

14.

$$U = f(X) \tag{3.1}$$

$$f(X) - f(a) = \epsilon_u$$

$$\epsilon_u = \epsilon_a \cdot f'(A)$$

$$U = f(A) = f(a + \Delta_a) = f(a) + f'(a)\Delta_a + \dots, \tag{3.2}$$

$$\Delta_u \approx f'(a)\Delta_a \tag{3.3}$$

$$\epsilon_u = |f'(a)|\epsilon_a \tag{3.4}$$

$$\delta_u = \left| \frac{f'(a)}{f(a)} \right| \cdot |a| \cdot \delta_a \tag{3.5}$$

\_\_\_\_\_.  
0,0087 .

tg 85°,

0°,5 =

$$\varepsilon_{\text{tg}} = \frac{1}{\cos^2 85^\circ} \cdot 0,0087 = 0,0087 \cdot 132 = 1,15 .$$

$$\text{tg } 85^\circ = 11,4.$$

$$1,4 - 1,15 = 10,25 \quad 11,4 + 1,15 = 12,55. \quad -$$

$$\text{tg } 84^\circ,5 = 10,4;$$

$$\text{tg } 85^\circ,5 = 12,7. \quad -$$

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0,1;

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#### 14.1.

1)  $\sin x \quad \cos x$

$$u = \sin a, \quad (3.4)$$

$$\varepsilon_u = |\cos a| \cdot \varepsilon_a \quad (3.8)$$

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$$\varepsilon_u \leq \varepsilon_a \quad (3.9)$$

$$\varepsilon_{\cos a} = |\sin a| \varepsilon_a. \quad (3.10)$$

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**46°**,

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**45°**. -

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2)  $\operatorname{tg} x = \operatorname{ctg} x$

$u = \operatorname{tg} a, v = \operatorname{ctg} a,$

$$\left. \begin{aligned} \varepsilon_u &= \frac{\varepsilon_a}{\cos^2 a}, \\ \varepsilon_v &= \frac{\varepsilon_a}{\sin^2 a}. \end{aligned} \right\} \quad (3.11)$$

$$\varepsilon_{\operatorname{tg} a} \geq \varepsilon_a; \varepsilon_{\operatorname{ctg} a} \geq \varepsilon_a \quad (3.12)$$

$90^\circ.$

3)

$= \arcsin \dots$

$$\varepsilon_u = \frac{\varepsilon_a}{\sqrt{1-a^2}} \quad (3.18)$$

)  $\varepsilon_u \geq \varepsilon_a;$   $= 0, \dots = 0;$

)  $\dots$

, ( ) ;

)  $\dots, 90^\circ,$

,  $\dots, = \arcsin 0,984,$

$$\varepsilon_u = \frac{5 \cdot 10^{-4}}{0,17} = 3 \cdot 10^{-3},$$

$10^\circ.$

$\sin 79^\circ 40' = 0,984$

$\sin 79^\circ 50' = 0,984.$

— , , , 90°

$$u = \operatorname{arctg} a, \quad v = \operatorname{arcctg} a.$$

$$\varepsilon_u = \frac{\varepsilon_a}{1+a^2}, \quad \varepsilon_v = \frac{\varepsilon_u}{1+a^2} \quad (3.14)$$

90°

4)

$$u = a^n,$$

$$\left. \begin{aligned} \varepsilon_u &= |n| a^{n-1} \varepsilon_a \\ \delta_u &= |n| \delta_a \end{aligned} \right\} \quad (3.15)$$

$$, \quad |n| > 1$$

$$; \quad |n| < 1 \quad -$$

, , )

$$2-3 \quad \frac{1}{2}, \frac{1}{3},$$

$$\pi^2 = 9,86, \quad \sqrt{\pi} = 1,77 \quad = 3,14,$$

$$\pi^2 = 9,8696, \quad \sqrt{\pi} = 1,7725, \quad = 3,1416.$$

$\pi^2$      $\sqrt{\pi}$ ,  
 ,    ,    ,    .  
 «    »  
 ,    (    ),    ,  
 ,    (    ),  
 $\pi^2$     9,87 (    -  
 ),    9,86.

5)

$u = \lg a$ .     $a = 10^u$ ,     $u = \lg e \ln a$ ,     $\ln a$  -  
 ,  $\lg e = 0,4343 < 0,5$ .

$$\varepsilon_u = \frac{1}{2} \frac{\varepsilon_a}{a} = \frac{1}{2} \delta_a \quad (3.16)$$

$\delta_a$

$$\delta_a = \frac{1}{2C \cdot 10^{s-1}} \quad (3.17)$$

$$\varepsilon_u = \frac{1}{4C} \cdot \frac{1}{10^{s-1}} \quad (3.18)$$

$$C > 2\frac{1}{2},$$

$$\varepsilon_u < \frac{1}{10^s} \quad (3.19)$$

$$C < 2\frac{1}{2},$$

$$\varepsilon_u > \frac{1}{10^s} \quad (3.19)$$

:

$$\varepsilon_u = 2,5 \cdot 10^{-s}.$$

$$\delta_a = \frac{1}{0,4343} \varepsilon_u \quad (3.20)$$

$$(u) \quad \delta_a = 2,4 \varepsilon_u \quad (u = \lg a). \quad (3.21)$$

$$\left. \begin{aligned} \varepsilon_u &= \frac{1}{2} \cdot 10^{-s}, \\ \delta_a &= 1,2 \cdot 10^{-s}, \end{aligned} \right\} \quad (3.22)$$

6)

)  $u = \lg \sin a$ ;

$$\varepsilon_u = 0,4343 \operatorname{ctg} a \cdot \varepsilon_a \quad (3.23)$$

$$\operatorname{ctg} a \leq 0,4343 \quad \operatorname{tg} a \geq 0,4343, \dots > 23^\circ 20'.$$

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 , 23,5°.  
 , 66,5°, 23,5°, 66,5°\*).

$$) u = \lg \operatorname{tg} a$$

$$\varepsilon_u = 0,4343 \operatorname{ctg} a \sec^2 a \cdot \varepsilon_a = \frac{0,8686}{\sin 2a} \varepsilon_a \quad (3.24)$$

$$\sin 2a \geq 0,8686, \dots 59^\circ 30' < 2a < 120^\circ 30' \quad ( \quad ) 30^\circ < < 60^\circ.$$

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\*)

$$\lg \operatorname{ctg} a = -\lg \operatorname{tg} a,$$

66°,5,

7.

$$) \lg \sin u = a, \quad \sin u = 10^a \quad u = \arcsin 10^a,$$

$$\varepsilon_u = \frac{10^a}{\sqrt{1-10^{2a}}} \cdot \frac{1}{0,4343} \varepsilon_a \quad (3.25)$$

$$\varepsilon_u = \frac{\operatorname{tg} u}{0,4343} \varepsilon_a \quad (3.25)$$

,  
 $\varepsilon_u \leq \varepsilon_a$ . -  
 $u \leq 23^\circ,5$ . ,  
 $23^\circ,5$ .  
 , -  
 $66^\circ,5$ . -  
 , :  $45^\circ$  ( -  
 ) ,  $45^\circ -$  . -  
 $23^\circ,5$   $66^\circ,5$  , -  
 $2,3$  ,  $45^\circ$ , -  
 ( -  
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