B** 4.5
- C** 9
- D** 10.5
- E** 11

Question 9

The curve C has equation $y = x^3 - 7x - 6$.

Find the equation of the tangent to C at the point where C cuts the positive x -axis.

A $y = 4 - 4x$

B $y = 2x - 6$

C $y = 5x - 10$

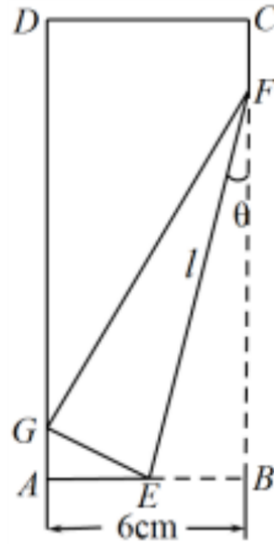
D $y = 9x - 27$

E $y = 20x - 60$

Question 10

There is a rectangle $ABCD$. We fold the lower right corner of the rectangular paper $ABCD$ so that the vertex of the corner falls on the side AD of the rectangle and is denoted as G .

If $\sin \theta = \frac{1}{4}$, the length of l is



- A $\frac{64}{5}$
- B $\frac{32}{5}$
- C $\frac{16}{5}$
- D 5
- E 13

Question 11

The simultaneous equations

$$3x^2 - xy = 4$$

$$2x - y = p$$

where p is a real constant, have two distinct real solutions for x .

What is the complete set of values that p can take?

- A** p can take any value
- B** $p < -4, p > 4$
- C** $-4 < p < 4$
- D** there are no possible values of p

Question 12

For an arithmetic sequence a_n , $a_1 + a_2 + \cdots + a_{100} + a_{101} = 0$.

Which of the following is correct?

A $a_1 + a_{101} > 0$

B $a_2 + a_{100} < 0$

C $a_3 + a_{99} = 0$

D $a_{51} = 51$

Question 13

Curve C has an equation $(x - 1)^2 + (y - 2)^2 = 5$.

Line L intersects curve C at A and B . Line L : $y = x$.

Find the distance AB .

A 9

B 7

C $3\sqrt{2}$

D 8

E 5

Question 14

The quadratic function $f(x) = x^2 + 2ax + 2b$ has two distinct roots x_1 and x_2 .

If $-1 < x_1 < 1 < x_2 < 2$, then which of the following is the range of the slope of the line $bx - (a-1)y + 3 = 0$?

A $\left(-\frac{2}{5}, \frac{2}{3}\right)$

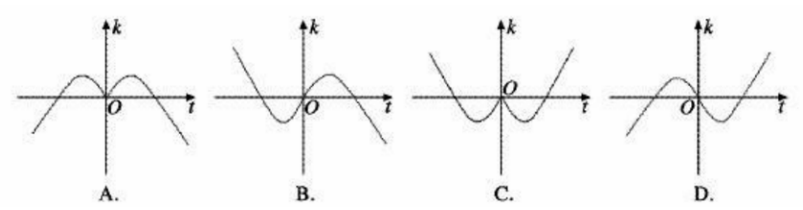
B $\left(-\frac{2}{5}, \frac{3}{2}\right)$

C $\left(-\frac{2}{5}, \frac{1}{2}\right)$

D $\left(-\infty, \frac{2}{5}\right) \cup \left(\frac{2}{3}, +\infty\right)$

Question 15

Which of the following is the image of the derivative function of $f(x) = x \sin x + \cos x$?



- A A
- B B
- C C
- D D

Question 16

For the equation

$$\sin x = \frac{x}{2}$$

use a graphical method or otherwise to find the total number of real solutions.

- A** 1
- B** 2
- C** 3
- D** 4
- E** 5

Question 17

We define the slope of the tangent for the function $f(x) = \ln x$ at $x = n$ (n is an integer) as a_n .

Then what is the value of $a_1a_2 + a_2a_3 + a_3a_4 + \dots + a_{2010}a_{2011}$?

- A $\frac{2010}{2011}$
- B $\frac{2009}{2010}$
- C $\frac{2009}{2011}$
- D $\frac{2011}{2012}$

Question 18

The equation

$$\frac{|\sin x|}{x} = k \quad (k > 0)$$

has exactly two different real solutions θ, φ (with $\theta > \varphi$).

Which of the following statements is correct?

- A** $\sin \varphi = \varphi \cos \theta$
- B** $\sin \varphi = -\varphi \cos \theta$
- C** $\cos \varphi = \theta \sin \theta$
- D** $\sin \theta = -\theta \sin \varphi$

Question 19

Suppose that x_1, x_2 are two different roots of

$$f(x) = x^2 + mx + \sqrt{1 + m^2} = 0$$

There is a line passing through the points $A(x_1, x_1^2)$ and $B(x_2, x_2^2)$.

How many intersections are there between the line and the circle $x^2 + y^2 = 1$?

- A** 0
- B** 1
- C** 2
- D** changing with different values of m

Question 20

The graph of $y = f(x)$ intersects the x -axis at exactly two distinct points.

Consider the graphs of the following:

I. $y = f(x) + 2$

II. $y = f(x + 2)$

III. $y = 2f(x)$

IV. $y = 2 - f(x)$

V. $y = f(-2x)$

How many of these graphs **necessarily** intersect the x -axis at exactly two distinct points?

A 0

B 1

C 2

D 3

E 4

F 5