

### Знайти границю функції за правилом Лопіталя:

1. a)  $\lim_{x \rightarrow 0} \frac{\ln(1+x) - x}{\operatorname{tg}^2 x};$

b)  $\lim_{x \rightarrow +0} (\arcsin x)^{\operatorname{tg} x}.$

2. a)  $\lim_{x \rightarrow 0} \frac{e^{3x} - 3x - 1}{\sin^2 5x};$

b)  $\lim_{x \rightarrow 0} x \cdot \ln\left(\frac{2}{\pi} \operatorname{arctg} x\right).$

3. a)  $\lim_{x \rightarrow +0} \frac{3 + \ln x}{2 - 3 \ln \sin x};$

b)  $\lim_{x \rightarrow \frac{\pi}{2}} (\pi - 2x) \operatorname{tg} x.$

4. a)  $\lim_{x \rightarrow a} \frac{\sin x - \sin a}{x - a};$

b)  $\lim_{x \rightarrow 0} \left( \frac{1}{x} - \frac{1}{\arcsin x} \right).$

5. a)  $\lim_{x \rightarrow 0} \frac{x - \arcsin x}{\sin^3 x};$

b)  $\lim_{x \rightarrow 0} x \cdot \operatorname{ctg} \pi x.$

6. a)  $\lim_{x \rightarrow 0} \frac{\operatorname{tg} x + \sec x - 1}{\operatorname{tg} x - \sec x + 1};$

b)  $\lim_{x \rightarrow 0} \left( \frac{1}{x^2} - \frac{1}{\sin^2 x} \right).$

7. a)  $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\sec^2 x - 2 \operatorname{tg} x}{1 + \cos 4x};$

b)  $\lim_{x \rightarrow 0} (e^x + e^{-x} - 2) \cdot \operatorname{ctg} x$

8. a)  $\lim_{x \rightarrow 0} \frac{\operatorname{tg} x - \sin x}{\sin^3 x};$

b)  $\lim_{x \rightarrow 0} = \left( \frac{1}{x \operatorname{arctg} x} - \frac{1}{x^2} \right).$

9. a)  $\lim_{x \rightarrow +0} \frac{\ln \sin x}{\operatorname{ctg} x};$

b)  $\lim_{x \rightarrow 1} (1 - x)^{\cos \frac{\pi x}{2}}.$

10. a)  $\lim_{x \rightarrow \frac{\pi}{2}} \frac{\ln \sin x}{(\pi - 2x)^2};$

b)  $\lim_{x \rightarrow 0} (1 + \sin x)^{\operatorname{ctg} x}$

11. a)  $\lim_{x \rightarrow 0} \frac{\ln(1+x) - x}{\operatorname{tg}^2 x};$

b)  $\lim_{x \rightarrow +0} (\arcsin x)^{\operatorname{tg} x}.$

12. a)  $\lim_{x \rightarrow 0} \frac{e^{3x} - 3x - 1}{\sin^2 5x};$

b)  $\lim_{x \rightarrow 0} x \cdot \ln\left(\frac{2}{\pi} \operatorname{arctg} x\right).$

13. a)  $\lim_{x \rightarrow +0} \frac{3 + \ln x}{2 - 3 \ln \sin x};$

b)  $\lim_{x \rightarrow \frac{\pi}{2}} (\pi - 2x) \operatorname{tg} x.$

14. a)  $\lim_{x \rightarrow a} \frac{\sin x - \sin a}{x - a};$

b)  $\lim_{x \rightarrow 0} \left( \frac{1}{x} - \frac{1}{\arcsin x} \right).$

$$15. a) \lim_{x \rightarrow 0} \frac{x - \arcsin x}{\sin^3 x};$$

$$16. a) \lim_{x \rightarrow 0} \frac{\operatorname{tg} x + \sec x - 1}{\operatorname{tg} x - \sec x + 1};$$

