Additional Mathematics
Formula that are within the syllabus and which need to be learnt.

The remainder theorem
Given the polynomial f(x), then remainder when f(x) is divided by ($x - a$) is f(a).

The factor theorem
If the remainder when f(x) is divided by ($x - a$) is 0, then ($x - a$) is a factor of f(x) and $x = a$ is a root of the equation f(x) = 0

Solution of quadratic equations
By formula and completing the square

For the quadratic equation $ax^2 + bx + c = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial expansion
Know how to derive terms in the expansions of $(1 + x)^n$ and $(a + b)^n$ where n is a positive integer.

The coefficients may be expressed in the form $^nC_r = \binom{n}{r} = \frac{n!}{r!(n-r)!}$

Be aware that $^nC_r = \binom{n}{r} = {}^nC_{n-r} = \binom{n}{n-r}$

Coordinate Geometry

Straight line
Know the forms of the straight line, including

$y = mx + c$

$y - y_1 = m(x - x_1)$

$\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}$

Condition for parallel lines: $m_1 = m_2$

Condition for perpendicular lines: $m_1 \times m_2 = -1$

Distance between two points $(x_1, y_1), (x_2, y_2) = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$

Midpoint of two points $(x_1, y_1), (x_2, y_2) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

The Circle

$(x - a)^2 + (y - b)^2 = r^2$ has centre (a, b) and radius r.

Trigonometry

In a right-angled triangle:

$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}},\ \cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}},\ \tan\theta = \frac{\text{opposite}}{\text{adjacent}}$$

Identities:

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$

$$\sin^2\theta + \cos^2\theta = 1$$

Sin rule:

$$\frac{a}{\text{Sin}A} = \frac{b}{\text{Sin}B} = \frac{c}{\text{Sin}C}$$

Cos rule:

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

Calculus

$$y = ax^n \Rightarrow \frac{\mathrm{d}y}{\mathrm{d}x} = nax^{n-1}$$

Stationary points occur when $\frac{\mathrm{d}y}{\mathrm{d}x} = 0$

Area under curve between $x = a$ and $x = b$ is $\int_a^b y\,\mathrm{d}x$

Kinematics

Constant acceleration formulae

$$s = ut + \frac{1}{2}at^2$$

$$s = \frac{(u+v)}{2}t$$

$$v = u + at$$

$$v^2 = u^2 + 2as$$