2025-2026 AUT
3rd Admission Examination

Mathematics (Type A)

ID (Application Number)	
Full Name	
Major	

2025-2026 AUT 1st Admission Test (Mathematics, Type A)

1. [5 pts] If $F(x) = \int_2^x (t^2 - \sin t)dt$, what is $F'(x)$?

   (1) $x^2 - \sin x$
   (2) $\frac{x^3}{3} + \cos x - \left(\frac{8}{3} + \cos 2\right)$
   (3) $2x - \cos x$
   (4) $x^2 - \sin x - (4 - \sin 2)$
   (5) $t^2 - \sin t$

2. [4 pts] On what interval is the function $f(x) = 2x^3 - 3x^2 - 12x + 1$ decreasing?

   (1) $(-\infty, -1)$ (2) $(-\infty, \infty)$ (3) $(2, \infty)$ (4) $(-\infty, -1) \cup (2, \infty)$ (5) $(-1, 2)$

3. [4 pts] A fruit basket contains two types of apples. Type A apples weigh $150g$ each, and Type B apples weigh $180g$ each. If 70% of the apples are Type A and 30% are Type B, what is the average weight of an apple in the basket?

   (1) $150g$ (2) $159g$ (3) $165g$ (4) $171g$ (5) $180g$

4. [3 pts] Find the solution for the following equation?

   $$\log_2(x - 1) = 3$$

   (1) 7 (2) 8 (3) 9 (4) 5 (5) 3

5. [4 pts] If $f(x) = x^2 - 1$ and $g(x) = 2x + 1$, what is $f(g(x))$?

   (1) $2x^2 + 1$
   (2) $4x^2 + 4x + 2$
   (3) $4x^2 + 4x$
   (4) $(2x + 1)(x^2 - 1)$
   (5) $2x^2 - 1$

6. [3 pts] If $x + \frac{1}{x} = 3$, what is the value of $x^2 + \frac{1}{x^2}$?

   (1) 5 (2) 7 (3) 9 (4) 11 (5) Cannot be determined

7. [4 pts] A committee of 3 people is to be chosen from a group of 7 people. How many different committees can be formed??

   (1) 21 (2) 35 (3) 42 (4) 210 (5) 840

8. [4 pts] A sphere has a radius r. A closed cylinder has a base radius R and a height H. The height of the cylinder is equal to the diameter of its base. If the surface area of the sphere is equal to the total surface area of the cylinder, what is the ratio r/R?

(1) $\frac{\sqrt{2}}{2}$ (2) 1 (3) $\frac{3}{2}$ (4) $\frac{\sqrt{6}}{3}$ (5) $\frac{\sqrt{6}}{2}$

9. [5 pts] The formula for continuous compounding is $A = Pe^{rt}$, where A is the future value of an initial principal investment P after t years at an annual interest rate r. Approximately how many years will it take for an investment to double at a rate of 7%? (Use $\ln 2 = 0.693$)?

(1) 7 years (2) 9.9 years (3) 14 years (4) 20 years (5) 0.099 years

10. [4 pts] A circle has a radius of 4 units. A sector of this circle has a central angle of $90°$. What is the area of the segment formed by this sector (the region bounded by the arc and the chord connecting its endpoints)?

(1) $16\pi - 8$ (2) $4\pi - 4$ (3) $4\pi - 8$ (4) $2\pi - 4$ (5) $8\pi - 16$

11. [4 pts] Which single transformation maps triangle ABC with vertices $\mathrm{A}(1,1)$, $\mathrm{B}(3,1)$, $\mathrm{C}(1,4)$ to triangle $\mathrm{A'B'C'}$ with vertices $\mathrm{A'}(-1,-1)$, $\mathrm{B'}(-3,-1)$, $\mathrm{C'}(-1,-4)$?

(1) Reflection over x-axis
(2) Reflection over y-axis
(3) $90°$ rotation counterclockwise about origin
(4) $180°$ rotation about origin
(5) Translation by $(-2,-2)$

12. [4 pts] A right-angled triangle has legs of length 3 cm and 4 cm. What is the radius of its inscribed circle (inradius)?

(1) 0.5 cm (2) 1 cm (3) 1.5 cm (4) 2 cm (5) 2.5 cm

13. [4 pts] Find the equation of the perpendicular bisector of the line segment connecting the points $\mathrm{A}(-2,3)$ and $\mathrm{B}(4,7)$?

(1) $3x + 2y - 13 = 0$
(2) $2x - 3y + 13 = 0$
(3) $3x + 2y - 11 = 0$
(4) $2x + 3y - 17 = 0$
(5) $3x - 2y + 7 = 0$

14. [4 pts] The vertices of a rectangle are $A(1,1)$, $B(5,1)$, $C(5,4)$, and $D(1,4)$. What is the perimeter of the rectangle?

(1) 10 units (2) 12 units (3) 14 units (4) 16 units (5) 20 units

15. [4 pts] In a class, 60% of students pass a math test, and 45% of students pass both math and science tests. If a student passed the math test, what is the probability they also passed the science test?

