

**Term:** Mathematics  
**Subject:** Admission Exams 2021  
**Last update:** April 4, 2021

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### Topics

The questions are organized into different sections by five (5) topics: probability & statistics, analytic geometry, geometry, functions and calculus.

#### Negative marking is applied

All questions have the same difficulty and worth the same amount of points.

- 5 points for each correct answer
- -1 point for each incorrect answer
- 0 if "No answer" is chosen

For example, let us say a student has answered 15 questions corrected and marked 5 questions incorrectly. Then the final score is calculated as

$$15 \times 5 + 5 \times (-1) = 70$$

At the same time, if a student answered 15 question correctly, 3 incorrectly and marked 2 questions as "No answer", then the final score is calculated as

$$15 \times 5 + 3 \times (-1) + 2 \times 0 = 72$$

#### Types of questions

All questions are multiple choice questions with 5 options.

- For each question, there is an option called "No answer". This option can be used when a student doesn't want to loose points for incorrect answers.
- The correct answer is one of the other 4 options. "No answer" is never the correct answer.

#### Number of questions

The following table summarizes the number of questions and amount of total points er section.

Summary		
Section	Questions	Points
Probability & Statistics	5	25
Analytic Geometry	3	15
Geometry	4	20
Functions	5	25
Calculus	3	15
<b>Total</b>	20	100

# 1 Probability & Statistics

1. (5 points) Find the value of  $P(7, 3)$ , where

$$P(n, k) = \frac{n!}{(n - k)!}$$

- A. 84  
B. 840  
C. 410  
**D. 210**  
E. No answer.
2. (5 points) Find the arithmetic mean of the following numbers: 6, 5, 7, 9, 11.  
**A. mean = 7.6**  
B. mean = 9.22  
C. mean = 7  
D. mean = 8  
E. No answer
3. (5 points) A bag contains 10 balls. 7 of them are red and 3 of them are blue. If one of the balls is chosen at random what is the probability that it is a red ball?  
A. 7  
B. 3/7  
C. 3/10  
**D. 7/10**  
E. No answer.
4. (5 points)  $A^C$  denotes the complementary event of  $A$ . Two events  $A, B$  are independent, and  $P(A^C) = \frac{3}{4}$ ,  $P(A^C \cap B) = \frac{1}{4}$ . Find the probability  $P(A \cup B)$ .  
A.  $\frac{7}{12}$   
B.  $\frac{1}{12}$   
**C.  $\frac{1}{2}$**   
D.  $\frac{1}{3}$   
E. No answer.
5. (5 points) How many different words can be created by rearranging the letters of the word "AABC"  
A. 24

- B. 12**
- C. 4
- D. 6
- E. No answer.

## 2 Analytic Geometry

1. (5 points) Find the sum of the components of the vector  $\vec{a} + \vec{b}$ , where the vectors  $\vec{a}$  and  $\vec{b}$  are given in the following form

$$\vec{a} = (1, 3), \quad \text{and} \quad \vec{b} = (4, -2)$$

- A. 2
  - B. 4
  - C. (5,1)
  - D. 6**
  - E. No answer.
2. (5 points) Find the scalar product of the following two vectors

$$\vec{u} = (6, -2, -3); \quad \text{and} \quad \vec{v} = (3, 5, 1)$$

*Hint: a scalar product between two vectors can be found by the following formula*

$$\vec{u} \cdot \vec{v} = u_1v_1 + u_2v_2 + u_3v_3, \quad \text{for} \quad \vec{u} = (u_1, u_2, u_3), \quad \vec{v} = (v_1, v_2, v_3)$$

- A. (18,-10,-3)
  - B. 5**
  - C. 25
  - D. 31
  - E. No answer.
3. (5 points) Find the minimum distance between the line  $y = 3$  and the point  $P(1, 0)$ .
- A. 1
  - B. 3**
  - C. 2
  - D. 1.2
  - E. No answer.

### 3 Geometry

- (5 points) Adjacent sides of a parallelogram have the length of 12 cm and 14 cm, and the angle between them is  $30^\circ$ . Find the area of the parallelogram.
  - 168
  - 112
  - 42
  - 84**
  - No answer.
- (5 points) The sum of all three sides of an isosceles triangle  $\triangle ABC$  ( $AB = AC$ ) with the base  $BC$  is 19. The sum of all three sides of an equilateral triangle  $\triangle ACD$  is 15 cm. Find the length of  $BC$ .
  - 9
  - 5
  - 10
  - 14
  - No answer.
- (5 points) Find the longest side of a right-angled triangle (the side opposite the right angle) if the other sides are equal to  $a = 3/5$  and  $b = 4/5$ .
  - 1**
  - 5
  - $8/5$
  - $1/5$
  - No answer.
- (5 points) Find the area of sector of a circle with radius 6 cm If angle of sector is  $180^\circ$ 
  - $36\pi$  cm
  - $\pi/6$  cm
  - $18\pi$  cm**
  - $6\pi$  cm
  - No answer.

### 4 Functions

- (5 points) Given  $f(x) = 2 + x$  and  $g(x) = 3 - x$ . Evaluate
$$f(g(-5)) \quad \text{or} \quad (f \circ g)(-5)$$

- A. -2  
B. 0  
**C. 10**  
D. -3  
E. No answer.
2. (5 points) Find the sum of all positive integer values of  $x$  that satisfies the following inequality

$$\left(\frac{1}{2}\right)^{x-4} \geq \log_3 81$$

- A. 3**  
B. 0  
C. 1  
D. 7  
E. No answer.
3. (5 points) In the expansion of  $(x - 3)^3$  find the coefficient of the  $x^2$  term.  
A. 9  
B. -3  
C. 27  
**D. -9**  
E. No answer.
4. (5 points) Consider the function  $g(x) = (8 - x)/2$ . Evaluate  $g^{-1}(6)$ .  
A. 1  
**B. -4**  
C. 5  
D. -2  
E. No answer.
5. (5 points) Find all values of  $x$  which satisfy the following equations

$$\begin{cases} y = x^2 \\ y = -2x - 1 \end{cases}$$

- A.  $x = \pm 1$   
**B.  $x = -1$**   
C.  $x = 1$   
D.  $x = 0$   
E. No answer.

## 5 Calculus: differentiation & Integration

- (5 points) Suppose  $f(x) = \ln(x - 3b)$  and  $f'(1) = \frac{1}{4}$ . Find the values of  $b$ .
  - 1
  - $-\frac{3e}{2}$
  - 1
  - 0
  - No answer.
- (5 points) Find the slope of the tangent line to the curve  $y = x^2 - 4x + 2$  at the point  $P(1, -1)$ .
  - 1
  - 2**
  - 4
  - $-\frac{1}{2}$
  - No answer.
- (5 points) Evaluate the following integral

$$\int_1^2 3(x^2 - 1) dx$$

- 2
- 0
- 5
- 4**
- No answer.