Section 3: The product and quotient rules

Exercise level 1

1. Using the product rule, differentiate:
   (i) $y = x(x-5)^3$ (ii) $y = x^2(4+3x)^{\frac{1}{3}}$

2. Differentiate these products:
   (i) $\sqrt{x}(5-3x)^4$ (ii) $x^3\sqrt{5-x^2}$

3. Using the quotient rule, differentiate:
   (i) $y = \dfrac{3x}{2x^2-5}$ (ii) $y = \dfrac{3x}{4+\sqrt{x}}$

4. Differentiate these quotients:
   (i) $\dfrac{\sqrt{x}}{(3x+4)^2}$ (ii) $\dfrac{x}{\sqrt{3x-2}}$

5. Differentiate:
   (i) $y = \dfrac{7x-3}{\sqrt{2x+1}}$ (ii) $y = (7x-3)\sqrt{2x+1}$

6. Given that $y = x(2x+1)^4$, find $\dfrac{dy}{dx}$, factorising your answer.

7. Given that $y = x\sqrt{1+2x}$, show that $\dfrac{dy}{dx} = \dfrac{1+3x}{\sqrt{1+2x}}$.

8. Given that $y = \dfrac{x^2}{\sqrt{1+x}}$, show that $\dfrac{dy}{dx} = \dfrac{x(3x+4)}{2(1+x)^{\frac{3}{2}}}$.

9. Given that $y = x^3(1+x)^{\frac{1}{3}}$, show that $\dfrac{dy}{dx} = \frac{1}{3}x^2(1+x)^{-\frac{2}{3}}(10x+9)$.

10. Given that $y = \dfrac{1+\sqrt{x}}{1-\sqrt{x}}$, show that $\dfrac{dy}{dx} = \dfrac{1}{\sqrt{x}(1-\sqrt{x})^2}$.