Team project

Science, Mathematics

How are the Trapezoidal Rule and Simpson’s Rule similar to Riemann’s Sums? How are they different? Trapezoidal Rule -- (or Trapezium Rule) refers to the technique of numerically evaluating the definite integral by approximating a trapezoidal area under the curve f(x) such that
where f(a) and f(b) are comparable to the bases of a trapezoid with the (b – a) as a difference representing the trapezoid’s altitude. For ‘ n’ subintervals, however, Trapezoidal Rule may be generalized into the formula:
Simpson’s Rule -- refers to the technique of numerically evaluating the definite integral by approximation of Closed Newton–Cotes Formula as follows:
However, if large intervals are involved so that larger ‘ n’ subintervals become necessary to maintain good accuracy of approximation, Simpson’s Rule may be modified in general to evaluate the integral of f(x) from ‘ a’ to ‘ b’ with:

Both the Trapezoidal Rule and the Simpson’s Rule share a common attribute with Riemann’s Sums in the sense that all the three of them pertain to algorithms for computing an approximate numerical solution to a definite integral. In application, moreover, Riemann’s Sums are similar with both Trapezoidal Rule and Simpson’s Rule for being a method that estimates the area under the curve in an approach that determines the sum of areas of the rectangular strips spread throughout the region, multiplied by the width Δx and divided by ‘ n’ subintervals.
Riemann’s Sum -- in effect, exhibits a more precise definition of the definite integral, being the limit of an infinite series given by –

Despite its similarities with the two aforementioned techniques, the Riemann’s Sum is different for bearing no factor with ‘ n’ in the denominator of the width (b – a), not like in the case of Simpson’s Rule where 1/3 factor is incorporated while in Trapezoidal Rule, a factor of 1/2 is further attached to the product of the width and the sum of the heights. Additionally, no coefficients appear for any of the in Riemann’s Sum unlike in the other two methods.