Задача 1

$$f(x) = \ln(\cos x), \quad n = 4$$

$$f^{(1)}(x) = -\tan x, \quad f^{(1)}(0) = -\tan 0 = 0$$

$$f^{(2)}(x) = -\frac{1}{\cos^2 x}, \quad f^{(2)}(0) = -\frac{1}{\cos^2 0} = -1$$

$$f^{(3)}(x) = -2 \cdot \frac{\tan x}{\cos x}, \quad f^{(3)}(0) = -2 \cdot \frac{\tan 0}{\cos 0} = 0$$

$$f^{(4)}(x) = -2 \cdot \frac{1 + \sin^2 x}{\cos^3 x}, \quad f^{(4)}(0) = -2 \cdot \frac{1 + \sin^2 0}{\cos^3 0} = -2$$

$$f(x) = -\frac{x^2}{2} - \frac{x^4}{12} + \circ(x^4)$$

Задача 2

$$\lim_{x \to 0} \frac{\cos x - e^{-\frac{x^2}{2}}}{x^4}$$

Solve:

$$\cos x = 1 - \frac{x^2}{2} + \circ(x^2), \quad e^{-\frac{x^2}{2}} = 1 - \frac{x^2}{2} + \circ(x^2)$$

$$\lim_{x \to 0} \frac{\cos x - e^{-\frac{x^2}{2}}}{x^4} = \lim_{x \to 0} \frac{1 - \frac{x^2}{2} + \circ(x^2) - (1 - \frac{x^2}{2} + \circ(x^2))}{x^4} =$$

$$= \lim_{x \to 0} \frac{0}{x^4} = 0$$

Answer:

$$\lim_{x \to 0} \frac{\cos x - e^{-\frac{x^2}{2}}}{x^4} = 0$$

Задача 3

$$y = -x^3 + 3x + 2$$

$$y' = -3x^2 + 3$$

$$y'' = -6x$$

$x \in$	$(-\infty, -1)$	[-1,0)	[0,1)	[1,2)	$[2, +\infty)$
y	>0	≥ 0	>0	>0	≤ 0
y'	<0	>0	>0	$\geq < 0$	<0
y''	>0	>0	≤ 0	<0	<0