每小題5分，請用 2B 鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

1. f is a continuously differentiable real-valued function defined on the open interval (-1, 4) such that $f(3) = 5$ and $f'(x) \geq -1$ for all x. What is the greatest possible value of $f(0)$?
   (A) 3
   (B) 4
   (C) 5
   (D) 8
   (E) None of the above.

2. g is a continuous real-valued function such that $3x^5 + 96 = \int_c^x g(t)dt$, where c is a constant. What is the value of c ?
   (A) -32
   (B) -2
   (C) 2
   (D) 32
   (E) None of the above.

3. Let $g(x) = e^{2x+1}$ for all real x. Then $\lim_{x\to 0} \frac{g(g(x))-g(e)}{x} =$
   (A) $2e$
   (B) $4e^2$
   (C) $2e^{2e+1}$
   (D) $4e^{2e+2}$
   (E) None of the above.

4. For what positive value of c does the equation $\log x = cx^4$ have exactly one real solution for x?
   (A) $(4e)^{-1}$
   (B) $4e^{-1}$
   (C) $2e^4$
   (D) $4e^{1/4}$
   (E) None of the above.

5. $\frac{d}{dx}\int_{x^3}^{x^4} e^{t^2} dt =$
   (A) $e^{x^6}(e^{x^8-x^6} - 1)$
   (B) $e^{x^6}(4x^3e^{x^8-x^6} - 3x^2)$
   (C) $e^{x^3}(e^{x^4-x^3} - 1)$
   (D) $e^{x^3}(4x^3e^{x^4-x^3} - 3x^2)$
   (E) None of the above.

6. What is the 19th derivative of $\frac{x-1}{e^x}$
   (A) $(18 - x)e^{-x}$
   (B) $(19 - x)e^{-x}$
   (C) $(20 - x)e^{-x}$
   (D) $(x - 19)e^{-x}$
   (E) None of the above.

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7. If y is a real-valued function such that $y' + xy = x$ and $y(0) = -1$, then $\lim_{x\to-\infty} y(x) =$
   (A) 1
   (B) ∞
   (C) $-\infty$
   (D) $\pi/2$
   (E) None of the above.

8. If a real number x is chosen at random in the interval [0, 3] and a real number y is chosen at random in the interval [0, 4], what is the probability that x < y ?
   (A) 3/4
   (B) 1/2
   (C) 5/8
   (D) 5/6
   (E) None of the above.

9. Suppose a and b are positive numbers. Then $\int_0^\infty \frac{e^{ax}-e^{bx}}{(1+e^{ax})(1+e^{bx})} =$
   (A) 0
   (B) 1
   (C) $\pi/2$
   (D) $(a-b)\log 2$
   (E) None of the above.

10. Which of the following statements are true?
   I. We can find a constant C such that $\log x \le C\sqrt{x}$ for all positive x.
   II. We can find a constant C such that $\sum_{k=1}^{n} k^2 \le Cn^2$ for all positive integer n.
   (A) I only
   (B) II only
   (C) I and II
   (D) None
   (E) None of the above.

11. Let $f(x) = \arcsin x$, then $f^{-1}(x)$ is
   (A) $\sin x,\ 0 \le x \le 1$
   (B) $\frac{1}{\sin x},\ -1 \le x \le 1$
   (C) $\sin x,\ -\frac{\pi}{2} \le x \le \frac{\pi}{2}$
   (D) $\frac{1}{\cos x},\ -1 \le x \le 1$
   (E) $\cos x,\ 0 \le x \le \pi$

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12. Find $\int \sqrt{3x+5}dx$.

(A) $\frac{1}{3}(3x+5)^{3/2}+C$

(B) $\frac{2}{9}(3x+5)^{3/2}+C$

(C) $\frac{2}{9}(3x+5)^{-3/2}+C$

(D) $3(3x+5)^{-1/2}+C$

(E) $3(3x+5)^{3/2}+C$

13. Find $\lim_{x\to 0} x\cot 3x$.

(A) 3

(B) 0

(C) Does not exist

(D) $\frac{1}{3}$

(E) None of the above

14. $\frac{d}{dx}\int_{2x}^{5x}\sqrt{2-\cos t}\,dt =$

(A) $2\sqrt{2-\cos 5x}-5\sqrt{2-\cos 2x}$

(B) $5\sqrt{2-\cos 2x}-2\sqrt{2-\cos 5x}$

(C) $2\sqrt{2-\cos 2x}-5\sqrt{2-\cos 2x}$

(D) $5\sqrt{5-\cos 2x}-5\sqrt{2-\cos 2x}$

(E) None of the above

15. The graph in the xy-plane represented by $x=3\sin t$ and $y=2\cos t$ is

(A) a line

(B) a parabola

(C) an ellipse

(D) a hyperbola

(E) a circle

16. Find the area inside one loop of the curve $r=\sin 2\theta$.

(A) $\frac{\pi}{8}$

(B) $\frac{\pi}{16}$

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

(D) $\frac{\pi}{4}$

(E) π

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17. The interval of convergence of series $\sum_{n=1}^{\infty}\frac{(x+2)^n}{n\sqrt{n}3^n}$.

(A) $-3 \le x \le 3$
(B) $-5 \le x \le 1$
(C) $-5 \le x < 1$
(D) $-3 \le x < 3$
(E) None of the above

18. The Maclaurin series of expansion of $\frac{1}{1+x^2}$ is

(A) $1+\frac{x^2}{2!}+\frac{x^4}{4!}+\frac{x^6}{6!}+\cdots$
(B) $1-\frac{x^2}{2!}+\frac{x^4}{4!}-\frac{x^6}{6!}+\cdots$
(C) $1+x^2+x^4+x^6+\cdots$
(D) $1-x^2+x^4-x^6+\cdots$
(E) None of the above

19. Find $\lim_{x\to -1^-}\frac{1}{1+x^2}$.

(A) $-\infty$
(B) ∞
(C) 1
(D) Does not exist and neither -∞ nor ∞
(E) None of the above

20. $\int \frac{dx}{\sqrt{9-x^2}} =$

(A) $\sin^{-1}3x + C$
(B) $\sin^{-1}\frac{x}{3} + C$
(C) $\frac{1}{3}\sin^{-1}3x + C$
(D) $\ln\left|x+\sqrt{9-x^2}\right| + C$
(E) $\frac{1}{3}\ln\left|x+\sqrt{9-x^2}\right| + C$

試題隨卷繳回