HW Questions:

(7) $f(x) = \frac{1}{(x+1)^2} = (x+1)^{-2}$

$$f'(x) = -2(x+1)^{-3}(1)$$

$$f'(x) = -2(x+1)^{-3}$$

$$0 = \frac{-2}{(x+1)^3}$$

no soln

$\therefore$ no max/min extrema

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(3) $f(x) = x^{\frac{5}{3}}$

$$f'(x) = \frac{5}{3}x^{\frac{2}{3}}$$

$$0 = \frac{5}{3}x^{\frac{2}{3}}$$

$$0 = x^{\frac{2}{3}}$$

$$0 = \left(\sqrt[3]{x}\right)^2$$

critical value of x

$$0 = x$$

$$f'(x) = \frac{5}{3}x^{\frac{2}{3}}$$

-1	0	1
$\frac{5}{3}$	0	$\frac{5}{3}$
↗	→	↗

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Product Rule

We will derive this one...

given y = f(x)g(x) find a formula for y'

$$y' = \lim_{h\to 0} \frac{f(x+h)g(x+h) - f(x)g(x)}{h}$$

$$= \lim_{h\to 0} \frac{f(x+h)g(x+h) - f(x+h)g(x) + f(x+h)g(x) - f(x)g(x)}{h}$$

$$= \lim_{h\to 0} f(x+h)\left[\frac{g(x+h)-g(x)}{h}\right] + g(x)\left[\frac{f(x+h)-f(x)}{h}\right]$$

$f(x+0)$

$$= \lim_{h\to 0} f(x)\,g'(x) + g(x)f'(x)$$

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find $f'(x)$

a) $f(x) = x^2 \sin(x)$

$f'(x) = x^2 \cos(x) + \sin(x)\; 2x$

$f'(x) = x^2 \cos(x) + 2x\sin(x)$

b) $f(x) = x^3 (x+1)^2$

$f'(x) = x^3\, 2(x+1)^1(1) + (x+1)^2\, 3x^2$

$= 2x^3(x+1) + 3x^2(x+1)^2$

$= x^2(x+1)\left[2x + 3(x+1)\right]$

$= x^2(x+1)(5x+3)$

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(c) $f(x) = e^x \cos x$

$$f'(x) = \underline{(e^x)(-\sin(x))} + \underline{(\cos(x))(e^x)}$$

$$= e^x(\cos(x) - \sin(x))$$

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$f(x) = x \cdot \ln(x)$

$$f'(x) = x\left(\frac{1}{x}\right) + \ln(x)(1)$$

$$= 1 + \ln(x)$$

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e) $f(x) = \underline{4x}\,\underline{e^x}$

$f'(x) = (4x)(e^x) + (e^x)(4)$

$= 4e^x(x+1)$

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$f(x) = x(\cos x + \sin x)$

$f'(x) = x(-\sin x + \cos x) + (\cos x + \sin x)(1)$

$= -x\sin(x) + x\cos(x) + \cos(x) + \sin(x)$

HW #6 $f(x) = x^2 e^{-x}$

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

$= \underline{-x^2 e^{-x}} + \underline{2xe^{-x}}$

$= xe^{-x}(-x+2)$

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