Government of **Western Australia**
School Curriculum and Standards Authority

WACE
Western Australian Certificate of Education

MATHEMATICS

UNITS 3C AND 3D

FORMULA SHEET
2013

This document is valid for teaching and examining until 31 December 2013.

Number and algebra

Index laws: For $a, b > 0$ and m, n real,

$$a^m b^m = (a\,b)^m \qquad a^m a^n = a^{m+n} \qquad (a^m)^n = a^{mn}$$

$$a^{-m} = \frac{1}{a^m} \qquad \frac{a^m}{a^n} = a^{m-n} \qquad a^0 = 1$$

For $a > 0$ and m an integer and n a positive integer, $a^{\frac{m}{n}} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$

Differentiation:

If $f(x) = y$ then $f'(x) = \frac{dy}{dx}$

If $f(x) = x^n$ then $f'(x) = nx^{n-1}$

If $f(x) = e^x$ then $f'(x) = e^x$

Product rule: If $y = f(x)\,g(x)$ then $y' = f'(x)\,g(x) + f(x)\,g'(x)$ or If $y = uv$ then $\frac{dy}{dx} = \frac{du}{dx}v + u\frac{dv}{dx}$

Quotient rule: If $y = \frac{f(x)}{g(x)}$ then $y' = \frac{f'(x)\,g(x) - f(x)\,g'(x)}{(g(x))^2}$ or If $y = \frac{u}{v}$ then $\frac{dy}{dx} = \frac{\frac{du}{dx}v - u\frac{dv}{dx}}{v^2}$

Chain rule: If $y = f(g(x))$ then $y' = f'(g(x))\,g'(x)$ or If $y = f(u)$ and $u = g(x)$ then $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

Integration:

Powers: $\int x^n dx = \frac{x^{n+1}}{n+1} + c,\ n \neq -1$

Exponentials: $\int e^x dx = e^x + c$

Fundamental Theorem of Calculus:

$$\frac{d}{dx}\left(\int_a^x f(t)\,dt\right) = f(x) \quad \text{and} \quad \int_a^b f'(x)\,dx = f(b) - f(a)$$

Incremental formula: $\delta y \simeq \frac{dy}{dx}\delta x$

Exponential growth and decay:

If $\frac{dy}{dt} = ky$, then $y = Ae^{kt}$

Space and measurement

Circle: $C = 2\pi r = \pi D$, where C is the circumference, r is the radius and D is the diameter
$A = \pi r^2$, where A is the area

Triangle: $A = \frac{1}{2}bh$, where b is the base and h is the perpendicular height

Parallelogram: $A = bh$

Trapezium: $A = \frac{1}{2}(a + b)h$, where a and b are the lengths of the parallel sides

Prism: $V = Ah$, where V is the volume and A is the area of the base

Pyramid: $V = \frac{1}{3}Ah$

Cylinder: $S = 2\pi rh + 2\pi r^2$, where S is the total surface area
$V = \pi r^2 h$

Cone: $S = \pi rs + \pi r^2$, where s is the slant height
$V = \frac{1}{3}\pi r^2 h$

Sphere: $S = 4\pi r^2$
$V = \frac{4}{3}\pi r^3$

Volume of solids of revolution:

$V = \int \pi y^2\, dx$ rotated about the x-axis

$V = \int \pi x^2\, dy$ rotated about the y-axis

Chance and data

Probability: For any event A and its complement $\bar{A}$, and event B

$P(A) + P(\bar{A}) = 1$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$P(A \cap B) = P(A)\, P(B|A) = P(B)\, P(A|B)$

In a binomial distribution:

Mean: $\mu = np$ and standard deviation: $\sigma = \sqrt{np(1-p)}$

A confidence interval for the mean of a population is:

$$\bar{x} - z\frac{\sigma}{\sqrt{n}} \le \mu \le \bar{x} + z\frac{\sigma}{\sqrt{n}}$$

where μ is the population mean,
σ is the population standard deviation,
$\bar{x}$ is the sample mean,
n is the sample size and
z is the cut-off value on the standard normal distribution corresponding to the confidence level.

Note: Any additional formulas identified by the examination panel as necessary will be included in the body of the particular question.