$f(x) = e^{-x^2}$ $\quad$ y-int = $(0,1)$ $\quad$ No x-int

No VA $\quad$ HA $\quad \lim\limits_{x\to\infty}\left(e^{-x^2}\right) = \lim\limits_{x\to\infty}\left(\frac{1}{e^{x^2}}\right) = 0$ $\quad y = 0$

No OA $\quad \lim\limits_{x\to-\infty}\left(e^{-x^2}\right) = \lim\limits_{x\to-\infty}\left(\frac{1}{e^{x^2}}\right) = 0$

$f'(x) = e^{-x^2}(-2x) \rightarrow e^{-x^2}(-2x) = 0 \quad -2x = 0 \quad x = 0$

$f''(x) = e^{-x^2}(-2) + e^{-x^2}(-2x)(-2x) = -2e^{-x^2} + 4x^2e^{-x^2} = 2e^{-x^2}(2x^2-1)$

$2e^{-x^2}(2x^2-1) = 0 \quad 2x^2 - 1 = 0 \quad x = \pm\sqrt{\frac{1}{2}} = \pm\frac{1}{\sqrt{2}} = \pm\frac{\sqrt{2}}{2}$

x		$-\frac{\sqrt{2}}{2}$		0		$\frac{\sqrt{2}}{2}$	
$f(x)$		$e^{-1/2}$		1		$e^{-1/2}$	
$f'(x)$		$+$	$\nearrow$	0 MAX	$\searrow$	$-$	
$f''(x)$	$\cup$ $+$	0 IP	$\cap$	$-$		0 IP	$+$ $\cup$

$f\left(-\frac{\sqrt{2}}{2}\right) = e^{-\frac{1}{2}}$

$f\left(\frac{\sqrt{2}}{2}\right) = e^{-\frac{1}{2}}$

$f'(-1) = e^{-1}(-2\cdot -1) = 2e^{-1} \quad f'(1) = e^{-1}(-2\cdot 1) = -2e^{-1}$

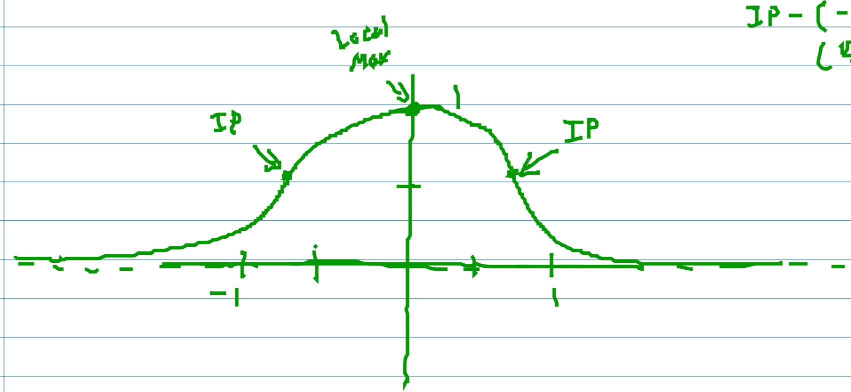
$f''(-1) = 2e^{-1}(2(-1)^2-1) = 2e^{-1}(1) \quad f''(0) = 2e^{0}(2(0)^2-1) = -2 \quad f''(1) = 2e^{-1}(2(1)^2-1) = 2e^{-1}$

Inc $-$ $(-\infty, 0)$ $\quad$ Local Max $-$ $(0,1)$ $\quad$ CCU $-$ $\left(-\infty, -\frac{\sqrt{2}}{2}\right) \cup \left(\frac{\sqrt{2}}{2}, \infty\right)$

Dec $-$ $(0, \infty)$ $\quad$ CCD $-$ $\left(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$

IP $-$ $\left(-\frac{\sqrt{2}}{2}, e^{-1/2}\right)$

$\left(\frac{\sqrt{2}}{2}, e^{-1/2}\right)$



$f(x) = e^{-x^2}$ $\quad$ y-int $= (0,1)$ $\quad$ No x-int

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x		$-\frac{\sqrt{2}}{2}$		0		$\frac{\sqrt{2}}{2}$	
$f(x)$		$e^{-1/2}$		1		$e^{-1/2}$	
$f'(x)$		$+$	$\nearrow$	0 max	$\searrow$	$-$	
$f''(x)$	$\cup$ $+$	0 IP	$\cap$	$-$		0 IP	$+$ $\cup$

$f\left(-\frac{\sqrt{2}}{2}\right) = e^{-\frac{1}{2}}$

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Inc $- (-\infty, 0)$ $\quad$ Local Max $- (0,1)$ $\quad$ CCU $- \left(-\infty, -\frac{\sqrt{2}}{2}\right) \cup \left(\frac{\sqrt{2}}{2}, \infty\right)$

