1 Product rule and quotient rule

1.1 Combinations of functions

1. Identify the form of the following functions:

   (i) $\frac{\sin x}{x+1}$ (ii) xe^x (iii) $\ln(3x^2+5x-8)$

   (iv) $(x^3-5)^5$ (v) $\cos(x^2-4x+5)$.

2. Identify the form of the following functions:

   (i) $x^3\cos x$ (ii) e^{4x^2-7} (iii) $\frac{\ln(x+3)}{x^2+1}$

   (iv) $(5x^2-4)^3$ (v) $\ln(x^3-4x+8)$.

1.2 Product rule

1. Find $\frac{dy}{dx}$ for each of the following

   (i) $y=(2x-1)\sin x$ (ii) $y=(3x^2-6x+1)e^x$ (iii) $(6x+5)\ln x$

   (iv) $y=x^2\cos x$ (v) $y=x\sin(2x)$ (vi) $y=e^{3x}\cos x$.

2. Find $\frac{dy}{dx}$ for each of the following

   (i) $y=x^3\sin x$ (ii) $y=(6x^2-12x+5)e^x$ (iii) $(7x-4)\ln x$

   (iv) $y=(2x^2+3)\cos x$ (v) $y=x\cos(4x)$ (vi) $y=e^{-x}\sin x$.

1.3 Quotient rule

1. Find $\frac{dy}{dx}$ for each of the following

   (i) $y=\frac{2x-3}{2x+7}$ (ii) $y=\frac{e^{4x}}{x+6}$ (iii) $y=\frac{x^2-4}{2x^2+1}$

   (iv) $y=\frac{\ln x}{x^2}$ (v) $y=\frac{\sin(2x)}{x}$ (vi) $y=\frac{\sin x}{\cos x}$.

2. Find $\frac{dy}{dx}$ for each of the following

   (i) $y=\frac{3x-7}{7x-2}$ (ii) $y=\frac{e^{2x}}{4x+1}$ (iii) $y=\frac{2x^2+3}{x^2+1}$

   (iv) $y=\frac{\ln x}{2x^3}$ (v) $y=\frac{\sin(5x)}{x}$ (vi) $y=\frac{\cos x}{\sin x}$.