

考試注意事項：

1. 此次考試，禁用 L'Hôpital's rule (羅必達規則)。
2. 答案紙直行對折，兩直欄書寫作答。
3. 無清楚計算過程，不予計分。
4. 沒依題目要求，不予計分。

試題：

1. (15%) Find $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - 1}{x}$.

2. (15%) Let

$$f(x) = \begin{cases} \frac{x^2 - 4}{x + 2} & \text{if } x \neq -2 \\ k & \text{if } x = -2. \end{cases}$$

Find the value of k that will make f continuous on $(-\infty, \infty)$.

3. (15%) Use the **definition of the derivative** to find the derivative of $y = \frac{1}{x+1}$.

4. (15%) How fast is $y = \left(\frac{2t-1}{t^2+1}\right)^5$ changing when $t = 1$?

5. (10%) Show that $f(x) = x^3 + x - 1$ has at least one zero in $(0, 1)$.

6. (10%) Use the **Product Rule** to find the derivative of $f(x) = (2 + 3x^2)(x^3 - 5)$.

7. (10%) Find the derivative of $y = \frac{\sqrt{x} - 1}{\sqrt{x} + 1}$.

8. (10%) Find the derivative of $y = \frac{\cos x}{1+x}$.