

## DIFFERENTIATION

To practice the technique of differentiation, take the derivatives of the following functions. The solutions are overleaf. Unless you have questions, we shall not discuss these in the exercise class.

(a)  $f(x) = x^5 + 2x + 1$

(b)  $f(x) = x^{-2}$

(c)  $f(x) = (a + bx)^3$

(d)  $f(x) = xe^{-x}$

(e)  $f(x) = x \ln(x)$

(f)  $f(x) = \frac{a+x}{b+x}$

(g)  $f(x) = \frac{1}{\sqrt{cx}}$

(h)  $f(x) = e^{a+bx+cx^2}$

(i)  $f(x) = \ln(a + bx)$

(j)  $f(x) = \ln(\sqrt{cx})$

## Solutions

(a)  $f'(x) = 5x^4 + 2$

(b)  $f'(x) = -2x^{-3}$

(c)  $f'(x) = 3b(a + bx)^2$

(d)  $f'(x) = e^{-x} - xe^{-x} = e^{-x}(1 - x)$

(e)  $f'(x) = \ln(x) + x(1/x) = \ln(x) + 1$

(f)  $f'(x) = \frac{b+x-(a+x)}{(b+x)^2} = \frac{b-a}{(b+x)^2}$

(g)  $f'(x) = -\frac{c}{2}(cx)^{-3/2}$  [write the original function as  $f(x) = \frac{1}{\sqrt{cx}} = (cx)^{-1/2}$ ]

(h)  $f'(x) = e^{a+bx+cx^2} (b + 2cx)$

(i)  $f'(x) = \frac{b}{a+bx}$

(j)  $f'(x) = \frac{1}{2}\ln(cx) = \frac{c}{2cx} = \frac{1}{2x}$  [write the original function as  $f(x) = \frac{1}{2}\ln(cx)$ ]