



**Mathematics 1 : Homework**

**Exercise 01:** 1) Simplify the following relationships :  $\frac{n!(n-1)!}{(n-2)!(n+1)!}$

2) Let  $x, y$  be real numbers. Publish the following sums using Newton's Binomial Theorem :  $(x^2 + 3)^5$  ,  $(2x - 3y)^6$  .

3) Solve the following equations : a)  $C_n^4 = C_n^2$  , b)  $\frac{(2n)!}{(2n-2)!} = 20$  .

**Exercise 02:** 1) Determine if the following sequences is increasing, decreasing, not monotonic, bounded :  $u_n = \frac{1}{4n}, \forall n \geq 1$ .

2) Determine if the given sequence converges or diverges. If it converges what is its limit ? :  $v_n = \frac{\ln(n+2)}{\ln(1+4n)}, \forall n \geq 1$ .

3) A person deposited an amount of 200000 DZD in a bank in 2023 and earned an annual compound interest of 10%. If we consider the deposited amount to be  $u_0$  and consider the number  $u_n$  to be the new balance after ( $n$ ) years.

a) Calculate the amount received in : 2024, 2025, 2026.

b) Find a relationship between  $u_{n+1}$  and  $u_n$ .

**Exercise 03:** 1) What is the domain of the following function and what are the intervals on which continuous :  $f(x) = \frac{1}{\sqrt{1-\sqrt{x}}}$  .

2) Which of the following functions are continuous on the interval  $(0, +\infty)$ :

$$f(x) = \frac{x^3 + x - 1}{x + 2}, \quad g(x) = \frac{x^2 + 3}{\cos x}, \quad h(x) = \frac{\sqrt{x^2 + 1}}{x - 2}, \quad k(x) = |\sin x|.$$

3) Given :  $f(x) = 2x^2 + 1$  ,  $g(x) = 3x - 5$ , find the following :  $f + g$ ,  $fg$ ,  $\frac{f}{g}$ ,  $f \circ g$ ,  $g \circ f$ ,  $g \circ g$ .

**Exercise 04:** 1) Given  $g(x)$  below. Find  $g'''(x)$  :  $g(x) = \frac{3}{x^2} - \frac{5}{x^4} + \frac{2}{x}$ .

2) Find the following integral :  $\int (3x^2 - \sqrt{5x + 2}) dx$ .