Approximate calculation of definite integrals by quadrature formulas

The purpose: To learn the methods of approximate calculation of definite integrals with the required accuracy on the basis of quadrature formulas.

Content

1. To construct graphs of functions f (x) and y (x) in the given ranges [and, b] and [c, d].
2. To calculate of value of certain integrals for functions f (x) and y (x), using MathCAD

3. To calculate integral by trapezoidal formula.
3.1. To define quantity of the number of partition points n of the interval [a,b] for calculation the integral of function f (x) with an accuracy $\varepsilon_1 = 10^{-3}$ and
3.2. To get any nodes grid x_i of the interval [a, b] for n values. To calculate values of function f (x) in the received nodes - $f(x_i)$.
3.3. To calculate integral of function f (x) with accuracy ε_1 and ε_2 by trapezoidal formula using MathCAD.

4*. To calculate the integral by Simpson's formula
4.1. Determine the number of partition points k1, k2 interval [c, d] to calculate the integral of a function y (x) with an accuracy of e1=10-2 and e2=10-4.
4.2. Get grid nodes xi interval xi interval [c, d] for the values of k1 and k2. Calculate the value of the function y (x) in the resulting nodes -y(xi).
4.3. Calculate the integral of y (x) with an accuracy of e1 and e2 by Simpson's formula using MathCAD

5. Calculate the error of integration, compared with given values ε_1 and ε_2. To make conclusions about the using of the trapezoidal rule and Simpson in numerical integration.

Table **1**

№ варианта	***f*(*x*)**	**[*a*; *b*]**	***y*(*x*)**	**[*c*; d]**
1	$1+x\cdot\cos(x)$	[0.1; 1]	$(x^2+1)\sin(x-0.5)$	[1; 2]
2	$0.5x+x\ln x$	[1; 2]	$\frac{\ln(x+2)}{x}$	[2; 3]
3	$x^2\cos(\frac{x}{4})$	[2; 3]	$\frac{x^2}{1+x^2}$	[0.1; π]
4	$x(2+x)e^x$	[0.1; 1]	$x\cdot tg(x^2+1)$	[0.1; 0.6]
5	$\frac{e^{-x}}{1+e^{-x}}$	[0.1; π]	$\sin x\frac{e^{-x}}{1+e^{-x}}$	$[0;2\pi]$
6	x^2e^x	[0.1; 0,5]	$\frac{2^x\ln(1+2^x)}{1+2^x}$	[0.1; 1]
7	$\frac{\ln(x+1)}{x}e^{-x}$	[0.2; 1]	$\frac{\cos x}{x^2+1}e^{-x}$	[0.5; 1]
8	$\frac{x+1}{\sqrt{x^2+4}}\sin\pi x$	[0.1; 1]	$\frac{x+1}{\sqrt{x^2+4}}\cos\pi x$	[0.1; 0,5]
9	$x\cdot tg(x^2+1)\ln(x+1)$	[0.1; 0.5]	$\frac{x+1}{\sqrt{x^2+4}}\cos(\pi x)e^{-x}$	[0.1; 0,5]
10	$\frac{1}{\sqrt{x^2+\pi^2}}$	[0.1; π]	$x^3e^{-x^2}$	[0.1; 1]
11	$\frac{\sin(0.2+0.7x)}{1.1-\cos(1.3-0.4x)}$	[0.1; 1.5]	$\frac{x+1}{\sqrt{x^2+1}}e^{-x}$	[0.1; 1]
12	$\frac{1}{\sqrt{2x^2+0.4}}$	[0.1; 1.8]	$x\cdot tg(x^2+1)$	[0.1; 0,5]
13	$\frac{x\cdot e^{-1}}{\sqrt{20-2x}}$	[0.1; 1.7]	$\frac{e^{-x}}{x(1+\ln^2 x)}$	[1; π]
14	$(x+1.9)\sin(\frac{x}{3})$	[1; 2]	$\frac{\ln(x+1)}{x}e^{-x^2}$	[0.1; 1]
15	$2.6x^2\ln x$	[1.2; 2.2]	$\frac{\ln^2(x+1)}{x}e^{-x}$	[0.1; 1]
16	$\frac{3\cos x}{2x+1.7}$	[0; 1]	$x^3(2-x)e^x$	[0.1; 1]
17	$\frac{e^{-x}}{x(1+\ln x)}$	[1; π]	$\frac{1}{\sqrt{x^2+7}}$	[1.2; 2.1]
18	$\frac{\sin x}{\sqrt{1+x^2}}e^{-(1+x)}$	[0.1; 0.5]	$\frac{\cos(x^2+1)}{x}$	[2.2; 2.6]
19	$\frac{1}{\sqrt{x^2+\pi}}$	$[0;\sqrt{\pi}]$	$\frac{tg(x+0.5)}{x}e^{-x}$	[0.1; 1]

20	$\frac{x^2+1}{\sqrt{x^2+4}}\ln\frac{2+x}{2-x}$	[0.1; 1]	$\frac{e^{-x}}{1+e^{-x}}$	[0.1; π]