

Mock TMUA Set C: Paper 1

20 questions

75 minutes

No calculator allowed

1.

The function f is given by $f(x) = \left(\frac{x}{2} - \frac{6}{x^2}\right)^2$ $x \neq 0$

What is the value of $f''(2)$

- A $-\frac{9}{2}$ B $\frac{25}{4}$ C 9 D $\frac{41}{4}$ E $\frac{53}{2}$

2.

A line l has equation $3y + x = 15$.

A second line is perpendicular to l and passes through the point $(0, -3)$.

Find the area of the region enclosed by the two lines and the y -axis.

- A $4\frac{1}{5}$ B 8 C $9\frac{3}{5}$ D 12 E $19\frac{1}{5}$

3.

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

The graph of $f(x)$ passes through the point $(0,1)$ and has a turning point at $(-1, -1)$.

Find an expression for $f(x)$.

- A $f(x) = 2x^2 + 4x + 1$
B $f(x) = 2x^2 + 5x + 2$
C $f(x) = 3x^2 + 5x + 1$
D $f(x) = -2x^2 + 1$
E $f(x) = -x^2 + x + 1$

4.

Given that $\int_1^2 \frac{2a + bx^2}{x^2} dx = 2$ find the value of $a + b$

- A 0 B $\frac{1}{4}$ C $\frac{1}{2}$ D 1 E 2

5.

The 1st, 2nd and 3rd terms of a geometric progression are also the 1st, 4th and 5th terms, respectively, of an arithmetic progression.

The sum to infinity of the geometric progression is 9.

Find the first term of the geometric progression.

- A 4 B $\frac{14}{3}$ C 5 D $\frac{16}{3}$ E 6

6.

The two circles with equations below have exactly one point in common.

$$(x + 2)^2 + (y - 3)^2 = 49 \quad \text{and} \quad (x - 4)^2 + (y + 5)^2 = r^2 \quad \text{where } r > 0$$

Find the sum of the two possible values of r .

- A 17 B 20 C 21 D 24 E 28

7.

What is the coefficient of x^3 in the series expansion of $(x - \frac{1}{2})^7(x^2 + 1)^3$

- A $\frac{161}{32}$
- B $\frac{147}{64}$
- C $\frac{161}{64}$
- D $\frac{147}{32}$

8.

How many solutions are there to

$$(4\cos 2\theta - 1)^2 = 9 \quad \text{for } -180^\circ \leq \theta \leq 180^\circ ?$$

- A 4 B 5 C 6 D 7 E 8

9.

The function $f(x)$ is such that $f(0) = 0$ and $xf(x) < 0$ for $x \neq 0$

You are given that $\int_{-5}^5 f(x) \, dx = 2$ $\int_{-5}^5 |f(x)| \, dx = 16$

Find $\int_{-5}^5 f(|x|) \, dx$

- A -14 B -4 C 0 D 4 E 14

10.

The four digit number 4284 is such that any two consecutive digits from it make a multiple of 14. Another number N has this same property, but it has 50 digits and the first digit is 9.

What is the last digit of N?

- A 1 B 2 C 4 D 8 E 9

11.

Find the minimum value of the function $2^{(2x+1)} - 2^{(x+3)} - 2$

- A -10 B -8 C $-\frac{25}{8}$ D -2 E $-\frac{25}{16}$

12.

The line $y = 2$ divides the circle $x^2 + y^2 = 8$ into two segments.

What is the area of the smaller segment?

- A $2\pi - 4$
B π
C 2π
D $\frac{\sqrt{2}}{2}\pi - 1$
E $16\pi - 32$

13.

Find the real non-zero solution to the equation $\frac{9^{(4^x)}}{27^{(2^x)}} = \frac{1}{3}$.

- A $\log_3 2$ B $\log_2 3$ C -1 D $-\log_2 3$ E $-\log_3 2$

14.

