

1 Probability & Statistics

1. Find the value of $P(8, 2) + C(8, 2)$, where

$$C(n, k) = \frac{n!}{(n-k)!k!} \quad \text{and} \quad P(n, k) = \frac{n!}{(n-k)!}$$

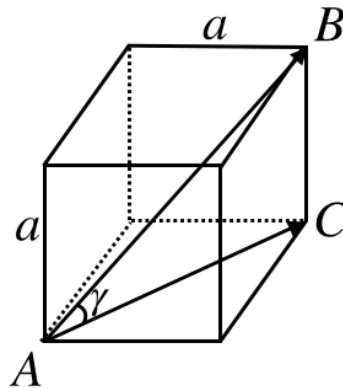
- A. 63
B. 21
C. 42
D. 84
E. No answer.
2. How many even, 4 digit natural numbers are there whose digits only consist of 1,2,3,4,5.
A. 375
B. 625
C. 256
D. 250
E. No answer.
3. A bowl contains 3 red, 5 blue and 2 green balls. If 2 balls are picked at random, what is the probability that 1 of them is red and the second is green?
A. $\frac{1}{2}$
B. $\frac{3}{50}$
C. $\frac{1}{15}$
D. $\frac{47}{90}$
E. No answer.
4. A^C denotes the complementary event of A . $P(A^C) = \frac{1}{3}$, $P(A \cap B) = \frac{1}{4}$, and $P(B) = 1/2$, find the value $P(A \cup B)$.
A. $\frac{11}{12}$
B. $\frac{7}{12}$
C. $\frac{5}{6}$
D. $\frac{3}{5}$
E. No answer.

2 Analytic Geometry

1. Find the scalar product of the following two vectors

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

- A. (8,3,2)
B. (12,10,-3)
C. -360
D. 19
E. No answer.
2. Find the cosine of the angle between the main diagonal of a cube and the diagonal on it's base.



- A. $\frac{\sqrt{3}}{2}$
B. $\frac{3}{\sqrt{3}}$
C. $\frac{1}{2}$
D. $\frac{2}{\sqrt{6}}$
E. No answer.
3. Let θ is the between the following two vectors \vec{a}, \vec{b} . Find the $\cos(\theta)$.

$$\vec{a} = (6, -2), \quad \text{and} \quad \vec{b} = (3, 1)$$

- A. $-\frac{2}{25}$
B. -8
C. 4
D. $\frac{4}{5}$
E. No answer.

3 Geometry

1. Line segments AB and CD are two diameters of a circle with the center at the point O . Find the sum of all three sides of the triangle AOD if $\overline{CB} = 13$ and $\overline{AB} = 16$.
 - A. 21
 - B. 14.5
 - C. 29**
 - D. 42
 - E. No answer.
2. Find the longest side of a right-angled triangle (the side opposite the right angle) if other sides are equal to $a = 6$ and $b = 8$.
 - A. 100
 - B. 12
 - C. 4
 - D. 10**
 - E. No answer.

4 Functions

1. Find the value of x which satisfies the following equation

$$5^{1-x} = \frac{1}{125}$$

- A. -3
 - B. -2
 - C. 4**
 - D. 2
 - E. No answer.
2. We know some values of the functions f, g $f(1) = 5; f(3) = 1; f(5) = 7; g(1) = 3; g(3) = 5; g(5) = 9$; Find

$$(f \circ g)(1) \quad \text{or} \quad f(g(1))$$

- A. 9
- B. 7
- C. 5**

D. 1

E. No answer.

3. Consider the function $g(x) = (8 - x)/2$. Evaluate $g^{-1}(6)$.

A. 1

B. -4

C. 5

D. -2

E. No answer.

4. In the expansion of $(x - 1)^7$ find the coefficient of the x^3 term.

A. -30

B. -21

C. 35

D. 7

E. No answer.

5. Find the sum of all values for positive integer 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.

5 Calculus: differentiation & Integration

1. Evaluate the following limit

$$\lim_{n \rightarrow \infty} \frac{\sqrt{25n^2 + 5}}{5n - 2}$$

A. 5

B. 0

C. $\frac{5}{2}$

D. 1

E. No answer.

2. Evaluate the following integral

$$\int_0^1 (1-x)\sqrt{x} dx$$

A. $\frac{4}{15}$

B. $\frac{2}{3}$

C. $\frac{2}{5}$

D. $\frac{1}{2}$

E. No answer.

3. Find the slope of the tangent line to the curve $y = x^2 - 4x + 4$ at the point $P(0, 4)$.

A. -4

B. 0

C. 4

D. -2

E. No answer.

4. Find the derivative of the following function at $x = -1$

$$f(x) = \frac{x^3}{x^2 + 1}, \quad f'(-1) = ?$$

A. 2

B. $-\frac{1}{2}$

C. 1

D. -2

E. No answer.

5. Given the function $f(x) = e^{kx} + x$ and $f'(0) = -8$. Find the value of k .

A. -9

B. -8

C. 8

D. 0

E. No answer.

6. Let $g(x)$ is the inverse of $f(x) = \ln(x^3)$. What is the value of $g'(0)$?

A. $\frac{1}{3}$

- B. $\frac{1}{2}$
- C. 1
- D. 2
- E. No answer.