Faculty of Sciences

Faculty of Engineering

Department of Mathematics

Mathematics Placement Test

Instructions

The Mathematics Placement Test is required for all applicants applying for both Faculties of Sciences and Engineering. The test consists of 24 MCQ exercises that must be solved within 60 minutes. The passing grade is 12/24. The exercises target the following topics:

A- **Functions (Absolute value, Trigonometric functions, Rational functions, Logarithmic function, Exponential function)**:

1- Domain of Definition.
2- Range.
3- Solving equation and inequalities.
4- Limits.
5- Continuity.
6- Differentiation.
7- Variations.
8- Tangents.
9- Graphs.
10- Composite functions.
11- Inverse functions.

B- **Integration and Areas**:

1- Substitution method.
2- Integration by parts (including tabular method).

C- **Complex numbers**:

1- Operations.
2- Magnitudes, arguments and distances.
3- Exponential form.
5- Trigonometric form.
6- Power of complex number.
7- Solving nth root of complex number.

D- **Vectors in the space**:

1- Plotting.
2- Operations.
3- Dot product (including properties and applications).

4- Cross product (including properties and applications).
5- Distances and magnitudes.
6- Angles between vectors.

Remark: All types of calculators are not allowed.

Sample Placement Test

Exercise 1:

The domain of the function $f(x) = \dfrac{x-4}{(x+4)(x-3)}$ is given by

1. $\mathbb{R}\setminus\{4,-4\}$.

2. $\mathbb{R}\setminus\{-4,-3\}$.

3. $\mathbb{R}\setminus\{-4,4,3\}$.

4. $\mathbb{R}\setminus\{-4,3\}$. ✓

5. None of the above.

Exercise 2:

If $f(x) = \cos(x)$ and $g(x) = x^2 - \sqrt{x}$, then the composite function $h(x) = (f \circ g)(x)$ is given by

1. $h(x) = \cos(x^2 - \sqrt{x})$. ✓

2. $h(x) = \cos(x^2) - \cos(\sqrt{x})$.

3. $h(x) = \cos^2(x) - \sqrt{\cos(x)}$.

4. $h(x) = \sqrt{\cos^2(x) - x}$.

5. None of the above.

Exercise 3:

The function $h(x) = e^{2x}$ has an inverse function h^{-1} given by

1. $h^{-1}(x) = \ln(2x)$.

2. $h^{-1}(x) = \dfrac{\ln(x)}{2}$. ✓

3. $h^{-1}(x) = \ln\left(\dfrac{x}{2}\right)$.

4. $h^{-1}(x) = 2\ln(x)$.

5. None of the above.

Exercise 4:

If

$$f(x) = \begin{cases} 2x+1 & x < 0, \\ x^2+3 & x \geq 0, \end{cases}$$

then $f(0)$ is equal to

1. 1.

2. 3. ✓

3. 4.

4. Does not exist.

5. None of the above.

Exercise 5:

Let $f(x) = \dfrac{\ln(x)}{x^2}$. Then $\lim\limits_{x \to +\infty} f(x)$ is equal to

1. $+\infty$.

2. 1.

3. 0. ✓

4. $-\infty$.

5. None of the above.

Exercise 6:

Given the function $g(x) = \begin{cases} \dfrac{1}{|x-2|} & \text{if} \quad x < 2, \\ 1, & \text{if} \quad x \geq 2, \end{cases}$, then $\lim_{x \to 2^-} g(x)$ is equal to

1. 1.

2. -1.

3. $+\infty$. ✓

4. Does not exit.

5. None of the above.

Exercise 7:

The slope of the tangent line to the curve $y = e^{3x}$ at the point $(1, e^3)$ is equal to

1. e.

2. e^2.

3. $\dfrac{e^3}{3}$.

4. $3e^3$. ✓

5. None of the above.

Exercise 8:

Let $f(x) = 3x\ln(x)$. Then the derivative function f' is equal to:

1. $f'(x) = 3\ln(x) + 3$. ✓

2. $f'(x) = \dfrac{3}{x}$.

3. $f'(x) = 3$.

4. $f'(x) = 3\ln(x) + 3x^2$.

5. None of the above.

Exercise 9:

Let $f(x) = \frac{\sqrt{x+1}}{e^x}$. Then, the derivative function f' is equal to

1. $f'(x) = \dfrac{1}{2\sqrt{x+1}e^x}$.

2. $f'(x) = \dfrac{e^x}{2\sqrt{x+1}} + e^x\sqrt{x+1}$.

3. $f'(x) = -\dfrac{(2x+1)}{2e^x\sqrt{x+1}}$. ✓

4. $f'(x) = -\dfrac{1}{2\sqrt{x+1}e^x}$.

5. None of the above.

Exercise 10:

If $5^{2x}20^x = 20$, then

1. $x = \dfrac{\ln(20)}{\ln(500)}$.

2. $x = \dfrac{\ln(2)}{\ln(50)}$.

3. $x = \dfrac{\ln(50)}{\ln(2)}$.

4. $x = \dfrac{\ln(500)}{\ln(20)}$. ✓

5. None of the above.

Exercise 11:

If $\ln(x+1)=10$, then

1. $x=e^{10}-1$. ✓

2. $x=1-e^{10}$.

