Exam VWO Math A

Formula sheet

Differentiation

rule	function	derivative
sum rule	$s(x) = f(x) + g(x)$	$s'(x) = f'(x) + g'(x)$
product rule	$p(x) = f(x) \cdot g(x)$	$p'(x) = f'(x) \cdot g(x) + f(x) \cdot g'(x)$
quotient rule	$q(x) = \dfrac{f(x)}{g(x)}$	$q'(x) = \dfrac{f'(x) \cdot g(x) - f(x) \cdot g'(x)}{\left(g(x)\right)^2}$
chain rule	$k(x) = f\left(u(x)\right)$	$k'(x) = f'\left(u(x)\right) \cdot u'(x)$ or $\dfrac{\mathrm{d}k}{\mathrm{d}x} = \dfrac{\mathrm{d}f}{\mathrm{d}u} \cdot \dfrac{\mathrm{d}u}{\mathrm{d}x}$

Rules for logarithms

rule	condition
$\log_g(a) + \log_g(b) = \log_g(ab)$	$g > 0, g \neq 1, a > 0, b > 0$
$\log_g(a) - \log_g(b) = \log_g\left(\frac{a}{b}\right)$	$g > 0, g \neq 1, a > 0, b > 0$
$k \cdot \log_g(a) = \log_g(a^k)$	$g > 0, g \neq 1, a > 0$
$\log_g(a) = \dfrac{\log_p(a)}{\log_p(g)}$	$g > 0, g \neq 1, a > 0, p > 0, p \neq 1$

Sequences

The sum of an **arithmetic sequence** is given by:

$$S = \tfrac{1}{2}N(u_{\text{first}} + u_{\text{last}})$$

Here N is the number of terms.

The sum of a **geometric sequence** with common ratio r is given by:

$$S = \frac{u_{\text{last}+1} - u_{\text{first}}}{r - 1} \qquad \text{with } r \neq 1$$

Rules for random variables

For two random variables X and Y, we have:

$$\mathrm{E}(X+Y)=\mathrm{E}(X)+\mathrm{E}(Y)$$

For two independent random variables X and Y, we have:

$$\sigma(X+Y)=\sqrt{\big(\sigma(X)\big)^2+\big(\sigma(Y)\big)^2}$$

If you have n independent random experiments, each with the same random variable X, then the following holds for the sum S and the mean $\bar{X}$:

$$\mathrm{E}(S)=n\cdot\mathrm{E}(X) \qquad \mathrm{E}(\bar{X})=\mathrm{E}(X)$$

$$\sigma(S)=\sqrt{n}\cdot\sigma(X) \qquad \sigma(\bar{X})=\frac{\sigma(X)}{\sqrt{n}}$$

Binomial distribution

For a binomially distributed random variable X, where n is the number of trials and p the probability of success, the probability of k successes is equal to:

$$\mathrm{P}(X=k)=\binom{n}{k}\cdot p^k\cdot(1-p)^{n-k}$$

Furthermore: $\mathrm{E}(X)=n\cdot p$ and $\sigma(X)=\sqrt{n\cdot p\cdot(1-p)}$

Normal distribution

If X is normally distributed with mean μ and standard deviation σ, then:

$Z=\dfrac{X-\mu}{\sigma}$ follows a standard normal distribution with: $\mathrm{P}(X\leq g)=\mathrm{P}\left(Z\leq\dfrac{g-\mu}{\sigma}\right)$