※**Single Choice (1~15, 5% each)** (每題恰有一解，答對得 5 分，答錯或不答得 0 分)

1. Find the domain of the function $f(x) = \ln x$.

   Select the correct answer.

   (A). $(-\infty, \infty)$ (B). $(-\infty, 0)$ (C). $(-\infty, 0]$ (D). $(0, \infty)$ (E). $[0, \infty)$

2. Find the range of the function $f(x) = \ln x$.

   Select the correct answer.

   (A). $(-\infty, \infty)$ (B). $(-\infty, 0)$ (C). $(-\infty, 0]$ (D). $(0, \infty)$ (E). $[0, \infty)$

3. $\lim\limits_{x \to 0} \dfrac{\sqrt{x+1} - 1}{x} = ?$

   Select the correct answer.

   (A). 0   (B). 1   (C). 2   (D). 0.5   (E). none of above

4. If $\lim\limits_{x \to 0} \dfrac{\sin x}{x} = 1$, find the value of $\lim\limits_{x \to 0} \dfrac{\sin(3x)}{x}$.

   Select the correct answer.

   (A). 0   (B). 1   (C). 3   (D). $\dfrac{1}{3}$ (E). none of above

5. $\lim\limits_{x \to 0} \dfrac{\sin^2 3x}{x^2} = ?$

   Select the correct answer.

   (A). 0   (B). 1   (C). 3   (D). $\dfrac{1}{3}$ (E). none of above

6. Which of the following statement is the $\varepsilon - \delta$ definition of $\lim\limits_{x \to a} f(x) = L$?

   Select the correct answer.

   (A). For every $\varepsilon > 0$, there is a $\delta > 0$ such that $|f(x) - L| < \varepsilon$ whenever $|x - a| < \delta$.

   (B). For every $\varepsilon > 0$, there is a $\delta > 0$ such that $|f(x) - L| < \delta$ whenever $0 < |x - a| < \varepsilon$.

   (C). For every $\varepsilon > 0$, there is a $\delta > 0$ such that $|f(x) - L| < \varepsilon$ whenever $0 < |x - a| < \delta$.

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(D). For every $\varepsilon > 0$, there is a $\delta > 0$ such that $|f(x) - L| < \delta$ whenever $|x - a| < \varepsilon$.

(E). none of above

7. Let $f(x) = \begin{cases} 1 & , x \le 0 \\ ax + b & , 0 < x < 1 \\ 2 & , 1 \le x \end{cases}$. If $f(x)$ is continuous on $(-\infty, \infty)$, then $a - b = ?$

Select the correct answer.

   (A). 0　　　　(B). 1　　　　(C). 2　　　　(D). 3　　　　(E). none of above

8. $\dfrac{d}{dx} \sin(x^3) = ?$

Select the correct answer.

   (A). $\cos(3x^2)$　(B). $3x^2 \cos(x^3)$　(C). $3\sin^2 x$　(D). $\sin(3x^2)$　(E). none of above

9. $\dfrac{d}{dx} \sin^3 x = ?$

Select the correct answer.

   (A). $\cos(3x^2)$　(B). $3x^2 \cos(x^3)$　(C). $3\sin^2 x$　(D). $\sin(3x^2)$　(E). none of above

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

Select the correct answer.

   (A). $-\dfrac{16}{13}$　　(B). $-\dfrac{6}{13}$　　(C). $\dfrac{16}{13}$　　(D). $\dfrac{6}{13}$　　(E). none of above

11. $\displaystyle\int \cos(3x)\, dx = ?$

Select the correct answer.

   (A). $\sin(3x) + C$　　(B). $3\sin(3x) + C$　　(C). $\dfrac{1}{3}\sin(3x) + C$

   (D). $3\sin(x) + C$　　(E). none of above

12. $\int_0^2 |x-1|\, dx = ?$

　　Select the correct answer.

(A). 0　　　　(B). 1　　　　(C). 2　　　　(D). 3　　　(E). none of above

13. $\int^2 x\sqrt{x-1}\, dx = ?$

　　Select the correct answer.

(A). $\dfrac{16}{15}$　　(B). $\dfrac{15}{16}$　　(C). $\dfrac{2}{3}$　　(D). $\dfrac{3}{2}$　　(E). none of above

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

　　Select the correct answer.

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

15. A region bounded by the curves : $y = x$, $y = 0$ and $x = 1$, find the volume of

　　the region rotates about x-axis.
　　Select the correct answer.

(A). π　　(B). $\dfrac{\pi}{2}$　　(C). $\dfrac{\pi}{3}$　　(D). $\dfrac{\pi}{4}$　　(E). none of above

※**Multiple Choice (16~20, 5% each)** (每題至少有二正確選項，完全答對得 5 分，

其餘情形得 0 分)

16. Consider the function $f(x) = |\sin x|$.

　　Select the correct statements.

(A). $f(x) \ge 0$ for every $x \in (-\infty, \infty)$.

(B). $f(x)$ is continuous on $(-\infty, \infty)$.

(C). $f(x)$ is differentiable on $(-\infty, \infty)$.

(D). $\lim_{x \to \infty} f(x)$ does not exist.

(E). $\int_a^b f(x)dx$ does not exist for $-\infty < a < b < \infty$.

17. Let $f(x)$ and $g(x)$ be two integrable and differentiable functions with

$f(x) \geq g(x)$ on $\Re$. Which of the following statements are true?

(A). $f(x) - g(x) \geq 0, x \in \Re$.

(B). $|f(x)| \geq |g(x)|, x \in \Re$.

(C). $f^2(x) \geq g^2(x), x \in \Re$.

(D). $f'(x) \geq g'(x), x \in \Re$.

(E). $\int_a^b f(x)\,dx \geq \int_a^b g(x)\,dx$, where $a < b$.

18. Which of the following statements are true?

(A). If $f(x)$ is continuous on $\Re$, then it is differentiable on $\Re$.

(B). If $f(x)$ is differentiable on $\Re$, then it is continuous on $\Re$.

(C). If $f(x)$ is continuous on $\Re$, then $\int_a^b f(x)dx$ exists for $-\infty < a < b < \infty$.

(D). If $\int_a^b f(x)dx$ exists for every $-\infty < a < b < \infty$, then $f(x)$ is continuous on $\Re$.

(E). If $\int_a^b f(x)dx$ exists for every $-\infty < a < b < \infty$, then $f(x)$ is differentiable on $\Re$.

19. The position of a partical is given by $s = f(t) = t^3 - 6t^2 + 9t$, where t is measured

in seconds and s in meters.
Which of the following statements are correct?
(A). The velocity after 2 s is -3 m/s.
(B). The partical is at rest after 1 s and 3 s.
(C). The total distance traveled by the partical during the first second is 10 m.
(D). The acceleration after 2 s is 0 m/s^2.
(E). The average velocity during the first 4 s is 1 m/s.

20. Which of the following functions have an inverse function?

(A). $f(x) = \sin x, \quad x \in [-\pi, \pi]$.

(B). $f(x) = \sin x, \quad x \in [-\dfrac{\pi}{2}, \dfrac{\pi}{2}]$.

(C). $f(x) = \cos x, \quad x \in [-\pi, \pi]$.

(D). $f(x) = \cos x, \quad x \in [-\dfrac{\pi}{2}, \dfrac{\pi}{2}]$.

(E). $f(x) = x, \quad x \in [-1, 1]$.