1. Find the derivative of $f(x) = (x + x^2)(x^{-1} + 3)$ in two ways:

    (i) by the product rule:

    (ii) by first expanding the product:

2. Differentiate.

    (a) $y = \dfrac{\sqrt{x}}{2 + x}$

    (b) $g(x) = \left(\pi^{1/2} + 5\sqrt{x}\right) e^x$

    (c) $f(x) = \dfrac{ax + b}{cx + d}$

3. If $h(2) = 4$ and $h'(2) = -3$, find

$$\frac{d}{dx}\left(\frac{h(x)}{x}\right)\Big|_{x=2}$$

4. Consider these facts:

- $\csc x = 1/\sin x$
- $\cot x = \cos x/\sin x$
- $(\sin x)' = \cos x$

Use the quotient rule and the above facts to show that

$$\frac{d}{dx}(\csc x) = -\csc x \cot x$$

5. Differentiate $f(\theta) = \theta \cos\theta \sin\theta$.