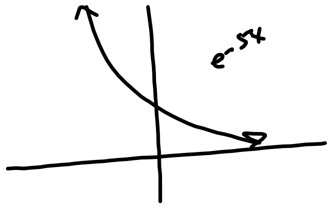
Find the limit. (If the limit is infinite, enter '∞' or '-∞', as appropriate. If the limit does not otherwise exist, enter

$\lim_{x\to\infty} (e^{-5x}\cos(x)) = \lim_{x\to\infty} e^{-5x} \lim_{x\to\infty} \cos(x) = 0$ Times something that's somewhere between -1 & $+1$.



$= 0$

The e^{-5x} DAMPENS EVERYTHING.

Find an equation of the tangent line to the following curve at the given point

$y = e^{5x}\cos(\pi x)$, $\boxed{(0, 1) = (x_1, y_1)}$

$\longrightarrow y' = f'(x) = (5e^{5x})\cos(\pi x) + e^{5x}(-\sin(x))$

$= 5e^{5x}\cos(\pi x) - e^{5x}\sin(x)$

$y'(0) = 5e^{5\cdot 0}\cos(0) - e^{0}\sin(0)$

$= 5 - 0 = 5 = m \longrightarrow y = m(x - x_1) + y_1$

$= 5(x-0)+1$

$y = 5x+1$ for WebAssign

$L(x) = f'(x_1)(x - x_1) + f(x_1)$

Consider the following function.

$f(x) = (4 - x)e^{-x}$

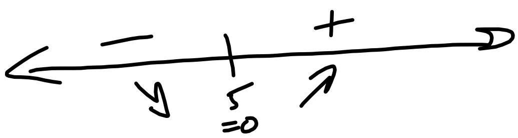
(a) Find the intervals of increase or decrease. (Enter your answers using interval notation.)

(b) Find the intervals of concavity. (Enter your answers using interval notation. If an answer doe
DNE.)

$f'(x) = -1e^{-x} - (4-x)e^{-x}$ $\qquad f'(x) = e^{-x}(x-5)$

$= -e^{-x} - 4e^{-x} + xe^{-x}$

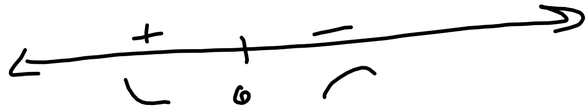
$= e^{-x}(-5+x) \overset{SET}{=} 0 \Rightarrow x = 5$



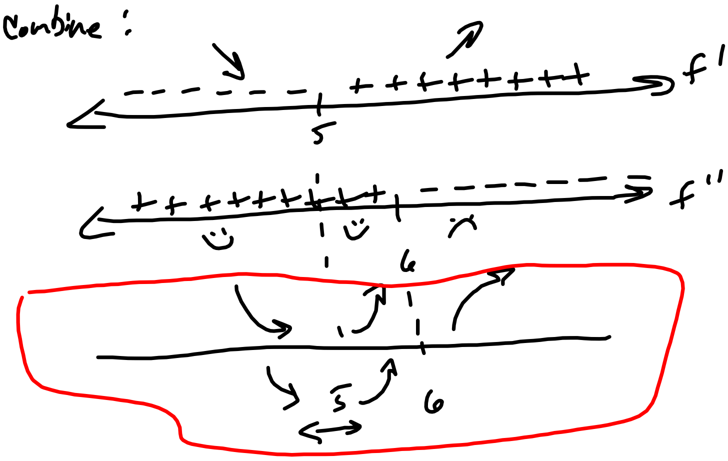
$f''(x) = -e^{-x}(x-5) + e^{-x} = -xe^{-x} + 5e^{-x} + e^{-x}$

$= -xe^{-x} + 6e^{-x} = e^{-x}(-x+6) \overset{SET}{=} 0 \Rightarrow$

$x = 6$



Combine:



Inc: $(5, \infty)$

Dec. $(-\infty, 5)$

c.up: $(-\infty, 6)$

c.down $(6, \infty)$

Inflection Point

$f(6) = (4-6)e^{-6} = -2e^{-6}$

$$y = \ln\left(x + \sqrt{x^2-3}\right) \Longrightarrow$$

$$y' = \frac{1 + \frac{1}{\cancel{2}}(x^2-3)^{-\frac{1}{2}}(\cancel{2}x)}{x + \sqrt{x^2-3}} = \frac{\frac{\sqrt{x^2-3}}{\sqrt{x^2-3}} + \frac{x}{\sqrt{x^2-3}}}{x + \sqrt{x^2-3}} = \frac{\frac{x + \sqrt{x^2-3}}{\sqrt{x^2-3}}}{\frac{x + \sqrt{x^2-3}}{1}}$$

$$= \frac{1}{\sqrt{x^2-3}}$$

$$\int \frac{3\cos(x)}{7+\sin(x)}\,dx = \int \frac{3\,du}{u} = 3\int \frac{du}{u} = 3\ln|u| + C$$

$$= \boxed{3\ln|\sin(x)+7| + C}$$

$u = \sin(x)+7 \Longrightarrow$

$du = \cos(x)\,dx$

Use logarithmic differentiation to find the derivative of the function.

$y = (\ln(x))^{\cos(4x)}$

$\Rightarrow \ln(y) = \cos(4x)\ln(\ln(x))$ (from $\ln\left(\ln(x)^{\cos(4x)}\right)$)

$\Rightarrow \frac{1}{y}\frac{dy}{dx} = \frac{y'}{y} = -4\sin(4x)\ln\underbrace{(\ln(x))}_{\text{what's inside}} + \cos(4x)\boxed{\frac{\frac{1}{x}}{\ln(x)}}$

Tricky

$\frac{d}{dx}\ln[f(x)] = \frac{f'(x)}{f(x)}$

$\Rightarrow y' = \left[-4\sin(4x)\ln(\ln(x)) + \frac{\cos(4x)}{x\ln(x)}\right](\ln(x))^{\cos(4x)}$

$$(\ln(x))^{\cos(4x)}\left(\frac{\cos(4x)}{x\ln(x)} - 4\sin(4x)\ln(\ln(x))\right)$$