4) a) $\lim\limits_{x\to 0} \frac{e^x-1-x}{x^2} = \lim\limits_{x\to 0} \frac{1+x+\frac{x^2}{2}+o(x^2)-1-x}{x^2} = \lim\limits_{x\to 0} \frac{x^2}{2}\cdot\frac{1}{x^2} = \frac{1}{2}$

b) $\lim\limits_{x\to 0} \frac{\cos x-1+\frac{x^2}{2}}{x^4} = \lim\limits_{x\to 0} \frac{1-\frac{x^2}{2}+\frac{x^4}{24}+o(x^4)-1+\frac{x^2}{2}}{x^4} =$

$= \lim\limits_{x\to 0} \frac{x^4}{24}\cdot\frac{1}{x^4}+o(x^4) = \frac{1}{24}$

5) a) $\lim\limits_{x\to 0} \frac{\operatorname{ch}3x+\cos 3x-2}{x^4} = \lim\limits_{x\to 0} \frac{\left(1+\frac{9x^2}{2}+\frac{81x^4}{24}+o(x^4)\right)}{x^4} +$

$+ \frac{\left(1-\frac{9x^2}{2}+\frac{81x^4}{24}+o(x^4)\right)-2}{x^4} = \lim\limits_{x\to 0} \frac{162x^4}{24}\cdot\frac{1}{x^4} = \frac{162}{24} = \frac{27}{4}$

b) $\lim\limits_{x\to 0} \frac{\operatorname{sh}2x-2\operatorname{sh}x}{x^3} = \lim\limits_{x\to 0} \frac{\left(2x+\frac{8x^3}{6}\right)-2x-\frac{2x^3}{6}}{x^3} =$

$= \lim\limits_{x\to 0} \frac{6x^3}{6}\cdot\frac{1}{x^3} = 1$

6) a) $\lim\limits_{x\to 0} \frac{e^x-\sqrt{1+2x}}{\ln\cos x} =$

$= \lim\limits_{x\to 0} \frac{\left(1+x+\frac{x^2}{2}+o(x^2)\right)-\left(1+x-\frac{x^2}{2}+o(x^2)\right)}{(-1+\cos x)-\frac{(1-2\cos x+\cos^2 x)}{2}+o(x^4)} \ominus$

$t=-1+\cos x$

$\ln\cos x = \ln(1+t) = x-\frac{x^2}{2}+o(x^2) = (-1+\cos x)-\frac{(1-2\cos x+\cos^2 x)}{2}+o(x^2)$

$\ominus \lim\limits_{x\to 0} \frac{2x^2}{2}\cdot\frac{2}{-3+4\cos x-\cos^2 x} = \lim\limits_{x\to 0} \frac{2x^2}{-3+4\cos x-\cos^2 x} =$

$$= \lim_{x \to 0} \frac{2x^2}{-3+4\left(1-\frac{x^2}{2}+o(x^2)\right)-\left(1-\frac{x^2}{2}+o(x^2)\right)^2} =$$

$$= \lim_{x \to 0} \frac{2x^2}{-3+4-\frac{4x^2}{2}-1+x^2+\frac{x^4}{4}} = \lim_{x \to 0} \frac{2x^2}{\frac{-4x^2+x^4}{4}} = \frac{8}{-4} = -2$$

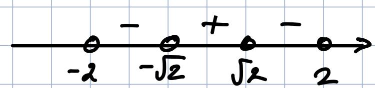
b) $$\lim_{x \to 0} \frac{3\cos x + \arcsin x - 3\sqrt[3]{1+x}}{\ln(1-x^2)} =$$

$$= \lim_{x \to 0} \frac{\cancel{3} - \frac{3x^2}{2} + o(x^2) \cancel{+x} + o(x^2) - \cancel{3} \cancel{-x} + \frac{x^2}{3} + o(x^2)}{x^2+o(x^2)} =$$

$$= \lim_{x \to 0} \frac{-\frac{7}{6}x^2+o(x^2)}{-x^2+o(x^2)} = \frac{7}{6}$$

9) a) $y = x\sqrt{4-x^2}$ $\qquad D(y) = [-2, 2]$

$f'(x) = \dfrac{4-2x^2}{\sqrt{4-x^2}}$



from $(-2,-\sqrt{2}] \cup [\sqrt{2}, 2)$ - decreasing

$[-\sqrt{2}; \sqrt{2}]$ - increasing

$x = \sqrt{2}$ is local maximum

$x = \sqrt{2}$ is local minimum

$x = \pm 2$ - critical point

$x = \pm\sqrt{2}$ - stationary points

b) $y = \dfrac{2x^2-1}{x^4}$ $\qquad x \pm 0 \quad D(y) = (-\infty; 0) \cup (0; +\infty)$

$f'(x) = \dfrac{-4x^2+4}{x^5}$

$x=0$ - critical point

$x=\pm 1$ - stationary point

$(-\infty; -1] \cup (0, 1]$ - increasing

$[-1, 0) \cup [1, +\infty)$ - decreasing

$x=\pm 1$ - local maximum