

Программа вычисления абсолютной погрешности функции методом итоговой регистрации на языке Turbo Pascal.

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program itog_pogresh; {A=(cos(a)+exp(b))/(2*sqr(b)+ln(a))}
  var a,b,da,db,p1,p2,a1, chisl1, znam2, itogreal;

function Dsum(dx,dy:real):real; {predehnaya absolyutnaya pogreshnost summi}
  begin Dsum:=dx+dy end;

function Dquot(x,y:real; dx,dy:real):real; {predehnaya absolyutnaya pogreshnost chasnogo}
Dquot:=(abs(x)*dy+abs(y)*dx)/sqr(y) end;

function Dmult(x:real; dx:real):real; {predehnaya absolyutnaya pogreshnost proizvedeniya}
Dmult:=2*abs(x)*dx end;

function Dln(x,dx:real):real; {predehnaya absolyutnaya pogreshnost naturalnogo
logarifma}
  begin Dln:=dx/x end;

function Dexp(x,dx:real):real;
  begin Dexp:=dx*exp(x) end;
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function Dsqrt(x,dx:real):real; {predehnaya absolyutnaya porshnost kvadratnogo kornya} begin
Dsqrt:=dx/(2*sqrt(x)) end;
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function Dsqr(x,dx:real):real; {predehnaya absolyutnaya pogrshnost kvadrata}
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begin Dsqr:=(2*(x))*dx end;
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function Dsin(x,dx:real):real; {predehnaya absolyutnaya pogrshnost sin}
begin Dsin=abs(cos(x))*dx; end;
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function Dcos(x,dx:real):real; {predehnaya absolyutnaya pogrshnost cos}
begin Dcos:=abs(sin(x))*dx; end;
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function Dtg(x,dx:real):real; {predehnaya absolyutnaya pogrshnost tg}
begin Dtg:=dx/sqr(x); end;
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```
function Darcsin(x,dx:real):real; {predelnaya absolyutnaya pogrshnost arcsin}  
begin Darcsin:=dx/(sqrt(1-sqr(x))); end;
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```
function Darccos(x,dx:real):real; {predelnaya absolyutnaya pogrshnost arccos}  
begin Darccos:=dx/(sqrt(1-sqr(x))); end;
```

```
function Darctg(x,dx:real):real; {predelnaya absolyutnaya pogrshnost arctg}  
begin Darctg:=dx/(1+sqr(x)); end;
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```
function D1_del_x(x,dx:real):real; {predelnaya absolyutnaya pogrshnost 1/x}  
begin D1_del_x:=dx/(sqr(x)); end;
```

```

begin
  Write('Vvedite sledujushie chisla'); readln;
  write('a='); readln(a);
  write('b='); readln(b);
  write('da='); readln(da);
  write('db='); readln(db);

  p1:=cos(a)+exp(b); {chislitel}
  p2:=2*sqr(b)+ln(a); {znamenatel}
  a1:=p1/p2;

  chisl1:=Dsum(Dexp(b,db),Dcos(a,da)); {predelnaya absolyutnaya pogreshnost
                                         chislitelya}
  znam2:=Dsum((2*dsqr(b,db)),dln(a,da)); {predelnaya absolyutnaya pogreshnost
                                         znamenatelya}

  itog:=Dquot(p1,p2, chisl1,znam2);
  writeln('chislo a=',a1:5:4);
  writeln('predelnaya absolyutnaya pogreshnost=',itog:5:4);
  readln;
end.

```

```
program granitsi; {poshagovii vivod znachenii granits v protsesse  
                vichislenii po formule  $A=(\cos(a)+\exp(b))/(2*\text{sqr}(b)+\ln(a))$ }  
  var a,b,da,db,nga,vga,ngb,vgb,lsum,upsum,lmult,upmult,  
      lsum2,aa,upsum2, lquot,upquot,r:real; n:integer;
```

```
{verhnyaya i nijnyaya granitsi pogreshnosti summi}  
procedure sum(la,upa,lb,upb:real; var ls,ups:real);  
  begin ls:=la+lb; ups:=upa+upb end;
```

```
{verhnyaya i nijnyaya pogreshnosti proizvedeniya}  
procedure mult(la,upa:real; var lm,upm:real);  
  begin lm:=sqr(la);upm:=sqr(upa); end;
```

```
{verhnyaya i nijnyaya pogreshnosti chastnogo}  
procedure quot(la,upa,lb,upb:real; var lq,upq:real);  
  begin lq:=la/upb; upq:=upa/lb; end;
```

begin

