

NATIONAL EDUCATIONAL ASSESMENT AND EXAMINATIONS AGENCY (NEAEA)  
ETHIOPIAN UNIVERSITY ENTRANCE EXAMINATION (EUEE)  
MATHEMATICS EXAMINATION 2008

BOOKLET CODE: 00

NUMBER OF ITEMS:

SUBJECT CODE: 00

TIME ALLOWED: 00

**1. Which one of the following is a one to one correspondence function from  $A=[0, 1]$  to  $B=[1, 2]$ ?**

- A)  $f(x) = x$
- B)  $f(x) = 1/3x^3 + 1$
- C)  $f(x) = 2x + 1$
- D)  $f(x) = x^2 + 1$

**2. What is the solution set of  $\frac{1-\frac{1}{x}}{1-\frac{1}{x^2}} = 3x^2 - \frac{x}{1+\frac{1}{x}}$ ??**

- A)  $\{-1, 1/3\}$
- B)  $\{1/3\}$
- C)  $\{3, -1/3\}$
- D)  $\{-1/3\}$

**3. Suppose  $\frac{1-\frac{1}{x}}{1-\frac{1}{x^2}} = 3x^2 - \frac{x}{1+\frac{1}{x}}$ ?, where  $Q(x)$  is a quadratic function. Which one of the following is necessarily true about the graph of  $f$ .**

- A)  $x = 0, x = 1$  and  $x = -1$  are vertical asymptotes of graph of  $f$ .
- B) the graph of  $f$  doesn't intersect with its horizontal asymptote.
- C) the vertical asymptotes of the graph of  $f$  is only  $x = -1$
- D) the vertical asymptotes of graph of  $f$  are  $x = 1$  and  $x = -1$  if  $Q(x) = 2x^2$ .

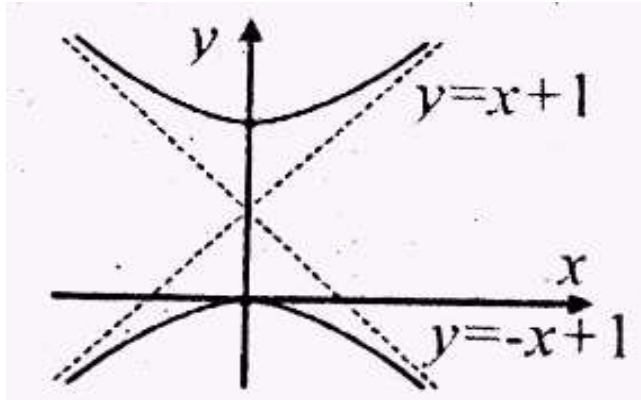
**4. Which one of the following is equation of a circle whose center is on  $y$ -axis and radius is 3?**

- A)  $x^2 + y^2 + 6y = 0$
- B)  $(x-2)^2 + y^2 = 9$
- C)  $x^2 + (y-2)^2 = 9$
- D)  $x^2 - 2x + y^2 = 8$

5. The planet Mercury's orbit around the sun is an ellipse with eccentricity 0.206, length of the major axis  $1.16 \times 10^8$  km and the sun at one focus. What is the max distance from Mercury to the sun?

- A)  $6.99 \times 10^8$  km  
 B)  $6.99 \times 10^7$  km  
 C)  $9.66 \times 10^7$  km  
 D)  $9.66 \times 10^8$  km

6. The graph of a hyperbola and the lines of its asymptotes are given as shown in the following figure. Which one of the following is an equation of the hyperbola?



- A)  $y^2 - 2y - x^2 = 0$   
 B)  $y^2 - 3y - x^2 = 0$   
 C)  $x^2 - (y-1)^2 = 1$   
 D)  $(x-1)^2 - y^2 = 1$

7. If the truth value of a proposition  $p$  is False, then which one of the following compound proposition has a truth value True?