3. $x=e^{10}$.

4. $x=1+e^{10}$.

5. None of the above.

Exercise 12:

The area of the region bounded by the x-axis and the curve $y=x^2+1$ between the two lines $x=0$ and $x=3$ is equal to

1. 24 unit square.

2. 12 unit square. ✓

3. 84 unit square.

4. 6 unit square.

5. None of the above.

Exercise 13:

The area $\mathcal{A}=\int_{-\ln(2)}^{0} 2e^{-x}dx$ is equal to

1. $\mathcal{A}=-2$ unit square.

2. $\mathcal{A}=0$ unit square.

3. $\mathcal{A} = \frac{1}{2}$ unit square.

4. $\mathcal{A} = 2$ unit square. ✓

5. None of the above.

Exercise 14:

The area $\mathcal{A} = \int_1^2 \ln(x)dx$ is equal to

1. $\ln(2) + 1$ unit square.

2. $2\ln(2) - 2$ unit square.

3. $2\ln(2) - 1$ unit square. ✓

4. $2\ln(2) + 2$ unit square.

5. None of the above.

Exercise 15:

Given $z = 1 + i$, then the exponential form of z is equal to

1. $z = \sqrt{2}e^{i\frac{\pi}{4}}$. ✓

2. $z = \sqrt{2}e^{-i\frac{\pi}{4}}$.

3. $z = -\sqrt{2}e^{-i\frac{\pi}{4}}$.

4. $z = -\sqrt{2}e^{i\frac{\pi}{4}}$.

5. None of the above.

Exercise 16:

Given $z = 3 - 2i$, then the modulus $|z|$ of z is equal to

1. 1 unit.
2. $3\sqrt{2}$ unit.
3. $2\sqrt{3}$ unit.
4. $\sqrt{13}$ unit. ✓
5. None of the above.

Exercise 17:

If $z = 1 - i$, then the argument of z is equal to

1. $\arg(z) = -\frac{\pi}{4}$ radians. ✓
2. $\arg(z) = -\frac{\pi}{3}$ radians.
3. $\arg(z) = \frac{\pi}{4}$ radians.
4. $\arg(z) = \frac{\pi}{3}$ radians.
5. None of the above.

Exercise 18:

If $|z| = 2$ and $arg(z) = \frac{\pi}{3}$, then conjugate $\bar{z}$ of z is given by

1. $\bar{z} = 4e^{i\frac{\pi}{3}}$.
2. $\bar{z} = 2e^{i\frac{\pi}{3}}$.

3. $\bar{z} = 4e^{-i\frac{\pi}{3}}$.

4. $\bar{z} = 2e^{-i\frac{\pi}{3}}$. ✓

5. None of the above.

Exercise 19:

The distance $|z_1 - z_2|$ between the two complex numbers $z_1 = 1 - i$ and $z_2 = 2 + i$ is equal to

1. $\sqrt{5}$ unit. ✓

2. $\sqrt{13}$ unit.

3. 3 unit.

4. 9 unit.

5. None of the above.

Exercise 20:

Let $A(1,2,3)$, $B(-1,1,2)$, and $C(0,1,1)$ be three points. Then, the dot product between the vectors $\overrightarrow{AB}$ and $\overrightarrow{BC}$ is equal to

1. 1.

2. -3. ✓

3. 0.

4. 2.

5. None of the above.

Exercise 21:

Given the two vectors $\vec{u} = (1,2,-1)$ and $\vec{v} = (1,1,0)$. The cross product $\vec{u} \times \vec{v}$ is equal to

1. $\vec{u} \times \vec{v} = \vec{i} + \vec{j} + \vec{k}$.
2. $\vec{u} \times \vec{v} = \vec{i} + \vec{j} - \vec{k}$.
3. $\vec{u} \times \vec{v} = -\vec{i} + \vec{j} - \vec{k}$.
4. $\vec{u} \times \vec{v} = \vec{i} - \vec{j} - \vec{k}$. ✓
5. None of the above.

Exercise 22:

The distance between the two points $A(4,4,1)$ and $B = (1,6,2)$ is equal to

1. 7 unit.
2. 2 unit.
3. $\sqrt{14}$ unit. ✓
4. 0 unit.
5. None of the above.

Exercise 23:

Given the two vectors $\vec{u} = (1,1,0)$ and $\vec{v} = (2,-1,0)$. If $\theta = \angle(\overrightarrow{u}, \overrightarrow{v})$, then $\cos(\theta)$ is equal to

1. $\dfrac{1}{\sqrt{5}}$.
2. 1.

3. $\frac{1}{\sqrt{10}}$. ✓

4. $\frac{1}{\sqrt{2}}$.

5. None of the above.

Exercise 24:

Given the two vectors $\vec{u} = (0, 2, -1)$ and $\vec{v} = (3, 0, 1)$, then which of the following is correct?

1. $\vec{u}$ and $\vec{v}$ are orthogonal.

2. $\vec{u}$ and $\vec{v}$ are parallel.

3. $||\vec{u} \times \vec{v}|| = 1$.

4. $\vec{u} \times \vec{v} = \vec{v} \times \vec{u}$.

5. None of the above. ✓