$$\lim_{x\to\infty} \sin\frac{1}{x} = 0$$

$$\frac{1}{\infty} \to 0$$

$$\sin\frac{1}{\infty} \to 0$$

44. $\lim_{x\to\infty}\left(1+\frac{1}{x}\right)^{x}$

1^{∞} indeterminate

$\log_a(x^p) = p\log_a x$

$(\log_a x)^p \cancel{=} p\log_a x$

$$\ln y = \ln\left[\lim_{x\to\infty}\left(1+\frac{1}{x}\right)^{x}\right]$$

$$\ln y = \lim_{x\to\infty}\left[x\ln\left(1+\frac{1}{x}\right)\right]$$

$$\ln y = \lim_{x\to\infty}\frac{\ln\left(1+\frac{1}{x}\right)}{\frac{1}{x}}$$

$\frac{0}{0}$ l'hopital applies

$$\ln y = \lim_{x\to\infty}\frac{\frac{1}{1+\frac{1}{x}}\cdot\cancel{\frac{-1}{x^2}}}{\cancel{\frac{-1}{x^2}}}$$

$$\ln y = 1$$

$$e^{\ln y} = e^{1}$$

$$y = \boxed{e}$$

$$\lim_{x\to 0} \frac{\sin x}{x} = 1$$

$$\lim_{x\to\infty} \frac{\sin x}{x} = 0$$

$$\lim_{x\to 0} \frac{1-\cos x}{x} = 0$$

$$\lim_{x\to 0^+} (\sin x)^x$$

0^0 is indeterminate

$y = \lim_{x\to 0^+} (\sin x)^x$ ← set limit $= y$

$\ln y = \ln\left[\lim_{x\to 0^+} (\sin x)^x\right]$ ← take log of both sides

$\ln y = \lim_{x\to 0^+} \left[\ln(\sin x)^x\right]$ ← interchange limit & log

$\ln y = \lim_{x\to 0^+} \left[x \ln(\sin x)\right]$ ← apply power rule for logs

$\ln y = \lim_{x\to 0^+} \frac{\ln(\sin x)}{\frac{1}{x}}$ ← rewrite $0\cdot\pm\infty$ as $\frac{0}{0}$ or $\frac{\pm\infty}{\infty}$ so l'hopital applies

$\ln y = \lim_{x\to 0^+} \frac{\frac{1}{\sin x}\cdot\cos x}{\frac{-1}{x^2}}$ ← apply l'hopital $\lim\frac{f}{g} = \lim\frac{f'}{g'}$

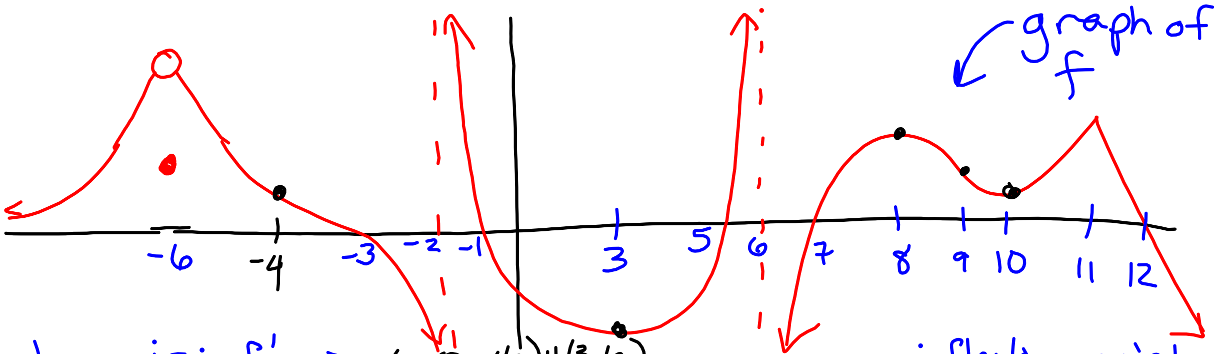
$\ln y = \lim_{x\to 0^+} \frac{\cot x}{\frac{-1}{x^2}} = \lim_{x\to 0^+} \frac{-x^2}{\tan x}$ ← simplify, rewrite, & apply l'hopital again if necessary

$\ln y = \lim_{x\to 0^+} \frac{-2x}{\sec^2 x} = \frac{0}{1} = 0$ ← find the limit

$\ln y = 0$

$e^{\ln y} = e^0$ ← apply exponential function to get variable out of exponent

$y = e^0 = \boxed{1}$



where is: $f' > 0$ $(-\infty,-6) \cup (3,6)$ $(6,8) \cup (10,11)$

$f' < 0$ $(-6,-2) \cup (-2,3) \cup (8,10) \cup (11,\infty)$

f' undefined $-6, -2, 6, 11$

$f'' > 0$ $(-\infty,-6) \cup (-6,-4) \cup (-2,6) \cup (9,11)$

$f'' < 0$ $(-4,-2) \cup (6,9)$

f not continuous $-6, -2, 6$

where does f have:

inflection points $-4, 9$

relative maxima $8, 11$

relative minima $3, 10$

a. $f(x) = \sqrt{\dfrac{x}{x^3-2x}} = \left(\dfrac{x}{x^3-2x}\right)^{1/2}$

$$f'(x) = \frac{1}{2}\left(\frac{x}{x^3-2x}\right)^{-1/2} \cdot \frac{(x^3-2x)(1) - x(3x^2-2)}{(x^3-2x)^2}$$