**Self-assessment: 15 Further integration**

**1.** The part of the curve with equation *y* =  between *x* = 0 and *x* = π is rotated 2*π* radians around the *x*-axis. Find the exact value of the resulting volume of revolution.

*(accessible to students on the path to grade 3 or 4) [5 marks]*

**2.** Use the substitution *u* = *x* − 1 to find .

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

**3.** Use a suitable substitution to evaluate .

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

**4.** A particle moves so that its velocity (measured in ms−1) depends on time (measured in seconds) according to the equation *v* = 3e −2*t* sin *t* for *t* ≥ 0.

(a) Find the maximum velocity of the particle.

(b) Find the acceleration of the particle when *t* = 3.

(c) Find the distance travelled by the particle in the first three seconds of motion.

*(accessible to students on the path to grade 3 or 4)*

(d) Initially the particle is at the origin. Find an equation for the displacement in terms of time.

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

*[13 marks]*