**Self-assessment: 14 Further differentiation**

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

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

(b) cos3(2*x*)

*(accessible to students on the path to grade 3 or 4) [4 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.** A closed cylinder has radius *r* cm and height *h* cm. Its volume is 208 cm3.

(a) Find an expression for the surface area of the cylinder in terms of *h* only.

(b) Find the value of *h* which minimises the surface area of the cylinder.

*(accessible to students on the path to grade 5 or 6)* *[7 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]*