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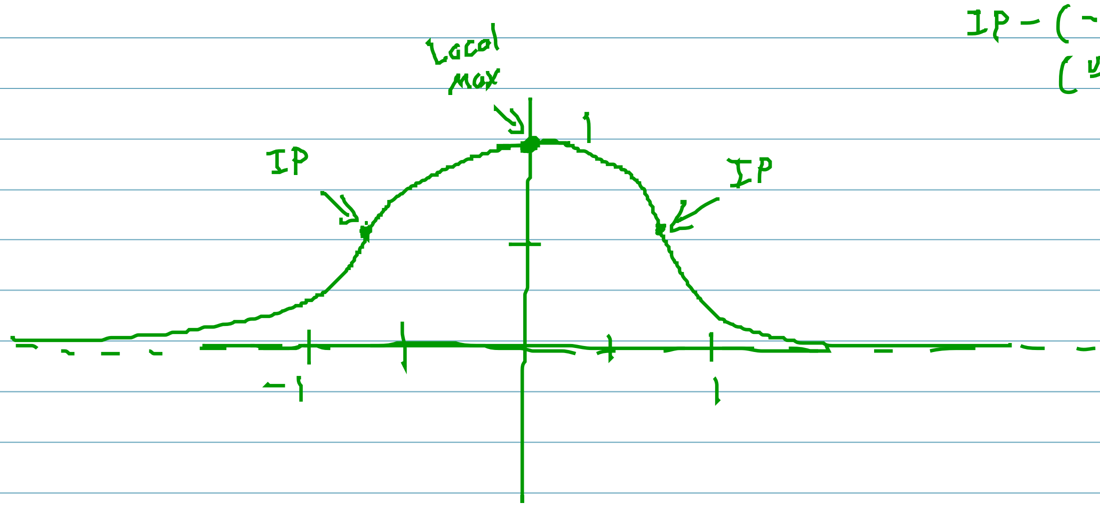
IP $- \left(-\frac{\sqrt{2}}{2}, e^{-1/2}\right)$

$\left(\frac{\sqrt{2}}{2}, e^{-1/2}\right)$

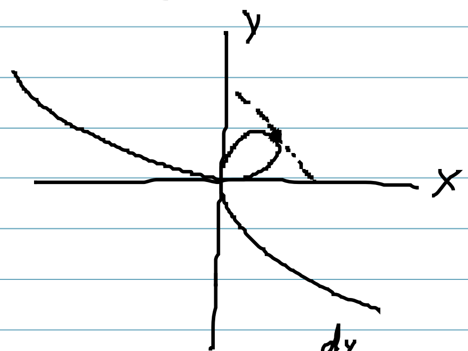


Explicit — $y = f(x)$

Implicit

$y \to \frac{dy}{dx} = y'$ $\qquad$ $x \to \frac{dx}{dx} = 1$

Folium of Descartes — $x^3 + y^3 = 6xy$



$\frac{dy}{dx} = ?$

$3x^2 \cancel{\frac{dx}{dx}} + 3y^2\frac{dy}{dx} = 6x(1)\frac{dy}{dx} + 6\cancel{\frac{dx}{dx}}(y)$

$3x^2 + 3y^2\frac{dy}{dx} = 6x\frac{dy}{dx} + 6y$

$(3y^2 - 6x)\frac{dy}{dx} = 6y - 3x^2 \quad \to \quad \frac{dy}{dx} = \frac{6y - 3x^2}{3y^2 - 6x} = \frac{3x^2 - 6y}{6x - 3y^2}$

$(3,3)$ $\uparrow$ $\qquad \left.\frac{dy}{dx}\right|_{(3,3)} = \frac{3(3^2) - 6(3)}{6(3) - 3(3^2)} = \frac{27-18}{18-27} = \frac{9}{-9} = -1 \leftarrow$

$y - 3 = -1(x-3) = -x + 3 \quad \to \quad y = -x + 6$

$\sin(xy) = x^2 + \ln(y)$

$\cos(xy)(xy' + y) = 2x + \frac{1}{y}y'$

$\cos(xy)\,x\underline{y'} + \cos(xy)\,y = 2x + \frac{y'}{\underline{y}}$

$x\cos(xy)\,y' - \frac{1}{y}y' = 2x - y\cos(xy)$ $\qquad$ $y' = \frac{2x - y\cos(xy)}{x\cos(xy) - \frac{1}{y}}$

$y'(x\cos(xy) - \frac{1}{y}) =$