



Unattributed TMUA Mock Set A 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

$f(x)$ is a quadratic function in x .

The graph of $y = f(x)$ passes through the point $(-1, 12)$ and has a turning point at $(3, -4)$.

Find an expression for $f(x)$.

A $x^2 + 6x + 5$

B $x^2 - 6x + 5$

C $4x^2 + 24x + 32$

D $4x^2 - 24x + 32$

E $x^2 + 6x + 8$

F $x^2 - 6x + 8$

Question 2

The sum of all binomial coefficients in the expansion of

$$\left(2x - \frac{a}{\sqrt{x}}\right)^n$$

is 64, and the constant term in the expansion is 60.

What is the value of a ?

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

Question 3

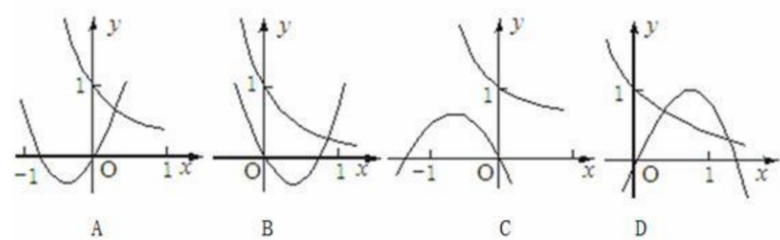
$\{a_n\}$ and $\{b_n\}$ are two arithmetic sequences, where $\frac{a_k}{b_k}$ ($1 \leq k \leq 5$) is a constant value.

Given $a_1 = 288$, $a_5 = 96$ and $b_1 = 192$, what is the value of b_3 ?

- A 64
- B 128
- C 256
- D 512
- E 1024

Question 4

The graphs of a quadratic function $y = ax^2 + bx$ and an exponential function $y = \left(\frac{b}{a}\right)^x$ can be:



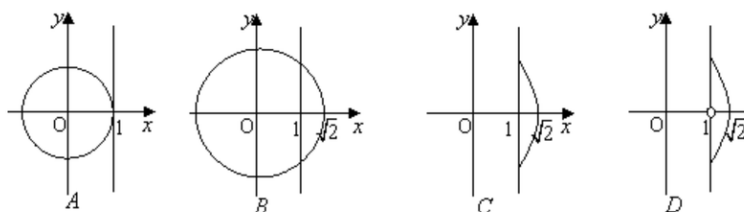
- A none of them
- B A
- C B
- D C
- E D

Question 5

The graph of the curve represented by the equation

$$\sqrt{x-1} \log_{10}(x^2 + y^2 - 1) = 0$$

is



A none of them

B A

C B

D C

E D

Question 6

If the circle C : $(x - 1)^2 + y^2 = 1$ is tangent to the circle C_2 : $x^2 + y^2 - 8x + 8y + m = 0$, then the value of m can be

- A** 16 or -4
- B** 7 or -7
- C** 7 or -4
- D** 16 or -7
- E** 4 or -4
- F** 16 or -16

Question 7

In the sequence $\{a_n\}$, $a_1 = -\frac{1}{4}$ and

$$a_n = 1 - \frac{1}{a_{n-1}} \quad (n > 1)$$

then the value of a_{2014} is

- A** $-\frac{1}{4}$
- B** 5
- C** $\frac{4}{5}$
- D** none of the above
- E** $\frac{1}{4}$

Question 8

The greatest value which the function

$$f(x) = \left(3 \sin^2(10x + 11) - 7\right)^2$$

takes, as x varies over all real numbers, equals

A -9

B 16

C 49

D 100

E 3

Question 9

The number of roots of the equation

$$\sqrt{x} - \ln x - 2 = 0$$

is

A 0

B 1

C 2

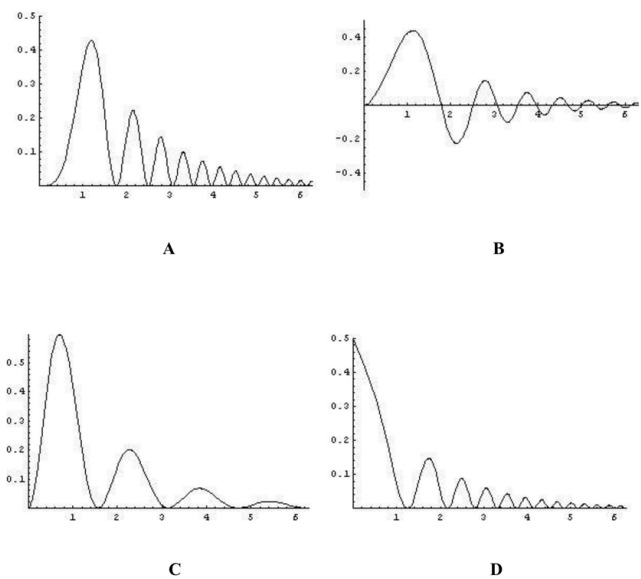
D 3

E 4

Question 10

Which of the following graphs is the graph of the function

$$y = 2^{-x} \sin^2(x^2) \text{ ?}$$

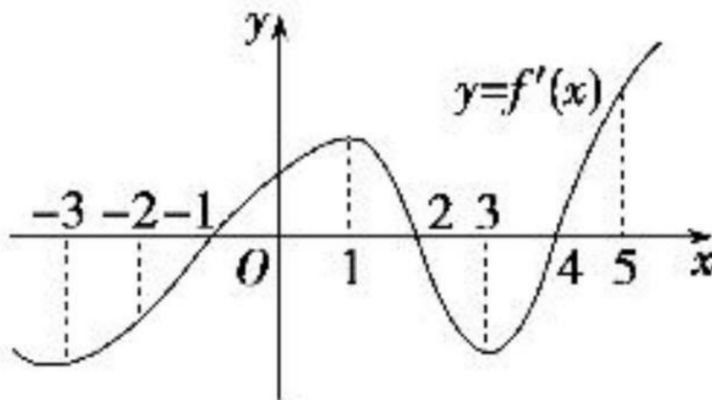


- A A
- B B
- C C
- D D

Question 11

The graph of the derivative function $y = f'(x)$ of the function $y = f(x)$ is shown in the figure. How many of the following conclusions are correct?

