

# Calculus Exams 3

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## 1 Question 1: 2pt

Compute the limit of the following sequence

$$s_n = \frac{3n^4 + \sin(n)}{2n^4 + 5n^2 + 2} \quad (1)$$

## 2 Question 1: 1pt

Show that these two functions are asymptotic to each other for  $x \rightarrow 0$ .

$$f(x) = 1 - \cos(x) \quad (2)$$

$$g(x) = x(e^x - 1)/2 \quad (3)$$

## 3 Question 3: 1pt

Write a Python script to approximate the following derivative at  $x_0 = 1$  with  $dx$  equal to 0.1.

$$\frac{d \left( x e^{x^2} \right)}{dx} \quad (4)$$

## 4 Question 4: 2pt

Compute derivative of the following function

$$f(x) = \phi(x^2 + \sin(\omega(x)^2)) \quad (5)$$

where  $\omega(x)$  and  $\phi(x)$  are arbitrary functions and  $\phi_0$  is a real number.

## 5 Question 4: 2pt

Compute the following integral:

$$\int_0^1 e^{2x+e^x} dx \tag{6}$$

Hint: You need to use both substitution and integration by parts.

## 6 Question 5: 2pt

Compute the integral

$$\int_0^1 x dx$$

using only the definition of integral.

Hint: you need to compute the limit of a sequence of approximations with rectangles.