(1) 0.27 (2) 0.45 (3) 0.60 (4) 0.75 (5) 0.80

16. [3 pts] Consider the dataset: 10, 12, 13, 15, 100. Which statement is true?

(1) The mean is less than the median.
(2) The mean is greater than the median.
(3) The mean and median are equal.
(4) The mode is the best measure of central tendency.
(5) The range is smaller than the median.

17. [4 pts] What is the scalar projection of vector $a = (2,2,1)$ onto vector $b = (1,-1,0)$?

(1) 0 (2) 1 (3) $\sqrt{2}$ (4) $1/\sqrt{2}$ (5) 4

18. [4 pts] Find the equation of the line that passes through the point $(2,-3)$ and is parallel to the following line.

$$4x + 5y - 1 = 0$$

(1) $4x + 5y + 7 = 0$
(2) $4x - 5y - 23 = 0$
(3) $5x - 4y - 22 = 0$
(4) $4x + 5y - 7 = 0$
(5) $5x + 4y + 2 = 0$

19. [4 pts] How many non-negative integer solutions (x, y) does the equation $3x + 5y = 47$ have?

(1) 1 (2) 2 (3) 3 (4) 4 (5) 0

20. [4 pts] If $f(x) = \frac{\sin x}{x^2+1}$, what is $f'(x)$?

(1) $\frac{\cos x - 2x \sin x}{(x^2+1)^2}$
(2) $\frac{(x^2+1)\cos x + 2x \sin x}{(x^2+1)^2}$
(3) $\frac{2x \sin x - (x^2+1)\cos x}{(x^2+1)^2}$
(4) $\frac{\cos x}{2x}$
(5) $\frac{(x^2+1)\cos x - 2x \sin x}{(x^2+1)^2}$

21. [5 pts] The radius r of a circle is increasing at a rate of 2cm/s. At what rate is the area A of the circle increasing when the radius is 10 cm?

(1) $20\pi\ \text{cm}^2/\text{s}$ (2) $200\pi\ \text{cm}^2/\text{s}$ (3) $100\ \text{cm}^2/\text{s}$ (4) $4\pi\ \text{cm}^2/\text{s}$ (5) $40\pi\ \text{cm}^2/\text{s}$

22. [4 pts] Evaluate the limit:

$$\lim_{x \to 3} \frac{x^2 - 9}{x - 3}$$

(1) 0 (2) 1 (3) 3 (4) 6 (5) Does not exist

23. [4 pts] A sequence is defined recursively by $a_1 = 2$ and $a_{n+1} = 2a_n - 1$ for $n \geq 1$. What is the value of a_4?

(1) 3 (2) 5 (3) 7 (4) 9 (5) 15

24. [4 pts] Evaluate the sum: $\sum_{k=1}^{4} 3 \cdot 2^{k-1}$

(1) 12 (2) 21 (3) 30 (4) 45 (5) 48

25. [4 pts] For what value of c is the function $f(x)$ continuous everywhere?

$$f(x) = \begin{cases} x^2 - 1 & \text{if } x < 3 \\ 2cx + 2 & \text{if } x \geq 3 \end{cases}$$

(1) 0 (2) 4/3 (3) 3 (4) 2 (5) 1

English	Uzbek	Russian
Absolute Value	Modul	Абсолютное значение / модуль
Angle Bisector	Burchak bissektrisasi	Биссектриса угла
Optimization	Optimizatsiya	Оптимизация
Area	Yuza	Площадь
Arithmetic Sequence	Arifmetik progressiya	Арифметическая прогрессия
Chain Rule	Zanjir qoidasi	Правило цепочки
Combinatorial Probability	Kombinatorik ehtimollik	Комбинаторная вероятность
Coordinate Geometry	Koordinata geometriyasi	Координатная геометрия
Derivative	Hosila	Производная
Exponential Function	Ko'rsatkichli funksiya / eksponensial funksiya	Показательная функция / экспоненциальная функция
Factorization	Ko'paytuvchilarga ajratish	Факторизация / разложение на множители
Geometric Sequence	Geometrik progressiya	Геометрическая прогрессия
Horizontal/Vertical Asymptotes	Gorizontal / Vertikal assimptotlar	Горизонтальные / вертикальные асимптоты
Inequality	Tengsizlik	Неравенство
Limit	Limit	Предел
Logarithm	Logarifm	Логарифм
Parameter	Parametr	Параметр
Probability	Ehtimollik	Вероятность
Product Rule	Ko'paytirish qoidasi	Правило произведения
Quadratic Equation	Kvadrat tenglama	Квадратное уравнение
Recurrence Relation	Rekurrent munosabat	Рекуррентное соотношение
Sequence	Ketma-ketlik	Последовательность
System of Equations	Tenglamalar sistemasi	Система уравнений
Tangent	Tangens	Тангенс
Trigonometric Equation	Trigonometrik tenglama	Тригонометрическое уравнение