

1) Edit the code that you have written to calculate the integral of the polynomial [2 ½ marks]

$$p(x) = 3x^5 - 4x^4 - 7x^3 + x^2 + 2x + 10$$

from -1.5 to 2.5 using the following methods

1. analytically integrating using `polyint`
2. left rectangular integration with 100 intervals (101 points)
3. trapezium integration with 100 intervals using your code
4. Simpson's rule integration with 100 intervals using your code
5. Simpson's rule integration with 100 intervals using **SciPy** `simps()` function.

2) Generate a figure with 2 subplots. [1 mark]

1. In the top one, plot the polynomial $p(x)$ given above from $x = -1.5$ to 2.5 .
2. In the bottom one, plot the integral of $p(x)$, starting from -1.5 , as a function of x . Evaluate this using both analytical integration **`polyint()`** and numerical integration using **`cumtrapz()`**. The two answers should agree.

3) A Gaussian distribution with zero mean and unit variance is given by [1 ½ marks]

$$y(x) = C \exp(-x^2/2).$$

The constant C is fixed so that the integral from negative infinity to infinity is 1.

1. Make a plot of the distribution function against x (assume $C=1$)
2. Numerically integrate the function over a wide enough range to capture virtually all of the area, and use this to determine the value of C .
3. What fraction of the area is contained between -1 and 1 ?
4. What fraction of the area is contained between -3 and 3 ?