(A) 0 (B)
$$-1$$
 (C) -2 (D) -3 (E) -4

7. In how many of the eight standard octants of xyz -space does the graph of $z = e^{x+y}$ appear?

(A) One (B) Two (C) Three (D) Four (E) Eight 8. Suppose that the function
$$f$$
 is defined on an interval by the formula $f(x) = \sqrt{\tan^2 x - 1}$. If f is continuous,

6. For what value of b is the value of $\int_{b}^{b+1} (x^2 + x) dx$ a minimum?

(C) $\left(\frac{\pi}{4}, \frac{3\pi}{4}\right)$

(D) $\left(-\frac{\pi}{4},0\right)$

(E) $\left(-\frac{3\pi}{4}, -\frac{\pi}{4}\right)$

Suppose that the function
$$f$$
 is defined on an interval by the formula $f(x) = \sqrt{\tan^2 x - 1}$. If f is continuous, which of the following intervals could be its domain?

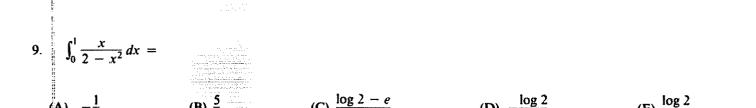
which of the following intervals could be its domain?
$$(A) \left(\frac{3\pi}{4}, \pi \right)$$

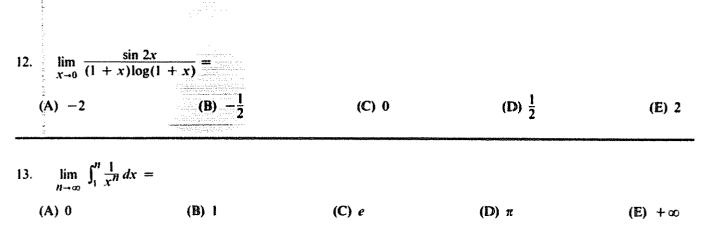
(A)
$$\left(\frac{3\pi}{4}, \pi\right)$$

(A)
$$\left(\frac{3\pi}{4}, \pi\right)$$
(B) $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$

(A)
$$\left(\frac{3\pi}{4}, \pi\right)$$
(B) $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$

(A)
$$\left(\frac{3\pi}{4}, \pi\right)$$





15. Let
$$f(x) = \int_1^x \frac{1}{1+t^2} dt$$
 for all real x. An equation of the line tangent to the graph of f at the point (2, f(2)) is

(A)
$$y - 1 = \frac{1}{5}(x - 2)$$
 (B) $y - \operatorname{Arctan} 2 = \frac{1}{5}(x - 2)$ (C) $y - 1 = (\operatorname{Arctan} 2)(x - 2)$

(D)
$$y - \operatorname{Arctan} 2 + \frac{\pi}{4} = \frac{1}{5}(x - 2)$$
 (E) $y - \frac{\pi}{2} = (\operatorname{Arctan} 2)(x - 2)$

16. Let
$$f(x) = e^{g(x)}h(x)$$
 and $h'(x) = -g'(x)h(x)$ for all real x. Which of the following must be true?

- (B) f is a linear nonconstant function.
- (C) g is a constant function.
- (D) g is a linear nonconstant function.

$$17. \quad 1 - \sin^2\left(\operatorname{Arccos}\frac{\pi}{12}\right) =$$

(E) None of the above

(A)
$$\sqrt{\frac{1-\cos\frac{\pi}{24}}{2}}$$
 (B) $\sqrt{\frac{1-\cos\frac{\pi}{6}}{2}}$ (C) $\sqrt{\frac{1+\cos\frac{\pi}{24}}{2}}$ (D) $\frac{\pi}{6}$ (E) $\frac{\pi^2}{144}$

 $f(x) = \sum_{n=0}^{\infty} (-1)^n x^{2n} \text{ for all } x \in (0, 1), \text{ then } f'(x) = 0$

) cos x

-

23.	Let f be a real-valued function continuous on the closed interval $[0, 1]$ and differentiable on the open interval $(0, 1)$ with $f(0) = 1$ and $f(1) = 0$. Which of the following must be true?
	I. There exists $x \in (0, 1)$ such that $f(x) = x$.
	II. There exists $x \in (0, 1)$ such that $f'(x) = -1$.
	III. $f(x) > 0$ for all $x \in [0, 1)$.

(A) I only (B) II only (C) I and II only (D) II and III only (E) I, II, and III

- 25. Let f be a real-valued function with domain [0, 1]. If there is some K > 0 such that $f(x) f(y) \le K|x y|$ for all x and y in [0, 1], which of the following must be true?

 - (A) f is discontinuous at each point of (0, 1).
 - f is not continuous on (0, 1), but is discontinuous at only countably many points of (0, 1).
 - (C) f is continuous on (0, 1), but is differentiable at only countably many points of (0, 1).
 - (D) f is continuous on (0, 1), but may not be differentiable on (0, 1). (E) f is differentiable on (0, 1).

29.
$$\lim_{n \to \infty} \sum_{k=1}^{n} \left(\frac{1}{k} - \frac{1}{2^k} \right) =$$
(A) 0 (B) 1 (C) 2 (D) 4 (E) $+\infty$

31. If
$$f(x) = \begin{cases} \sqrt{1 - x^2} & \text{for } 0 \le x \le 1 \\ x - 1 & \text{for } 1 < x \le 2, \end{cases}$$

then
$$\int_0^2 f(x) dx$$
 is

$$\int_0^{\pi} \int (x) dx \text{ is}$$

$$(A) \frac{\pi}{2}$$

(B)
$$\frac{\sqrt{2}}{\sqrt{2}}$$

(B)
$$\frac{\sqrt{}}{2}$$

34.
$$\frac{d}{dx} \int_0^{x^2} e^{-t^2} dt =$$
(A) e^{-x^2} (B) $2e^{-x^2}$ (C) $2e^{-x^4}$ (D) $x^2e^{-x^2}$

(D) $x^2e^{-x^2}$

(E) $2xe^{-x^4}$

(C) $2e^{-x^4}$

(A) e^{-x^2}

(A) an integer

(B) nonpositive

(E) any real number

38.
$$\lim_{n\to\infty} \frac{3}{n} \sum_{i=1}^{n} \left[\left(\frac{3i}{n} \right)^2 - \left(\frac{3i}{n} \right) \right] =$$

(C) equal to $\frac{2n-1}{2}$ for some integer n

(D) equal to $\frac{4n-1}{4}$ for some integer n



39. For a real number x, $\log(1 + \sin 2\pi x)$ is <u>not</u> a real number if and only if x is



(D)
$$\frac{9}{2}$$

(E) $\frac{31}{6}$

43. Let n be an integer greater than 1. Which of the following conditions guarantee that the equation

Let *n* be an integer greater than 1. Which of the following converges
$$x^n = \sum_{i=0}^{n-1} a_i x^i$$
 has at least one root in the interval $(0, 1)$?

I. $a_0 > 0$ and $\sum_{i=0}^{n-1} a_i < 1$

II.
$$a_0 > 0$$
 and $\sum_{i=0}^{n-1} a_i > 1$

III.
$$a_0 < 0$$
 and $\sum_{i=0}^{n-1} a_i > 1$

- (A) None (B) I only
- (C) II only (D) III only
- (E) I and III

44. If x is a real number and P is a polynomial function, then
$$\lim_{h\to 0} \frac{P(x+3h)+P(x-3h)-2P(x)}{h^2} =$$

(B) 6P'(x)(A) 0

(C) 3P''(x)

(D) 9P''(x)

(E) ∞