- A)  $\neg p \wedge p$   
 B)  $\neg p \Rightarrow p$   
 C)  $\neg(\neg p \vee p)$   
 D)  $p \Rightarrow \neg p$

8. What is the contrapositive of "If  $x \in \mathbb{N}$ , then  $x$  is integer and  $x > 0$ ."?

- A) if  $x$  is not integer or  $x < 0$ , then  $x \in \mathbb{N}$   
 B) if  $x$  is integer or  $x > 0$ , then  $x \in \mathbb{N}$   
 C) if  $x$  is not integer or  $x \leq 0$ , then  $x \notin \mathbb{N}$   
 D) if  $x \notin \mathbb{N}$ , then  $x$  is not integer and  $x \leq 0$

9. Which one of the following compound propositions is a tautology?

- A)  $(q \vee \neg q) \Rightarrow p$   
 B)  $p \Rightarrow (p \vee \neg q)$   
 C)  $p \vee (q \wedge \neg q)$   
 D)  $p \Rightarrow (q \wedge \neg q)$

10. The following is sample frequency distribution of data with variable  $x$ .

X	3	5	6	7
Frequency	2	5	2	1

What are the mean ( $\bar{x}$ ) and variance ( $\delta^2$ ) of the data?

- A)  $\bar{x} = 5, \delta^2 = 0.7$
- B)  $\bar{x} = 6, \delta^2 = 1.4$
- C)  $\bar{x} = 6, \delta^2 = 0.7$
- D)  $\bar{x} = 5, \delta^2 = 1.4$

11. A box contains 10 items of which 3 are defective. If 2 items are randomly taken out of the box, what is the probability that both items are not defective?

- A) 7/10
- B) 4/7
- C) 7/15
- D) 49/100

12. Items produced by accompany are subjected to two kinds of defects D1 and D2. Out of the total product, 5% have the defect D1, 10% have defect D2, and 2% have both defects. What is the probability that a randomly selected item has neither defect D1 nor defect D2?

- A) 0.13
- B) 0.5
- C) 0.98
- D) 0.87

13. If  $A = \begin{pmatrix} 2 & 7 \\ 1 & 3 \end{pmatrix}$  and  $B^{-1} = \begin{pmatrix} 1 & 1 \\ 0 & 2 \end{pmatrix}$ , then  $(AB)^{-1}$  is equal to:

- A)  $\begin{pmatrix} 4 & -3 \\ 4 & -5 \end{pmatrix}$
- B)  $\begin{pmatrix} -2 & 5 \\ 2 & -4 \end{pmatrix}$
- C)  $\begin{pmatrix} -3 & 11 \\ 1 & -3 \end{pmatrix}$
- D)  $\begin{pmatrix} 4 & 0 \\ 0 & 2 \end{pmatrix}$

14. Let  $A = \begin{pmatrix} 0 & \alpha & \beta \\ 2 & 2 & 1 \\ 3 & 1 & 2 \end{pmatrix}$ ,  $b = \begin{pmatrix} 6 \\ 0 \\ 0 \end{pmatrix}$ , and  $X = \begin{pmatrix} x \\ y \\ z \end{pmatrix}$ . If  $\det(A) = 3$ , then what is the solution set of the system  $AX = b$ ?

A)  $\{(6, -2, -8)^T\}$

B)  $\left\{\left(0, \frac{1}{\alpha}, \frac{5}{\beta}\right)^T\right\}$

C)  $\{(-3, 1, 4)^T\}$

D)  $\emptyset$

15. In set of complex numbers, what is the solution set of  $x^2 + 4x + 5 = 0$ ?

A)  $\{\emptyset\}$

B)  $\{1 - 2i, 1 + 2i\}$

C)  $\{2 - i, 2 + i\}$

D)  $\{-2 - i, -2 + i\}$

16. If  $z = (1 + i)^{10}$ , then which one of the following is equal to  $z$ ?

A)  $1 + 32i$

B)  $32i$

C)  $10i$

D)  $1 + 10i$

17. If  $\{A_n\}_{n=1}^{\infty}$  is an arithmetic sequence such that its 1<sup>st</sup> term  $A_1 = -5$  and its 5<sup>th</sup> term  $A_5 = 15$ , then its 11<sup>th</sup> term  $A_{11}$  is equal to:

A) 40

B) 50

C) 45

D) 55

18. What is the sum of all multiples of 4 that are between 30 and 301?

A) 12,882

B) 11,288

C) 6,288

D) 6,882

19. The left hand side limit  $\lim_{x \rightarrow 0^-} \frac{xe^x - |x|}{x}$  is equal to:

A) 0

B) 2

C) 1

D) does not exist

20. Which one of the following is equal to  $\lim_{x \rightarrow 0} \frac{2x + \tan x}{x \sec x}$  ?

- A) 2  
 B) 0  
 C) 1  
 D) 3

21. Which one of the following is true about the horizontal asymptote(s) of the graph of  $y = \frac{|x|+2}{x}$  ?

- A)  $y = 2$  is the only horizontal asymptote of the graph.  
 B)  $y = 1$  &  $y = -1$  are the horizontal asymptote of the graph.  
 C)  $y = 2$  &  $y = -2$  are the horizontal asymptote of the graph.  
 D)  $y = 1$  is the only horizontal asymptote of the graph.

