

**AH Mathematics**

**Applications of  
Algebra  
and Calculus**

**Practice  
Assessment**

**1**

### Applications of Algebra and Calculus Assessment Standard 1.1

1 Expand  $(2x + 3)^5$  using the Binomial Theorem and simplify as far as possible. (3)

2 Complex numbers are defined as follows :  $z_1 = p + i$  and  $z_2 = 4 - 3i$ .

Express the following in the form  $a + ib$  :

a)  $z_1 z_2$  (1)

b)  $\frac{z_1}{z_2}$  (2)

### Applications of Algebra and Calculus Assessment Standard 1.2

3 An arithmetic sequence is given by : 5, 17, 29, ... .

Find :

a) the 20<sup>th</sup> term of the sequence. (2)

b) the sum of the first 20 terms. (2)

4 A geometric sequence is given by : 6, 30, 150, ... .

Find :

a) the 9<sup>th</sup> term of the sequence. (2)

b) the sum of the first 9 terms. (2)

5 Find the first four terms of the Maclaurin series for  $f(x) = e^{4x}$ . (3)

### Applications of Algebra and Calculus Assessment Standard 1.3

6 Evaluate  $\sum_{k=1}^{14} (4k - 3)$ . (3)

- 7 Use proof by induction to show that,  $\forall n \geq 1, n \in \mathbb{N}$

$$\sum_{r=1}^n 4r = 2n(n+1). \quad (5)$$

### Applications of Algebra and Calculus Assessment Standard 1.4

8  $f(x) = \frac{x^2 - x + 3}{x - 2}, x \in \mathbb{R} : x \neq 2$

For the graph  $y = f(x)$  :

- Give the equation of the vertical asymptote. (1)
  - Show that there is a non-vertical asymptote and state the equation. (2)
- 9 Given that  $f(x) = \sin(2x)$ , sketch the graph of  $|4f(x)|$ ,  
where  $0 \leq x \leq \pi$ . (2)
- 10 Show that there is a point of inflexion on the graph of  $y = 4x^3 + x$   
at  $x = 0$ . (3)

### Applications of Algebra and Calculus Assessment Standard 1.5

- 11 A car begins travelling from rest along a straight road. Its velocity,  
 $v(t)$  metres per second, is given by

$$v(t) = \frac{200t}{3t + 13}.$$

Find the acceleration of the car at 3 seconds. (4)

- 12 The area bounded by the curve  $y = \sqrt{1 + \cos 2x}$  between  $x = 0$   
and  $x = \frac{\pi}{2}$  is rotated  $2\pi$  radians about the  $x$ -axis.

Determine the exact value of the volume of the solid formed. (4)