Find the area between the curves with equations $y = \sqrt{px}$ and $x = \sqrt{py}$

where p is a positive constant

- A $\frac{1}{3}p^3$ B $\frac{2}{3}p^2 - \frac{1}{2}p^3$ C $\frac{1}{3}p^2$ D $\frac{2}{3}p^{\frac{3}{4}} - \frac{1}{3}p^2$ E p^3

15.

The function f is such that for every integer n $\int_0^n f(x) \, dx = \frac{1}{2}n(n+1)$

Evaluate $\sum_{r=1}^5 \left(\int_r^{r+2} f(x) \, dx \right)$

- A 7 B 14 C 15 D 28 E 45

16.

Given that $f(x) = \log\left(\frac{1+x}{1-x}\right)$, where $-1 < x < 1$

then $f\left(\frac{3x+x^3}{1+3x^2}\right) - f\left(\frac{2x}{1+x^2}\right)$ is equal to

- A $-f(x)$
- B $f(x)$
- C $3f(x)$
- D $(f(x))^2$
- E $(f(x))^3$

17.

The minimum value of the function $x^4 - (px)^2$ is -16 where p is a real number.

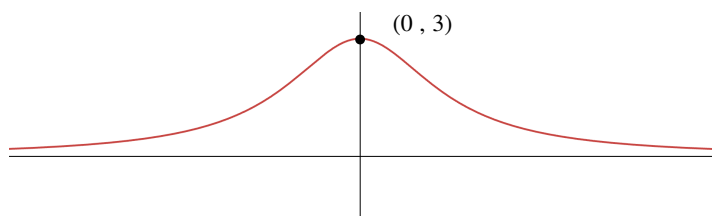
Find the minimum value of the function $x^2 + px + 5$

- A -5
- B $5 - \sqrt{2}$
- C $2\sqrt{2}$
- D 3
- E 5

18.

The diagram shows the graph of $y = f(x)$.

The function f attains its maximum value at $(0,3)$ and $f(x) > 0$ for all values of x .



Find the difference between the maximum and minimum values of $(f(x))^3 - 3f(x)$

- A 0
- B 4
- C 12
- D 18
- E 20

19.

The equation $\cos^2(4^{\sin\theta} \times 30^\circ) = \frac{1}{4}$ has exactly two solutions in the range $0^\circ \leq \theta \leq x^\circ$

What is the range of all possible values of x ?

A $30 \leq x < 150$

B $60 \leq x < 180$

C $60 \leq x < 390$

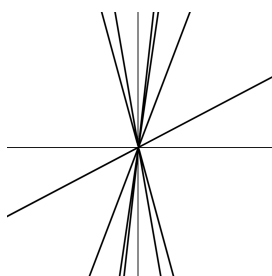
D $90 \leq x < 150$

E $90 \leq x < 390$

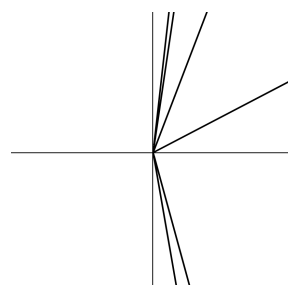
20.

Which of the following sketches shows the graph of $\sin\left(\frac{y}{x}\right) = \frac{1}{2}$ for $-3\pi x \leq y \leq 3\pi x$

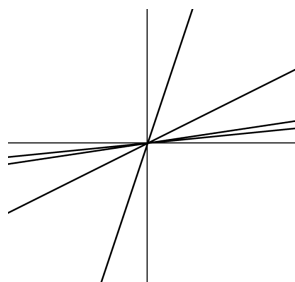
A



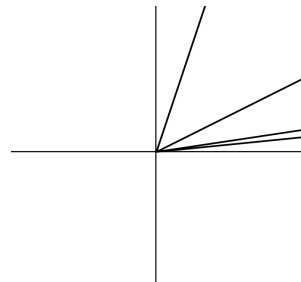
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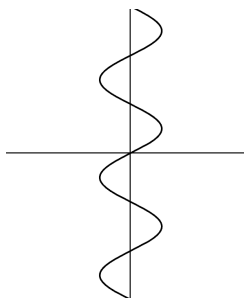
C



D



E



F