22. If  $f(x) = 2x^2 - 3x$ , then  $\lim_{x \rightarrow 1} \frac{f(x) - f(1)}{x - 1}$  is equal to:

- A) 1  
 B) -1  
 C) 7  
 D)  $\infty$

23. If  $f(x) = e^{3x} \cos x - \frac{x+\pi}{x^2+2}$ , then  $f'(0)$  is equal to:

- A)  $3 - \pi/2$   
 B)  $3/2$   
 C)  $7/4$   
 D)  $5/2$

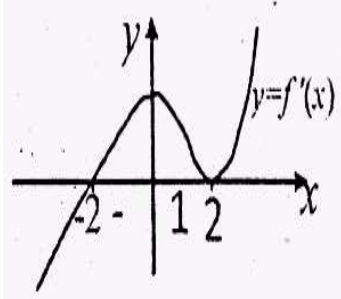
24. If  $f(x) = \ln \sqrt{x^2 - 5}$ , then which of the following is equal to  $f'(x)$ ?

- A)  $\frac{x}{x^2-5}$   
 B)  $\frac{-x}{\sqrt{x^2-5}}$   
 C)  $\frac{2x}{x^2-5}$   
 D)  $\frac{-x}{x^2-5}$

25. Let  $f$  be twice differentiable function on  $\mathbb{R}$ . which one of the following is necessarily true?

- A) if  $f(c) = 0$ , at some  $c \in \mathbb{R}$ , then  $f$  has relative extreme at  $x = c$ .
- B) if  $f'(x)$  is increasing, then graph of  $y = f(x)$  is concave upward.
- C) if  $f'(x) = 0$  for all  $x \in \mathbb{R}$ , then  $f(x) = 0$  for all  $x \in \mathbb{R}$
- D) if  $f(x)$  is increasing, then  $f''(x) = 0$  for all  $x \in \mathbb{R}$

26. Suppose  $f(x)$  is differentiable on  $(-\infty, \infty)$  and the graph of its derivative,  $y = f'(x)$  is as shown in the following figure.



- A)  $f(x)$  is increasing on  $(-\infty, 0) \cup (2, \infty)$
- B)  $f(x)$  has a local extreme value at  $x = 2$
- C)  $f(x)$  has a local minimum value at  $x = -2$
- D)  $f(x)$  has a local maximum value at  $x = 0$

27. A closed cylindrical can is to be made to hold  $1000 \text{ cm}^3$  of oil. What are the dimensions (radius  $r$  and height  $h$ ) that will minimize the total surface area of the can?

- A)  $r = \frac{\sqrt[3]{50}}{\pi}, h = 2 \frac{\sqrt[3]{50}}{\pi}$
- B)  $r = \frac{\sqrt[3]{500}}{\pi}, h = 2 \frac{\sqrt[3]{500}}{\pi}$
- C)  $r = \sqrt[3]{\frac{50}{\pi}}, h = 2 \sqrt[3]{\frac{50}{\pi}}$
- D)  $r = \sqrt[3]{\frac{500}{\pi}}, h = 2 \sqrt[3]{\frac{500}{\pi}}$

28. If  $f(x) = 3x^2\sqrt{x^3 - 1}$ , then which one of the following is anti-derivative of  $f(x)$ ?

- A)  $\frac{3x}{2}(x^3 - 1)^{3/2} + c$
- B)  $\frac{2}{3}(x^3 - 1)^{3/2}$

- C)  $\frac{3}{2}(x^3 - 1)^{3/2}$
- D)  $\frac{2}{3}(x^3 - 1)^{3/2} + c$

29. Which one of the following is equal to  $\int \frac{(\ln x)^2 + x^2 \cos x}{x} dx$ ?

- A)  $1/x^2 \ln x + x \sin x - \cos x + c$
- B)  $1/3 (\ln x)^3 + x \sin x - \cos x + c$
- C)  $1/3 (\ln x)^3 + x \sin x + \cos x + c$
- D)  $1/x^2 \ln x + x \sin x + \cos x + c$

