1~15:單選題(75%)（每題恰有一正確選項,答對一題得五分,答錯或不答時,不倒扣也不給分）

1. What is the domain of the function $f(x)=x^2+2x$?

   Select the correct answer.

   (A) $(-\infty,\infty)$ (B) $[0,\infty)$ (C) $(-\infty,0]$ (D) $(0,\infty)$ (E) none of above.

2. What is the range of the function $f(x)=x^2+2x$?

   Select the correct answer.

   (A) $(-\infty,\infty)$ (B) $[0,\infty)$ (C) $(-\infty,0]$ (D) $(0,\infty)$ (E) none of above.

3. Find the limit, $\lim_{x\to 0}\dfrac{\sqrt{x+4}-2}{x}=?$

   Select the correct answer.

   (A) 0 (B) 1 (C) 0.5 (D) 0.25 (E) none of above.

4. Find the limit, $\lim_{x\to\infty} e^{-x}\ln x=?$

   Select the correct answer.

   (A) 0 (B) 1 (C) ∞ (D) $-\infty$ (E) none of above.

5. Let $f(x)=\begin{cases}1 & ,\ x\le -1\\ ax+b & ,\ -1<x\le 1\\ 2 & ,\ 1<x\end{cases}$. If $f(x)$ is continuous on $(-\infty,\infty)$, then $a+b=?$

   Select the correct answer.

   (A) 1 (B) 2 (C) 3 (D) 4 (E) none of above.

6. Find $\dfrac{d}{dx}x\sin x=?$

   Select the correct answer.

   (A) $x\cos x$ (B) $\sin x+\cos x$ (C) $\sin x+x\cos x$ (D) $\cos x+x\sin x$ (E) none of above.

7. Find $\dfrac{d}{dx}\sin(x^2)=?$

   Select the correct answer.

   (A) $\cos(x^2)$ (B) $\cos(2x)$ (C) $x\cos(x^2)$ (D) $2x\cos(x^2)$ (E) none of above.

8. If $f(x)+x[f(x)]^3=10$ and $f(1)=2$, find $f'(1)=?$

   Select the correct answer.

   (A) $-\dfrac{16}{13}$ (B) $-\dfrac{8}{13}$ (C) $\dfrac{16}{13}$ (D) $-\dfrac{10}{13}$ (E) $\dfrac{10}{13}$

9. Find $\int_0^{\sqrt{3}} x\sqrt{1+x^2}\,dx = ?$

Select the correct answer.

(A) 7 (B) $\frac{7}{2}$ (C) $\frac{7}{3}$ (D) $\frac{7}{4}$ (E) none of above.

10. Find $\int_1^{\infty} xe^{-x}dx = ?$

Select the correct answer.

(A) 0 (B) 1 (C) e^{-1} (D) $2e^{-1}$ (E) none of above.

11. Find the absolute maximum value of the function $f(x) = \sqrt{x} - \frac{1}{3}x$ on $0 \le x \le 9$

Select the correct answer.

(A) 0 (B) $\frac{4}{9}$ (C) $\frac{3}{4}$ (D) $\frac{3}{2}$ (E) none of above.

12. Find the area enclosed by the given curves $y = x^2 - 4x$ and $y = 2x - x^2$

Select the correct answer.

(A) 9 (B) 18 (C) 27 (D) 45 (E) none of above.

13. If $f(x,y) = \sin^2(mx+ny)$, find $f_{xx}(x,y) = ?$

Select the correct answer.

(A) $2m^2\cos(2mx+2ny)$ (B) $2mn\sin(mx+ny)$ (C) $2n^2\cos(2mx+2ny)$
(D) $2mn\cos(2mx+2ny)$ (E) none of above.

14. Consider the following two statements.

(1) If $F'(x) = f(x)$, then $\int f(x)dx = F(x) + C$

(2) $\frac{d}{dx}\int_a^b f(x)\,dx = f(x)$

Select the correct answer.

(A) (1) is correct but (2) is incorrect.
(B) (2) is correct but (1) is incorrect.
(C) Both (1) and (2) are correct.
(D) Neither (1) nor (2) is correct.

15. Let $f(x)$ and $g(x)$ be two differentiable functions with $f(x) \geq g(x), x \in \Re$. Consider the following two statements.

(1) $\frac{d}{dx} f(x) \geq \frac{d}{dx} g(x), \quad x \in \Re$

(2) $\int_a^b f(x)\,dx \geq \int_a^b g(x)\,dx$, for every $a \leq b$

Select the correct answer.

(A) (1) is correct but (2) is incorrect.

(B) (2) is correct but (1) is incorrect.

(C) Both (1) and (2) are correct.

(D) Neither (1) nor (2) is correct.

16~20：複選題(25%)（每題至少有二個正確選項, 完全答對得五分, 其餘情形得 0 分）

16. By definition, if $f(-x) = -f(x)$, then $f(x)$ is called an odd function. Which of the following functions are odd functions?

(A) $|x|$ (B) x^2 (C) $\sin x$ (D) $\tan x$ (E) e^x.

17. If $f(x) = \sqrt{x}$ and $g(x) = \sqrt[3]{1-x}$, which of the following statements are correct?

(A) $f \circ g(-7) = \sqrt{2}$.

(B) The domain of $g \circ f(x)$ is $(-\infty, \infty)$.

(C) $g \circ f(4) = -1$.

(D) $g \circ g(1) = 0$.

(E) The range of $f \circ f(x)$ is $(-\infty, \infty)$.

18. Consider the function $f(x) = |x|$, $x \in \Re$. Which of the following statements are correct?

(A) $f(x)$ is continuous on $\Re$.

(B) $f(x)$ is differentiable for every $x \in \Re$.

(C) $f(x)$ is an even function.

(D) $f(x)$ is an increasing function.

(E) $\int f(x)\,dx = \frac{1}{2}x^2 + C$.

19. Which of the following conditions are necessary for a function $f(x)$ being continuous at x_0?

(A) $\lim_{x \to x_0} f(x)$ exists.

(B) $f(x)$ is differentiable at x_0.

(C) $f(x_0)$ is well-defined.

(D) $\lim_{x \to x_0} f(x) = f(x_0)$.

(E) $\lim_{x \to x_0^-} f(x) = \lim_{x \to x_0^+} f(x_0)$.

20. Which of the following equalities are correct?

(A) $\int_0^1 \int_0^1 f(x) + g(y) dxdy = \int_0^1 f(x) dx + \int_0^1 g(y) dy$.

(B) $\int_0^1 \int_0^1 f(x) - g(y) dxdy = \int_0^1 f(x) dx - \int_0^1 g(y) dy$.

(C) $\int_0^1 \int_0^1 f(x) \cdot g(y) dxdy = \int_0^1 f(x) dx \cdot \int_0^1 g(y) dy$.

(D) $\int_0^1 \int_0^1 \frac{f(x)}{g(y)} dxdy = \frac{\int_0^1 f(x) dx}{\int_0^1 g(y) dy}$.

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ANSWER

1	2	3	4	5	6	7	8	9	10
A	E	D	A	B	C	D	B	C	D

11	12	13	14	15
C	A	A	A	B

16	17	18	19	20
C, D	A, C	A, C	A, C, D, E	A, B, C