City&Guilds

2850-361 DECEMBER 2014
Level 3 Diploma in Engineering (IVQ)
Advanced Mathematics

Tuesday 8 December 2014
14:00-17:00

Do not write your answers in this booklet as it will not be marked. All answers should be written in the space provided on the question paper.

SOURCE DOCUMENT
Formulae Sheet

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Trigonometry

Cosine rule $a^2 = b^2 + c^2 - 2bcCosA$

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Area of triangle $= \frac{1}{2}a.b.\sin C$

Trigonometric identities

- *Sin(A ± B) = Sin A Cos B ± Cos A Sin B*
- *Cos(A ± B) = Cos A Cos B ∓ Sin A Sin B*

Numerical integration

Simpson's rule

$$\int_a^b y.dx = \frac{1}{3}h\{(y_0 + y_n) + 4(y_1 + y_3 + \cdots\ y_{n-1}) + 2(y_2 + y_4 + \cdots y_{n-2})\}$$

where $h = \frac{b-a}{n}$ and n is even

Trapezium rule

$$\int_a^b y.dx = \frac{1}{2}h\{(y_0 + y_n) + 2(y_1 + y_2 + \ldots\ y_{n-1})\} \text{ where } h = \frac{b-a}{n}$$

Volume of revolution around x axis

$$V = \int_a^b \pi y^2 dx$$

Standard deviation $= \sqrt{\left(\frac{\sum x^2 f}{\sum f}\right) - (mean)^2}$

Complex numbers

$$[r(\cos\theta + j\sin\theta)]^n = r^n(\cos n\theta + \sin n\theta)$$

Calculus

Differentiation

$y = f(x)$	$\frac{dy}{dx} = f'(x)$
lnx	$\frac{1}{x}$
e^{ax}	ae^{ax}
$Sinx$	$Cos\ x$
$Cos\ x$	$-Sinx$
$Tanx$	Sec^2x

Product rule

If $y = uv$ then $\frac{dy}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$

Quotient rule

If $y = \frac{u}{v}$ then $\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

Chain (or function of a function rule)

If $y = f(u)$ and $u = g(x)$ then $\frac{dy}{dx} = \frac{dy}{du}.\frac{du}{dx}$

Integration

$f(x)$	$\int f(x)dx$
x^n	$\frac{x^{n+1}}{n+1} + c$
$\frac{1}{x}$	$lnx + c$
$Cosxdx$	$Sinx + c$
$Sinxdx$	$-Cosx + c$
Sec^2xdx	$tanx + c$

By parts

$\int udv = uv - \int vdu$

Substitution

$\int f\big(g(x)\big)g'(x)dx = \int f(u)du$