```
Writeln('Vvedite sledujushie chisla');
```

```
write('a='); readln(a);
```

```
write('b='); readln(b);
```

```
write('da='); readln(da);
```

```
write('db='); readln(db); writeln;
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nga:=a-da; vga:=a+da; writeln(nga:10:4,'< a <',vga:10:4);
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```
ngb:=b-db; vgb:=b+db; writeln(ngb:10:4,'< b <',vgb:10:4);
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```
writeln('nijnyaya granitsa e^b=',exp(ngb));
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writeln('verhnyaya granitsa e^b=',exp(vgb)); writeln;
```

```
writeln('nijnyaya granitsa cos(a)=',cos(nga));
```

```
writeln('verhnyaya granitsa cos(a)=',cos(vga));
```

```
writeln('nijnyaya granitsa 2*sqrt(b)=',2*sqrt(ngb));
```

```
writeln('verhnyaya granitsa 2*sqrt(b)=',2*sqrt(vgb));
```

```
writeln('nijnyaya granitsa ln(a)=',ln(nga));
```

```
writeln('verhnyaya granitsa ln(a)=',ln(vga)); writeln;
```

```

sum(cos(nga),cos(vga),exp(ngb),exp(vgb),lsum,upsum);
writeln('nijnyaya granitsa cos(a)+exp(b)=',lsum);
writeln('verhnyaya granitsa cos(a)+exp(b)=',upsum); writeln;

mult(ngb,vgb,lmult,upmult); writeln;
writeln('nijnyaya granitsa b^2=',lmult);
writeln('verhnyaya granitsa b^2=',upmult); writeln;

sum(ln(nga),ln(vga),2*lmult,2*upmult,lsum2,upsum2);
writeln('nijnyaya granitsa 2*b^2+ln(a)=',lsum2);
writeln('verhnyaya granitsa 2*b^2+ln(a)=',upsum2); writeln;

quot(lsum,upsum,lsum2,upsum2,lquot,upquot);
aa:=(lquot+upquot)/2; writeln('A=',aa:6:4);
writeln('nijnyaya granitsa A=',lquot:6:4);
writeln('verhnyaya granitsa A=',upquot:6:4);
writeln('absolyutnaya pogreshnost A=',abs(upquot-lquot)/2:6:4);
writeln;
repeat until keypressed; end.

```

1.7. Задания для лабораторных работ. Вычислить абсолютную погрешность по методам итоговой регистрации погрешностей и границ

№	a	b	Δa	Δb	A
1	5	4	0.001	0.002	$\frac{\cos(a + b^2) - \ln(b + \sqrt{a})}{2b^3 - 4a^{(5/3)} - 1}$
2	3	2	0.0005	$\frac{0.000}{5}$	$\frac{\sin(b^2 - 3a + ab) + e^{2b}}{\ln(a^3 + b)}$
3	2.1	3.9	0.001	0.003	$\frac{e^{3a} + \ln(\sqrt{a} + b^2)}{\sin(2a^2 - b)}$
4	3	6	0.0006	$\frac{0.000}{5}$	$\frac{\sin(2b^3 - 7a) - \cos(2a + b)}{\ln(b^2 + a^2)}$
5	4	6	0.0004	0.002	$\frac{ab}{\sqrt{a + b^2}}$
6	0.3	3.2	0.0006	$\frac{0.000}{7}$	$\frac{a + \sqrt{b}}{\lg(a^2 + b^2)}$

7	1.7	1.2	0.0005	0.000 6	$\frac{e^a - \sqrt[3]{b}}{\ln(1+a^2)}$
8	7	3	0.002	0.003	$\lg \frac{\cos^2 a + b}{a^{\sqrt{b}} + b^{\sqrt{a}}}$
9	6.5	3.5	0.0004	0.000 4	$\ln(a-b)(a + \sin b) + e^{2a}$
10	7	2	0.0005	0.000 7	$10a(b^2 + \ln a) + (a - b^2)$
11	2	1	0.0002	0.000 3	$(\sin(ab + a^2) - e^{\sqrt{b}})(\lg(a-b) + 3a^3)$
12	4	3	0.0001	0.000 2	$e^a \ln(a + b^2) + e^b \sin(2a^2 - 3b^3)$
13	1	4	0.0004	0.000 5	$\sqrt{ab} - (e^a + 3\sqrt{b})\cos(b^2 - 3a)$
14	5	5	0.001	0.002	$\sqrt{ab} \ln a \ln b + e^{2a} \sin b$

