4) $f(x) = 2x^3 - 7x$, $g(x) = -3x$

$(f-g)(x) = 2x^3 - 7x - (-3x)$

$= 2x^3 - 4x$

$= 2\times5^3 - 4(5) = 230$

5) $f(x) = 4x^2 + 2$ and $g(x) = 2x + 3$

$f(x) = 4x^2 + 2$

$fog(x) = 4(2x+3)^2 + 2$

$= 4(4x^2 + 12x + 9) + 2$

$= 16x^2 + 48x + 36 + 2$

$= 16x^2 + 48x + 38$

6) $dy/dx = m =$ gradient

$x^2 + 2xy + y^2 = 1020$

$2x\frac{dx}{dx} + 2\left(x\frac{dy}{dx} + y\frac{dx}{dx}\right) + 2y\frac{dy}{dx} = \frac{d}{dx}(1020)$

$= 2x + 2x\frac{dy}{dx} + 2y + 2y\frac{dy}{dx} = 0$

$= 2x + \frac{dy}{dx}(2x+2y) + 2y = 0$

$\frac{dy}{dx}(2x+2y) = -2x - 2y \Rightarrow -1$

$\frac{dy}{dx} = \frac{-2x-2y}{2x+2y}$

7) $y = x^2\cos x$

$u = x^2$, $v = \cos x$

$\frac{du}{dx} = 2x$, $\frac{dv}{dx} = -\sin x$

$\frac{dy}{dx} = u\frac{dv}{dx} + v\frac{du}{dx} = x^2(-\sin x) + \cos x(2x)$

$= -x^2\sin x + 2x\cos x$

3) $y = \cos 3x$

$y + \Delta y = \cos 3(x + \Delta x)$

$\Delta y = \cos(3x + 3\Delta x) - y$

Recall that $y = \cos 3x$

$\Delta y = \cos(3x + 3\Delta x) - \cos 3x$

$\cos A - \cos B = -2 \sin \frac{A+B}{2} \cdot \sin \frac{A-B}{2}$

Compare eqns 1 and 2

$A = 3x + 3\Delta x$, $B = 3x$

$\frac{A+B}{2} = \frac{3x + 3\Delta x + 3x}{2} = \frac{6x + 3\Delta x}{2} = 3x + \frac{3\Delta x}{2}$

$\frac{A-B}{2} = \frac{3x + 3\Delta x - 3x}{2} = \frac{3\Delta x}{2}$

$\Delta y = -2 \sin\left(3x + \frac{3\Delta x}{2}\right) \cdot \sin\left(\frac{3\Delta x}{2}\right)$

Divide both sides by Δx

$\frac{\Delta y}{\Delta x} = \frac{-2 \sin\left(3x + \frac{3\Delta x}{2}\right) \cdot \sin\left(\frac{3\Delta x}{2}\right) \times \frac{1}{2}}{\Delta x \times \frac{1}{2}}$

$\frac{\Delta y}{\Delta x} = \frac{-\sin\left(3x + \frac{3\Delta x}{2}\right) \cdot \sin\left(\frac{3\Delta x}{2}\right)}{\Delta x}$

$\lim_{\Delta x \to 0} \frac{dy}{dx} = \lim_{\Delta x \to 0} \sin\left(3x + \frac{3\Delta x}{2}\right) \lim_{\Delta x \to 0} \frac{\sin\left(\frac{3\Delta x}{2}\right)}{\frac{\Delta x}{2}}$

$= -\sin 3x$

$= 3$

$= -3 \sin 3x$

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1.) $\lim_{x \to 0} \left\{ \frac{x - \cos x}{x} \right\}$

Using the L'Hopital's rule

$\lim_{x \to 0} \left\{ \frac{x - \cos x}{x} \right\} = \lim_{x \to 0} \left\{ \frac{1 - (-\sin x)}{1} \right\}$

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

$= \frac{1 + 0}{1} = 1$

2. find dy/dx if $y = -3 \tan 7x e^{3x}$

$u = -3$ $\quad v = \tan 7x$, $\quad w = e^{3x}$

$\frac{du}{dx} = 0$ $\quad \frac{dv}{dx} = 7 \sec^2 7x$ $\quad \frac{dw}{dx} = 3e^{3x}$

$\frac{dy}{dx} = y \left[\frac{1}{u} \frac{du}{dx} + \frac{1}{v} \frac{dv}{dx} + \frac{1}{w} \frac{dw}{dx} \right]$

$= y \left[\frac{1}{-3}(0) + \frac{1}{\tan 7x} (7 \sec^2 7x) + \frac{1}{e^{3x}} (3e^{3x}) \right]$

$= y \left[0 + \frac{7 \sec^2 7x}{\tan 7x} + 3 \right]$

$= -3 \tan 7x e^{3x} \left[\frac{7 \sec^2 7x}{\tan 7x} + 3 \right]$