30. The volume of the solid generated when the region bounded between graph of  $y = \begin{cases} x^2, & 0 \leq x \leq 2 \\ 4, & 2 \leq x \leq 3 \end{cases}$  and x-axis is rotated about the x-axis:

- A)  $32\pi/5$
- B)  $112\pi/5$
- C)  $112\pi/3$
- D)  $64\pi/5$

31. If  $f: A \rightarrow B$  and  $g: B \rightarrow C$  are functions, then which one of the following is true about the composition function?

- A) domain of  $g \circ f \subseteq$  domain of  $f$
- B) range of  $g \circ f \not\subseteq$  range of  $g$
- C) domain of  $g \circ f \not\subseteq$  domain of  $f$
- D) range of  $g \circ f$  range of  $f$

32. If the point  $(3, -2)$  is on the graph of  $y = f(x)$ , then which point is on the graph of  $y = f^{-1}(x)$ ?

- A)  $(1/3, -2)$
- B)  $(3, -1)$
- C)  $(-2, 3)$
- D)  $(3, -1/2)$

33. The equation of the line that passes through  $(2, -1)$  and perpendicular to the line  $3x + 4y = 6$  is:

- A)  $-4x + 3y = 5$
- B)  $4x - 3y = 5$
- C)  $4x + 3y = 11$
- D)  $-4x + 3y = -11$

34. If  $Z = \frac{2-4i}{1+i}$ , then the modulus of the conjugate of  $Z, |\bar{Z}|$  is:

- A)  $\sqrt{10}$
- B)  $3\sqrt{2}$
- C)  $2\sqrt{3}$
- D)  $2\sqrt{2}$

**35. The  $n^{\text{th}}$  term of the sequence: 1, -4, 9, -16,... is:**

- A)  $a_n = (-2)^n$
- B)  $a_n = (-1)^n n^2$
- C)  $a_n = (-1)2^n n^2$
- D)  $a_n = (-1)^{n-1} n^2$

**36. Which one of the following is true about the horizontal asymptote(s) of the graph of  $y = \frac{|x|+2}{x}$**

- A)  $y = 2$  is the only horizontal asymptote of the graph.
- B)  $y = 1$  and  $y = -1$  are the horizontal asymptotes of the graph.
- C)  $y = 2$  and  $y = -2$  are the horizontal asymptote of the graph.
- D)  $y = 1$  is the only horizontal asymptote of the graph.

**37. For any  $n \times n$  square matrix A, which of the following is true?**

- A)  $\text{Det}(A) = -\text{det}(A^T)$ , where  $A^T$  is the transpose of A
- B) If  $k$  is a scalar, then  $\text{det}(kA) = k^n \text{det}(A)$
- C) If B is a matrix obtained from A by interchanging of two rows of A, then  $\text{det}(B) = \text{det}(A)$
- D) If A is invertible, then  $\text{det}(A) = \text{det}(A^{-1})$

**38. The solution of the system of linear equation of** 
$$\begin{cases} x - 3y - 2z = 6 \\ 2x - 4y - 3z = 8 \\ -3x + 6y + 8z = -5 \end{cases}$$
 **is:**

- A)  $x = -1, y = -3, z = -2$
- B)  $x = -1, y = -3, z = 2$
- C)  $x = 1, y = -3, z = 2$
- D)  $x = 1, y = 3, z = -2$

**39. there are three children in a room, ages three, four, and five. If a four- year- old child enters the room then which one of the following is true?**

- Mean age will stay the same but the standard deviation will increase.
- Mean age will stay the same but the standard deviation will decrease.
- Mean age and standard deviation will increase.
- Mean age ad standard deviation will stay the same.

