

# 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	$q(x) = \frac{f(x)}{g(x)}$	$q'(x) = \frac{g(x) \cdot f'(x) - f(x) \cdot g'(x)}{(g(x))^2}$
chain rule	$k(x) = f(u(x))$	$k'(x) = f'(u(x)) \cdot u'(x)$ or $\frac{dk}{dx} = \frac{df}{du} \cdot \frac{du}{dx}$

### Rules for logarithms

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

### Sequences

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

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

Here  $N$  is the number of terms.

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

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

## Rules for random variables

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

$$E(X + Y) = E(X) + E(Y)$$

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

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

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  $\bar{X}$ :

$$E(S) = n \cdot E(X)$$

$$E(\bar{X}) = E(X)$$

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

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

## 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:

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

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