2024−2025 AUT

Admission Examination Sample

Mathematics

Test ID Number	
Full Name	
Major	

- **These sample questions for your references. In real exam there will be 25 questions for 90 minutes.**

1. Vectors $\boldsymbol{i}$ and $\boldsymbol{j}$ are unit vectors in x and y directions, respectively. A unit vector perpendicular to $2\boldsymbol{i} + 3\boldsymbol{j}$ is

① $(3\boldsymbol{i} - 2\boldsymbol{j})/\sqrt{13}$ ② $(-2\boldsymbol{i} + 3\boldsymbol{j})/\sqrt{13}$ ③ $\boldsymbol{i} - \boldsymbol{j}$

④ $(\boldsymbol{i} - \boldsymbol{j})/\sqrt{2}$ ⑤ $(3\boldsymbol{i} + \mathbf{2}\boldsymbol{j})/\sqrt{13}$

2. Find the slope of the tangent line to the curve $y^3 = x$ at (x, y) = (-1, -1).

① $\frac{1}{2}$ ② $-\frac{1}{4}$ ③ $\frac{1}{3}$ ④ $\frac{1}{4}$ ⑤ $-\frac{1}{3}$

3. What is the range of x that satisfies the inequality, $\cos x \geq \sin x$

in [0 ; π]

① $[0 ; \frac{\pi}{4}]$ ② $[\frac{\pi}{4} ; \frac{\pi}{2}]$ ③ $[\frac{\pi}{2} ; \frac{3\pi}{4}]$ ④ $[\frac{3\pi}{4} ; \pi]$ ⑤ [0 ; π]

4. Evaluate the following determinant:

$$\begin{vmatrix} 2 & 3 & 1 \\ 1 & 2 & 1 \\ 4 & -2 & 0 \end{vmatrix}$$

① 1 ② 4 ③ -1 ④ -4 ⑤ 6

5. For the value of $x > 1$, find the minimum of $\frac{x^3}{x-1}$

① 2 ② 3.775 ③ 6.75 ④ 12.5 ⑤ 25

6. If $\sin\alpha = \frac{3}{5}$, then $\cos(2\alpha)$ is equal to

① $\frac{7}{25}$ ② $-\frac{7}{25}$ ③ $\frac{9}{25}$ ④ $-\frac{9}{25}$ ⑤ $\frac{2}{5}$

7. If $a + b = 1$ and $a - b = 3$, find $a^2 + b^2$.

① 1 ② 2 ③ 3 ④ 4 ⑤ 5

8. Let $a, b, and\ z$ be complex numbers.

Find $a\ and\ b$ such that the following holds for all z:

$$\frac{1}{z^2+4} = \frac{a}{z+i2} + \frac{b}{z-i2}$$

① $a = 1,\ b = -1$ ② $a = i, b = i$ ③ $a = i, b = -i$

④ $a = \frac{i}{2}, b = \frac{i}{2}$ ⑤ $a = \frac{i}{4}, b = -\frac{i}{4}$