STEP Support Programme

STEP II Miscellaneous Topic Notes

The STEP specification can be found here. The notes here are for some parts of the specification but please refer to the published specification for full details.

Expansions

$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \cdots + \binom{n}{r}a^{n-r}b^r + \cdots \binom{n}{n-1}ab^{n-1} + b^n$

Where $\binom{n}{r} = \dfrac{n!}{r!(n-r)!}$ and n is a positive integer.

$(1+x)^k = 1 + kx + \dfrac{k(k-1)}{2!}x^2 + \dfrac{k(k-1)(k-2)}{3!}x^3 + \cdots$ where k is a rational number and $|x| < 1$.

Arithmetic series

Recurrence relation: $t_n = t_{n-1} + d$
n^{th} term: $t_n = a + (n-1)d$
Sum of n terms: $S_n = \frac{1}{2}n\big(a + l\big) = \frac{1}{2}n\big(2a + (n-1)d\big)$

Geometric series

Recurrence relation: $t_n = r \times t_{n-1}$
n^{th} term: $t_n = a \times r^{n-1}$
Sum of n terms: $S_n = \dfrac{a(r^n - 1)}{r - 1} = \dfrac{a(1 - r^n)}{1 - r}$
Infinite sum: $S_\infty = \dfrac{a}{1 - r}$ for $|r| < 1$

Exponential series

$\mathrm{e}^x = 1 + x + \frac{x^2}{2!} + \cdots + \frac{x^r}{r!} + \cdots$

Coordinate geometry

Gradient between (x_1, y_1) and (x_2, y_2): $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

Distance between (x_1, y_1) and (x_2, y_2): $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Midpoint of (x_1, y_1) and (x_2, y_2): $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

Equation of a straight line with gradient m passing through (x_1, y_1): $y - y_1 = m(x - x_1)$

Equation of a circle radius R passing through (a, b): $(x - a)^2 + (y - b)^2 = R^2$