**40. In how many more ways can 4 people be arranged in a row than if they were arranged in a circle?**

- A) 1
- B) 6

- C) 18  
 D) 12

**41. Two machines A and B work independently. The probability that both machines A and B work is 0.4. If the conditional probability that machine B works given that machine A works is 0.5, then the conditional probability that machine A works given that machine B works is**

- A) 0.8  
 B) 0.3  
 C) 0.5  
 D) 0.7

**42. Which of the following is true about the function  $f$  defined by  $f(x)=x^2 + e^{2x}$  ?**

- A)  $f$  is decreasing for  $x = 0$   
 B)  $f$  is increasing for  $x = 0$   
 C)  $f$  has a relative minimum  $x = 0$   
 D)  $f$  has a relative maximum at  $x = 0$

**43. The value of  $\int_0^1 (x + 1)e^{(x^2+2x)} dx$  is:**

- A.  $\frac{e^3}{2}$   
 B.  $\frac{e^4 - e}{2}$   
 C.  $\frac{e^3 - 1}{2}$   
 D)  $e^3 - 1$

**44.  $\int_0^3 (x + 1)^{\frac{1}{2}} dx =$  \_\_\_\_\_.**

- A)  $21/2$   
 B)  $14/3$   
 C) 7  
 D)  $16/3$

**45. Given  $f(x) = \begin{cases} x + 1, & \text{for } x < 0 \\ \cos \pi x, & \text{for } x \geq 0 \end{cases}$ , then  $\int_{-1}^1 f(x) dx =$  \_\_\_\_\_**

- A.  $\frac{1}{2} + \frac{1}{\pi}$   
 B.  $\frac{1}{2} - \frac{1}{\pi}$

- C)  $1/2$   
 D)  $-1/2$

46. The sum of  $\sum_{n=0}^{\infty} 5 \left(\frac{2}{3}\right)^n$  is \_\_\_\_\_.

- A) 0  
 B) 15  
 C)  $10/3$   
 D) 5

47. In which interval the sequence  $\left\{\frac{(-1)^n}{3n}\right\}_{n=1}^{\infty}$  is bounded?

- A.  $\left[\frac{-1}{9}, \frac{1}{12}\right]$   
 B.  $\left[\frac{-1}{3}, \frac{1}{6}\right]$   
 C.  $\left[\frac{-1}{6}, \frac{1}{3}\right]$   
 D.  $\left[\frac{-1}{12}, \frac{1}{9}\right]$

48. Which one of the following is true about the function given by the formula  $f(x) = \begin{cases} \frac{x^2}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$  ?

- A. f is continuous except at  $x = 0$   
 B. f has an infinite discontinuity at  $x = 0$   
 C. f is continuous everywhere  
 D. f has  $x = 0$  as a vertical asymptote

49.  $\lim_{x \rightarrow \infty} x \sin \frac{1}{x}$  is equal to :?

- A) 0  
 B) 1  
 C)  $\infty$   
 D) -1

50.  $\frac{d}{dx} (\ln e^{2x})$  is equal to :?

- A.  $\frac{1}{e^{2x}}$

B.  $\frac{2}{e^{2x}}$

C)  $2x$

D)  $2$

51. If  $f(x) = 2 + |x - 3|$  for all  $x$ , then the value of the derivative  $f'(x)$  at  $x = 3$

A)  $-1$

B) Does not exist

C)  $1$

D)  $2$

52. The graph of  $y = 5x^4 - x^5$  has a point of inflection at:

A)  $(3, 162)$  only

B)  $(4, 256)$  only

C)  $(0, 0)$  only

D)  $(0, 0)$  and  $(3, 162)$

53. Let the angle between  $\vec{V} = -2\vec{i} - \vec{j} + 2\vec{k}$  and  $\overrightarrow{PQ}$  be  $60^\circ$ , where P and Q are points in space. If  $\vec{V} \cdot \overrightarrow{PQ} = 2$ , then what is the distance between P and Q?

A)  $3/4$

B)  $4/5$

C)  $4/3$

D)  $5/4$

54. Consider the following assertion of a person and his proof "If  $x$  and  $y$  are equal positive integers, then  $x + y = y$ ."

**Proof:** the following steps and reasons are used to prove the assertion.

Step	Reason
1. $x = y$	Given hypothesis
2. $x^2 = xy$	Multiply both sides of (1) by $x$
3. $x^2 - y^2 = xy - y^2$	Subtract $y^2$ from both sides of (2)
4. $(x - y)(x + y) = (x - y)y$	Factor both sides of (3)
5. $x + y = y$	Divide both sides of (4) by $x - y$

Step 5 completes the proof.

Which one of the following is true about this proof?

A) It is a correct direct proof of the assertion.