$$17. a) \lim_{x \rightarrow \frac{\pi}{4}} \frac{\sec^2 x - 2 \operatorname{tg} x}{1 + \cos 4x};$$

$$18. a) \lim_{x \rightarrow 0} \frac{\operatorname{tg} x - \sin x}{\sin^3 x};$$

$$19. a) \lim_{x \rightarrow +0} \frac{\ln \sin x}{\operatorname{ctg} x};$$

$$20. a) \lim_{x \rightarrow \frac{\pi}{2}} \frac{\ln \sin x}{(\pi - 2x)^2};$$

$$21. a) \lim_{x \rightarrow 0} \frac{\ln(1+x) - x}{\operatorname{tg}^2 x};$$

$$22. a) \lim_{x \rightarrow 0} \frac{e^{3x} - 3x - 1}{\sin^2 5x};$$

$$23. a) \lim_{x \rightarrow +0} \frac{3 + \ln x}{2 - 3 \ln \sin x};$$

$$24. a) \lim_{x \rightarrow a} \frac{\sin x - \sin a}{x - a};$$

$$25. a) \lim_{x \rightarrow 0} \frac{x - \arcsin x}{\sin^3 x};$$

$$26. a) \lim_{x \rightarrow 0} \frac{\operatorname{tg} x + \sec x - 1}{\operatorname{tg} x - \sec x + 1};$$

$$27. a) \lim_{x \rightarrow \frac{\pi}{4}} \frac{\sec^2 x - 2 \operatorname{tg} x}{1 + \cos 4x};$$

$$28. a) \lim_{x \rightarrow 0} \frac{\operatorname{tg} x - \sin x}{\sin^3 x};$$

$$b) \lim_{x \rightarrow 0} x \cdot \operatorname{ctg} \pi x.$$

$$b) \lim_{x \rightarrow 0} \left( \frac{1}{x^2} - \frac{1}{\sin^2 x} \right).$$

$$b) \lim_{x \rightarrow 0} (e^x + e^{-x} - 2) \cdot \operatorname{ctg} x$$

$$b) \lim_{x \rightarrow 0} = \left( \frac{1}{x \arctg x} - \frac{1}{x^2} \right).$$

$$b) \lim_{x \rightarrow 1} (1 - x)^{\cos \frac{\pi x}{2}}.$$

$$b) \lim_{x \rightarrow 0} (1 + \sin x)^{\operatorname{ctg} x}$$

$$b) \lim_{x \rightarrow +0} (\arcsin x)^{\operatorname{tg} x}.$$

$$b) \lim_{x \rightarrow 0} x \cdot \ln \left( \frac{2}{\pi} \arctg x \right).$$

$$b) \lim_{x \rightarrow \frac{\pi}{2}} (\pi - 2x) \operatorname{tg} x.$$

$$b) \lim_{x \rightarrow 0} \left( \frac{1}{x} - \frac{1}{\arcsin x} \right).$$

$$b) \lim_{x \rightarrow 0} x \cdot \operatorname{ctg} \pi x.$$

$$b) \lim_{x \rightarrow 0} \left( \frac{1}{x^2} - \frac{1}{\sin^2 x} \right).$$

$$b) \lim_{x \rightarrow 0} (e^x + e^{-x} - 2) \cdot \operatorname{ctg} x$$

$$b) \lim_{x \rightarrow 0} = \left( \frac{1}{x \arctg x} - \frac{1}{x^2} \right).$$

$$29. a) \lim_{x \rightarrow +0} \frac{\ln \sin x}{ctg x};$$

$$b) \lim_{x \rightarrow 1} (1 - x)^{\cos \frac{\pi x}{2}}.$$

$$30. a) \lim_{x \rightarrow \frac{\pi}{2}} \frac{\ln \sin x}{(\pi - 2x)^2};$$

$$b) \lim_{x \rightarrow 0} (1 + \sin x)^{ctg x}$$