4. $f(x) = 2x^2 + 7x \quad g(x) = -3x$

$(f-g)(5) = f(5) - g(5)$

$= [2(5)^2 - 7(5)] - [3(5)]$

$= (250 - 35) - (-15)$

$= 215 + 15$

$= 230$

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

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

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

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

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

6. Find the gradient of $x^2 + 2xy + y^2 = 1020$

$(x+y)^2 = 1020 \quad x^2 + 2xy + y^2 = 1020$

$x + y = \pm\sqrt{1020} \quad 2x + 2x\, dy/dx + 2y + 2y\, dy/dx = 0$

$x + y = \pm 2\sqrt{255} \quad 2x + 2x\, dy/dx + 2y + 2y\, dy/dx = 0$

$x + y = +2\sqrt{255} \quad \frac{2x\, dy}{dx} + \frac{2y\, dy}{dx} = -2x - 2y$

$x + y = -2\sqrt{255} \quad dy/dx(2x + 2y) = -2x - 2y$

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

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

$dy/dx = x^2 \cos x$

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

$du/dx = 2x \quad dv/dx = -\sin x$

$dy/dx = u\, dv/dx + v\, du/dx$

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

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

1. Find the limit of the function $\left(\frac{x-\cos x}{x}\right)$ $x \to 0$

$\frac{dy}{dx} = \frac{1+\sin x}{1}$ $\quad x \to 0$

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

$\frac{dy}{dx} = 1$

$-3\tan 7x e^{3x}$

2. If $y = -3\tan 7x$ find $\frac{dy}{dx}$

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

$\frac{dy}{dx} = -21\sec^2 x$ $\quad \frac{dv}{dx} = 3e^{3x}$

$\frac{dy}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$

$= -3\tan 7x(3e^{3x}) + e^{3x}(-21\sec^2 x)$

3. $y = \cos 3x$

using first Principle

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

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

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

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

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

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

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

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

$\Delta x \times 3/2$

$\frac{\Delta y}{\Delta x} = -\sin(3x + 0) \cdot \lim_{x \to 0} \frac{\sin\left(\frac{3\Delta x}{2}\right)}{\left(\frac{3\Delta x}{2}\right)}$

since $\lim_{\Delta x \to 0} \frac{\sin\left(\frac{3\Delta x}{2}\right)}{\left(\frac{3\Delta x}{2}\right)} = 1$

$\frac{\Delta y}{\Delta x} = -3\sin 3x$