B) It follows the technique of a proof by contradiction because the steps lead to a contradiction.

C) The proof is invalid because Step 4 does not lead to Step 5.

D) The proof is invalid because Step 4 does not follow from Step 3.

55. Which one of the following is a valid assertion that can be proved by the principle of mathematical induction?

- A)  $2^n > 10^n$  for every integer  $n$  such that  $n \geq 6$ .
- B)  $r^2 > 0$  for every real number  $r$  such that  $r \geq 1$ .
- C)  $n^2 + 10n > 2n^2$  for every natural number  $n \geq 1$ .
- D)  $2^n > 8n$  for every integer  $n$  such that  $n \geq 3$ .

56. The image of a figure with vertices  $A(1, 2)$ ,  $B(3, 6)$ ,  $C(-1, 2)$ , and  $D(-2, -2)$  after reflection across the  $x$ -axis is:

- A)  $A'(1, -2)$ ,  $B'(-3, -6)$ ,  $C'(1, -2)$ , and  $D'(2, 2)$
- B)  $A'(-1, 2)$ ,  $B'(-3, 6)$ ,  $C'(1, -2)$ , and  $D'(2, -2)$
- C)  $A'(1, 2)$ ,  $B'(3, -6)$ ,  $C'(-1, -2)$ , and  $D'(-2, 2)$
- D)  $A'(1, -2)$ ,  $B'(3, 6)$ ,  $C'(-1, 2)$ , and  $D'(-2, -2)$

57. If  $\vec{V} = \vec{AB} + 3\vec{BA}$ , where  $A$  and  $B$  are distinct points in the coordinate plane, then which one of the following is equal to  $3\vec{V}$  ?

- A.  $6\vec{AB}$
- B.  $-6\vec{AB}$
- C.  $12\vec{AB}$
- D.  $-12\vec{AB}$

58. If  $\vec{U}$  is a unit vector in the direction of  $\vec{A}$  and  $|\vec{A}| = 4$ , then  $\vec{A} \cdot \vec{U}$  is equal to \_\_\_\_\_.

- A) 1/4
- B) 4
- C) 1/2
- D) 2

59. If  $\vec{A}$  and  $\vec{B}$  are parallel vectors with opposite directions and  $|\vec{B}| = |2\vec{A}|$ , then  $\vec{B} - \vec{A}$  is equal to:

- A.  $\vec{A}$
- B.  $-\vec{A}$
- C.  $-3\vec{A}$

D.  $3\vec{A}$

60. If  $\cot(\theta) = 2$ , then which of the following is equal to  $\csc(\theta)$ ?

- A)  $\sqrt{5}$   
 B)  $2/\sqrt{5}$   
 C)  $1/\sqrt{5}$   
 D)  $1/2$

61. What is the amplitude and period, respectively, of the graph of  $f(x) = 4\sin(x/3)\cos(x/3)$ ?

- A)  $4, \pi/3$   
 B)  $2, 3\pi$   
 C)  $2, 2\pi/3$   
 D)  $4, 3\pi$

62. A boat on a sea sailed from its station toward North with constant speed of 80 km/h. Another boat from the same station sailed  $60^\circ$  NE (North East) with constant speed of 100km/h. If the two boats started sailing at the same time, what is the straight distance between them after they have sailed for just 30 minutes?

- A)  $10\sqrt{42}$ km  
 B) 90km  
 C)  $10\sqrt{41}$  km  
 D)  $10\sqrt{21}$ km

63. What is the value k, for which the two vectors  $\vec{U} = \begin{pmatrix} 1 \\ k \\ -3 \end{pmatrix}$  and  $\vec{V} = \begin{pmatrix} 2k \\ -5 \\ 4 \end{pmatrix}$  are perpendicular?

- A) 4  
 B) -4  
 C) 3  
 D) -3

64. If one of the end point of the line segment is (3, 2, -4) and the mid-point is (4, 1, -2), then the coordinate of the other end point is:

- A) (5, 0, 0)  
 B) (2, 0, 5)  
 C) (5, 1, 2)  
 D) (3, 1, 0)

65. What is the value of  $\arcsin\left(-\frac{\sqrt{2}}{2}\right)$ .

- A)  $\pi/4$   
 B)  $\pi/2$

C)  $-\pi/4$

D)  $-\pi/2$

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