- I. $f(x)$ is increasing on $(-3, -1)$.
- II. $f(x)$ is increasing on $(1, 2)$.
- III. $f(x)$ is decreasing on $(1, 3)$.
- IV. $f(x)$ obtains a minimum value when $x = 4$.



- A 0
- B 1
- C 2
- D 3
- E 4

Question 12

$f(x) = \sin(ax + b)$, where $a > 0$ and $|b| \leq \frac{\pi}{2}$.

$x = -\frac{\pi}{4}$ is a zero of $f(x)$, and $f(x) \leq \left|f\left(\frac{\pi}{4}\right)\right|$ for all x .

If there is a minimum but no maximum in the interval $\left(-\frac{\pi}{12}, \frac{\pi}{24}\right)$, then the maximum value of a is

A 11

B 13

C 15

D 17

E 19

Question 13

The tangent to the curve $y = \frac{2x}{x-1}$ at the point $P(2, 4)$ is parallel to the line l , and the distance between them is $2\sqrt{5}$.

Then the equation of the line l is

- A** $2x + y + 2 = 0$
- B** $2x + y + 2 = 0$ or $2x + y - 18 = 0$
- C** $2x - y - 18 = 0$
- D** $2x - y + 2 = 0$ or $2x - y - 18 = 0$

Question 14

The derivative of the function $f(x)$ is $f'(x)$. If there exists x_0 such that $f(x_0) = f'(x_0)$, then x_0 is a **coincidence point** of $f(x)$.

How many of the following functions have a coincidence point?

I. x

II. x^2

III. $\frac{1}{x}$

IV. $\ln x$

V. $\left(\frac{1}{e}\right)^x$

A 0

B 1

C 2

D 3

E 4

F 5

Question 15

l is a tangent to the curve $y = x^2 - 2x + 3$, and l meets the curve at P . If the range of the x -coordinate of P is $\left[1, \frac{3}{2}\right]$, then which of the following is the range of the inclination angle of the tangent?

- A** $\left[0, \frac{\pi}{2}\right]$
- B** $\left[0, \frac{\pi}{4}\right]$
- C** $[0, \pi]$
- D** $[0, \pi)$
- E** $\left[\frac{3\pi}{4}, \pi\right)$
- F** $\left[\frac{3\pi}{4}, \pi\right]$

Question 16

The graph of the function $g(x)$ is translated to the left by $\frac{\pi}{6}$ to give the graph of $f(x) = \sin\left(2x - \frac{\pi}{6}\right)$.

What is the minimum value of $y = g(x) + \cos 2x$ on the interval $\left[0, \frac{\pi}{2}\right]$?

A $\sqrt{3}$

B 2

C $-\sqrt{3}$

D $\frac{3}{2}$

E -2

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

Question 17

If the function $f(x)$ ($x \in \mathbb{R}$) is even and the function $g(x)$ ($x \in \mathbb{R}$) is odd, then

- A** the function $f(x) + g(x)$ is an odd function
- B** the function $f(x)g(x)$ is an even function
- C** the function $f[g(x)]$ is an even function
- D** the function $g[f(x)]$ is an odd function

Question 18

$\{a_n\}$ is a geometric sequence. Which of the following holds for any positive integer k ?

A $a_k a_{k+1} > 0$

B $a_k a_{k+2} > 0$

C $a_k a_{k+1} a_{k+2} > 0$

D $a_k a_{k+3} > 0$

E $a_{k+1} a_{k+2} > 0$

Question 19

$f(x)$ is an odd function whose domain is $\mathbb{R}$, and $f(1) = 0$.

When $x > 0$,

$$x f'(x) - f(x) < 0$$

What is the complete set of x for which $x^2 f(x) > 0$?

A $(-\infty, -1) \cup (1, +\infty)$

B $(-\infty, -1) \cup (0, 1)$

C $(-1, 0) \cup (0, 1)$

D $(-1, 0) \cup (1, +\infty)$

Question 20

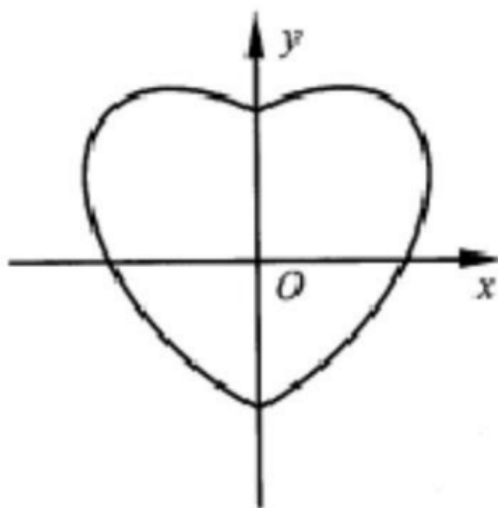
There are many beautifully shaped and meaningful curves in mathematics, and the curve C :

$$x^2 + y^2 = 1 + |x|y$$

is one of them. Consider the following three statements:

- I. The curve C passes through exactly 6 points whose horizontal and vertical coordinates are both integers.
- II. The distance from any point on the curve C to the origin does not exceed $\sqrt{2}$.
- III. The area of the heart-shaped region enclosed by the curve C is less than 3.

How many of these statements are true?



- A none of them
- B 1
- C 2
- D 3