1a) $\lim\limits_{x\to\infty} \frac{\ln(x)}{e^x} \to$ „$\frac{\infty}{\infty}$" L'Hôpital ✓

13,5/16

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$\lim\limits_{x\to\infty} \frac{\frac{1}{x}}{e^x} \neq \lim\limits_{x\to\infty} \frac{e^x}{x} \to$ „$\frac{\infty}{\infty}$"

$\lim\limits_{x\to\infty} \frac{1}{xe^x} = 0$

$\cancel{\lim\limits_{x\to\infty} \frac{e^x}{1} = \infty}$

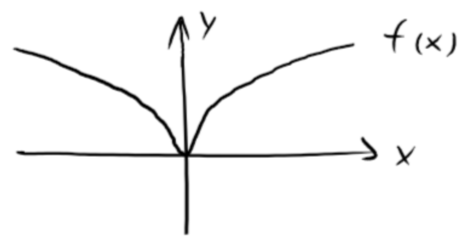
1b) $\lim\limits_{x\to 1} \frac{1+\cos(x\pi)}{x^2-2x+1} \to \frac{1+\cos(\pi)}{1-2+1} =$ „$\frac{0}{0}$"

$\lim\limits_{x\to 1} \frac{-\pi\sin(x\pi)}{2x-2} \to \frac{-\pi\sin(\pi)}{2-2} =$ „$\frac{0}{0}$" L'Hopital

$\lim\limits_{x\to 1} \frac{-\pi^2\cos(x\pi)}{2} = \frac{\pi^2}{2} \approx 4.935$ ✓

12 $f(x) = \ln(1+x^2)$ $\cancel{f'(x) = \frac{1}{1+x^2}}$

1,5/3



Just going by the behaviour of graphs, we can see that ln(x) has no maxima and increases indefinitely. Using x² instead of x, only changes the fact that it works in the negative x-direction as well. By adding 1 we remove the singularity at x = 0 of any logarithm and, in this case, get a minima of y = 0.

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13 $x(t) = A\sin(\omega t + \phi_0)$

✓ $x'(t) = \omega A\cos(\omega t + \phi_0)$

✓ $x''(t) = -\omega^2 A\sin(\omega t + \phi_0)$

$-\omega^2 A\sin(\omega t + \phi_0) + \omega^2 \cdot x(t) = 0$

$-A\sin(\omega t + \phi_0) + x(t) = 0$

$x(t) = A\sin(\omega t + \phi_0)$ ✓

$x(0) = A\sin(\omega\cdot 0 + \phi_0) = A\sin(\phi_0)$ ✓

$x\left(\frac{2\pi}{\omega}\right) = A\sin\left(\omega\cdot\frac{2\pi}{\omega} + \phi_0\right) = A\sin(2\pi + \phi_0)$

since $\sin(k\cdot 2\pi x)$ $k \in \mathbb{N}$ $= \sin(x)$ ✓

we get $A\sin(0+\phi_0)$ ✓

/4 assume $U(p) = p\,N(p) - k(x)$ U(p) is already defined!

4/5

$$U(p) = p(100 - 0.1p - 0.2p^2) - (100 + x) \qquad x = N(p)$$

$$U(p) = -0.2p^3 - 0.1p^2 + 100p - 100 - (100 - 0.1p - 0.2p^2)$$

$$U(p) = -0.2p^3 - 0.1p^2 + 100p - 100 - 100 + 0.1p + 0.2p^2$$

$$U(p) = -0.2p^3 + 0.1p^2 + 100.1p - 200$$

$$U'(p) = -0.6p^2 + 0.2p + 100.1$$

$$U''(p) = -1.2p + 0.2$$

$$U'(p) = 0$$

$$0 = -0.6p^2 + 0.2p + 100.1$$

$$p_{1/2} = \frac{-0.2 \pm \sqrt{0.2^2 - 4\cdot(-0.6)\cdot 100.1}}{-1.2}$$

$\cancel{p_1 = -12{,}75}$ not relevant

$p_2 = 13{,}08$

Since p1 is negative, which doesn't make sense for a profit-oriented price, p2 is the max.