Numerical solution error

Goal: Get skills in calculating errors in numerical solutions. To study methods for calculating errors of a complex function from known errors of its parameters.

Content

1. Calculate the value of the analytical expression (Table 1.1) and evaluate the absolute and relative errors of the composed function.

2. According to the relative or absolute error of the analytical expression obtained in 1. round up the dubious digits of the number (analytical expression), leaving only the correct signs.

3*. Determine which equality is more accurate (Table 1.2).

4. Make a report.

Table.1

Variants

№ Variant	Composite function $Z(a,b,c)$	Parameter value
1	$\frac{(b\cdot a^2)}{\sqrt{c^3}}\cdot b^2$	$a=3,85\pm0,01$ $b=2,0435\pm0,004$ $c=926,6\pm0,2$
2	$\frac{a\cdot b}{\sqrt[3]{c}}(a+5)^2\sin(c)$	$a=0,12456\pm0,0005$ $b=0,078\pm0,0003$ $c=0,2468\pm0,00013$
3	$\frac{ab^2}{\sqrt[3]{c}}\sin(c\cdot b)+100$	$a=2,35\pm0,003$ $b=3,272\pm0,001$ $c=27,03\pm0,009$
4	$\frac{a+b^2}{\sqrt[3]{a-b}}a\ln(a+c)$	$a=0,1245\pm0,0005$ $b=0,12\pm0,0003$ $c=2,08\pm0,015$
5	$\frac{\sqrt{(c+b-a)^3}}{b\sqrt[3]{c^3+b}}$	$a=0,2456\pm0,0005$ $b=0,078\pm0,003$ $c=8\pm0,25$
6	$\frac{a^2b}{\sqrt[3]{c}}(1+b)\sin(2c)$	$a=2456\pm0,0005$ $b=0,00078\pm0,00003$ $c=0,008\pm0,00013$
7	$\frac{(c-a)b^2}{\sqrt[3]{c+b}}$	$a=3,85\pm0,01$ $b=2,0435\pm0,004$ $c=926,6\pm0,2$
8	$\frac{(a+b)c}{a-b}\ln^2(1+c)$	$a=0,2456\pm0,0005$ $b=0,20078\pm0,00003$ $c=0,008\pm0,00013$
9	$\left[\frac{(a+b^2)c}{a-b^2}\right]^2\ln(a+ac^2)$	$a=0,2556\pm0,0005$ $b=0,50078\pm0,00003$ $c=0,8\pm0,013$
10	$\frac{a+b}{\sqrt{c-a}}a\ln(\pi c)$	$a=0,12456\pm0,0005$ $b=0,12078\pm0,00003$ $c=2,08\pm0,015$

№ Variant	Composite function $Z(a,b,c)$	Parameter value
11	$\frac{(c+b-a)^2 b^2}{\sqrt[3]{c^2+b^2}}$	$a = 33,23 \pm 0,02$ $b = 5,65 \pm 0,05$ $c = 0,7695 \pm 0,0001$
12	$\frac{a+b}{\sqrt[3]{a-b}}(a^2+b)\ln(3+c)$	$a = 0,2456 \pm 0.0005$ $b = 0.0078 \pm 0.00003$ $c = 8 \pm 1.23$
13	$\frac{a+b}{a-b}\ln(1+ac)$	$a = 0,12456 \pm 0,0005$ $b = 0,0078 \pm 0,00003$ $c = 0,008 \pm 0,00013$
14	$\frac{c^2\sqrt[3]{a+b}}{13}\sin(1+a)$	$a = 0,2456 \pm 0,0005$ $b = 0,0078 \pm 0,00003$ $c = 8 \pm 0,23$
15	$\frac{ab}{\sqrt[3]{1+c}}(a+b)\sin(c)$	$a = 0,12456 \pm 0,0005$ $b = 0,0078 \pm 0,00003$ $c = 0,008 \pm 0,00013$
16	$\frac{\sqrt[3]{b+c}}{\cos(c^2)}(a^2+\sqrt{b})$	$a = 33,23 \pm 0,02$ $b = 5,65 \pm 0,05$ $c = 0,7695 \pm 0,0001$
17	$\frac{(c-a)b^2}{\sqrt[3]{c+b}}\ln(1+ac)$	$a = 3,85 \pm 0,01$ $b = 2,0435 \pm 0,004$ $c = 926,6 \pm 0,2$
18	$\frac{c^3}{13}(a-b)^3\cos(a^2c)$	$a = 0,2456 \pm 0,0005$ $b = 0,0078 \pm 0,00003$ $c = 8 \pm 0,23$
19	$a+\frac{a+b}{\sqrt{a-b}}\lg(ac)$	$a = 3,85 \pm 0,01$ $b = 2,0435 \pm 0,004$ $c = 926,6 \pm 0,2$
20	$\frac{(a+b^2)}{\sqrt{a-b}}(1+c)\lg(c)$	$a = 3,85 \pm 0,01$ $b = 2,0435 \pm 0,004$ $c = 926,6 \pm 0,2$

Table.2

№	
1	$29/13 = 2,23;\ \sqrt{6} = 2,45$
2	$17/14 = 1,21;\ \sqrt{8} = 2,83$
3	$20/13 = 1,54;\ \sqrt{3,8} = 1,95$
4	$22/7 = 3,143;\ \sqrt{14} = 3,742$
5	$14/17 = 0,823;\ \sqrt{58} = 7,61$
6	$4/7 = 0.576;\ \sqrt{10} = 3.16$
7	$5/13 = 0,385;\ \sqrt{3/20} = 0,387$
8	$16/7 = 2,28;\ \sqrt{\pi} = 1,77$
9	$20/29 = 0,69;\ \sqrt{83} = 9,11$
10	$20/13 = 1,54;\ \sqrt{6,8} = 2,61$
11	$13/15 = 0,87;\ \sqrt{2/3} = 0,82$
12	$18/17 = 1,06;\ \sqrt{15} = 3,87$
13	$17/13 = 1,31;\ \sqrt{3,7} = 1,92$
14	$6/13 = 0,462;\ \sqrt{1/2} = 0,707$
15	$23/15 = 1,53;\ \sqrt{27} = 5,19$
16	$21/29 = 0,724;\ \sqrt{83} = 9,11$
17	$19/3 = 6,33;\ \sqrt{51} = 7,14$
18	$7/12 = 0,583;\ \sqrt{23} = 4,796$
19	$29/21 = 1,38;\ \sqrt{18} = 4,243$
20	$11/3 = 3,667;\ \sqrt{12} = 3,464$