**Self-assessment: 18 Further differentiation methods**

**1.** Differentiate the following expressions with respect to *x*:

(a) (2*x* + 1)5

(b) cos3(2*x*)

(c) arcctan(*x*2)

(d)  *[9 marks]*

**2.** **Do not use a calculator to answer this question.**

Find the *x*-coordinate of the stationary point on the graph of *y* = .

*(accessible to students on the path to grade 5 or 6) [5 marks]*

**3.** Find the gradient of the curve with equation ln(*y*2) + 3*x*2 = 12 at the point (2, 1).

*(accessible to students on the path to grade 5 or 6) [5 marks]*

**4.** Given that *f* (*x*) = *x* sin(*ax*) with *a* > 0,

(a) Find *f* ′(*x*) and *f* ″(*x*).

*(accessible to students on the path to grade 5 or 6)*

(b) (i) Show that the stationary points of *f* (*x*) satisfy the equation tan(*ax*) = −*ax*.

(ii) Use a graph to show that the above equation has only one solution for *x* ∈ .

(iii) Hence find the coordinates of the stationary point on the graph of *y* = *f* (*x*) and determine its nature.

*(accessible to students on the path to grade 7)*

(c) Find the value of *a* for which *f* (*x*) satisfies the equation *f* ″(*x*) + 4*f* (*x*) = 2*a* cos(*ax*).

*(accessible to students on the path to grade 5 or 6)*

*[14 marks]*