



**Instructions**

This examination consists of a core and six modules. Students should answer **all** questions in the core and then select **three** modules and answer **all** questions within the modules selected.

You need not give numerical answers as decimals unless instructed to do so. Alternative forms may involve, for example,  $\pi$ , surds or fractions.

Diagrams are not to scale unless specified otherwise.

**SAMPLE**  
Number of questions and mark allocations  
may vary from the information indicated.

# **FURTHER MATHEMATICS**

## **Written examinations 1 and 2**

### **FORMULA SHEET**

#### **Directions to students**

Detach this formula sheet during reading time.

This formula sheet is provided for your reference.

## Further Mathematics Formulas

### Core: Data analysis

standardised score: 
$$z = \frac{x - \bar{x}}{s_x}$$

least squares line: 
$$y = a + bx \quad \text{where } b = r \frac{s_y}{s_x} \quad \text{and} \quad a = \bar{y} - b\bar{x}$$

residual value: 
$$\text{residual value} = \text{actual value} - \text{predicted value}$$

seasonal index: 
$$\text{seasonal index} = \frac{\text{actual figure}}{\text{deseasonalised figure}}$$

### Module 1: Number patterns

arithmetic series: 
$$a + (a + d) + \dots + (a + (n - 1)d) = \frac{n}{2}[2a + (n - 1)d] = \frac{n}{2}(a + l)$$

geometric series: 
$$a + ar + ar^2 + \dots + ar^{n-1} = \frac{a(1 - r^n)}{1 - r}, \quad r \neq 1$$

infinite geometric series: 
$$a + ar + ar^2 + ar^3 + \dots = \frac{a}{1 - r}, \quad |r| < 1$$

### Module 2: Geometry and trigonometry

area of a triangle: 
$$\frac{1}{2}bc \sin A$$

Heron's formula: 
$$A = \sqrt{s(s - a)(s - b)(s - c)} \quad \text{where } s = \frac{1}{2}(a + b + c)$$

circumference of a circle: 
$$2\pi r$$

area of a circle: 
$$\pi r^2$$

volume of a sphere: 
$$\frac{4}{3}\pi r^3$$

surface area of a sphere: 
$$4\pi r^2$$

volume of a cone: 
$$\frac{1}{3}\pi r^2 h$$

volume of a cylinder: 
$$\pi r^2 h$$

volume of a prism: 
$$\text{area of base} \times \text{height}$$

volume of a pyramid: 
$$\frac{1}{3} \text{area of base} \times \text{height}$$

Pythagoras' theorem:  $c^2 = a^2 + b^2$

sine rule:  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

cosine rule:  $c^2 = a^2 + b^2 - 2ab \cos C$

### Module 3: Graphs and relations

#### Straight line graphs

gradient (slope):  $m = \frac{y_2 - y_1}{x_2 - x_1}$

equation:  $y = mx + c$

### Module 4: Business-related mathematics

simple interest:  $I = \frac{PrT}{100}$

compound interest:  $A = PR^n$  where  $R = 1 + \frac{r}{100}$

hire purchase: effective rate of interest  $\approx \frac{2n}{n+1} \times \text{flat rate}$

### Module 5: Networks and decision mathematics

Euler's formula:  $v + f = e + 2$

### Module 6: Matrices

determinant of a  $2 \times 2$  matrix:  $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}; \det A = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$

inverse of a  $2 \times 2$  matrix:  $A^{-1} = \frac{1}{\det A} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$  where  $\det A \neq 0$