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have considered the case where an antiderivative of the integrand cannot be computed. We now investigate the situation where the integrand is not known. This is, in fact, the most widely used application of Numerical Integration methods.

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term and no integral in the second term.

The approach will be to replace the midpoint approximation with an integral expression. Indeed, if we denote the midpoint by  $c$ , i.e.,  $c = \frac{a+b}{2}$ , then the tangent line to  $f(x)$  at  $x = c$  is given by  $P$

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$f(x) = f(c) + f'(c)(x - c)$ . Clearly,  $\int_a^b f(x) dx = (b - a)f(c)$ , and hence  $\int_a^b f(x) dx - (b - a)f\left(\frac{a+b}{2}\right) = \int_a^b (f(x) - P_1(x)) dx$ .

## 6 Numerical Integration

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integrand is evaluated at a finite set of points called integration points and a weighted sum of these values is used to approximate the integral.

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different methods of numerical integration  
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because the above form has 1/3 in its formula it is called simpsons 1/3rd rule composite simpsons 1/3rd rule one can subdivide the interval  $a$   $b$  into  $n$  segments and apply simpsons 1/3rd rule repeatedly over every two segments the segment width  $h = (b - a) / n$  apply simpsons 1

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N.B. This is for single variable integrals, it gets worse as the number of variables increases. Assignment 2. You should now be able to start the second assignment which investigates numerical integration using Simpson ' s rule.

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Different ideas and motivations led several authors to develop special methods for the integration of oscillatory problems. Among the algorithms designed specifically for the numerical resolution of second-order

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systems are Falkner methods, the Adams extrapolation formulas, St ö rner – Cowell methods [20,21], and Gauss – Jackson methods [22,23].

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methods with the hope of generalizing the two traditional numerical integration methods (Runge-Kutta methods and linear multistep methods) as a result of the

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