FORMULAE

PURE MATHEMATICS

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

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

For an arithmetic series:

$$u_n = a + (n - 1)d, \qquad S_n = \frac{n}{2}\{2a + (n - 1)d\}$$

For a geometric series:

$$u_n = a r^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1},\ r > 1, \qquad S_n = \frac{a(1 - r^n)}{1 - r},\ r < 1, \qquad S_\infty = \frac{a}{1 - r},\ |r| < 1$$

Binomial expansion:

$$(a+b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 +, \ \dots \ + b^n,$$ where n is a positive integer.

$$\binom{n}{r} = {}^nC_r = \frac{n!}{r!(r-1)!}$$

$$(1 + x)^n = 1 + nx + \frac{n(n-1)}{1 \times 2} x^2 + \dots + \frac{n(n-1)\dots(n-r+1)}{1 \times 2 \times \dots r} x^r + \dots$$ where n is a real number and $|x|<|$

Summations:

$$\sum_{r=1}^{n} r = \frac{1}{2} n(n+1). \qquad \sum_{r=1}^{n} r^2 = \frac{1}{6} n(n+1)(2n+1). \qquad \sum_{r=1}^{n} r^3 = \frac{1}{4} n^2 (n+1)^2$$

Complex numbers:

$z^n = (\cos x + i \sin x)^n = \cos nx + i \sin nx$, where n is an integer and x is real

$e^{ix} = \cos x + i \sin x$ where x is real

$[r(\cos x + i \sin x)]^n = r^n(\cos nx + i \sin nx)$