8730-031

T Level Technical Qualification(s) in Engineering and Manufacturing (Level 3)

Core: Exam paper 1

Formula sheet

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.

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Note that you may not require every formula on this sheet to answer the questions, and you may require additional formulae not presented here.

Pythagoras theorem	$a^2 + b^2 = c^2$	
Trigonometric functions	$\sin\theta = \frac{opposite}{hypotenuse}$	
	$\cos\theta = \frac{adjacent}{hypotenuse}$	
	$\tan\theta = \frac{opposite}{adjacent}$	
Trigonometric identities	$\tan\theta = \frac{\sin\theta}{\cos\theta}$	
	$\cot\theta = \frac{1}{\tan\theta}$	
	$\sec\theta = \frac{1}{\cos\theta}$	
	$\operatorname{cosec}\theta = \frac{1}{\sin\theta}$	
Sine rule	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$	
Cosine rule	$a^2 = b^2 + c^2 - 2bc\cos A$	
	$b^2 = a^2 + c^2 - 2ac\cos B$	
	$c^2 = a^2 + b^2 - 2ab\cos C$	
Standard derivatives	ax^n	anx^{n-1}
	$\sin ax$	$a\cos ax$
	$\cos ax$	$-a\sin ax$
	$\tan x$	$sec^2 x$
Standard integrals	ax^n	$\frac{ax^{n+1}}{n+1} + c \; where \; n \neq 1$
	$\sin ax$	$\frac{-1}{a}\cos ax + c$
	$\cos ax$	$\frac{1}{a}\sin ax + c$
	$\tan x$	$-\ln\cos x + c$
Simple shapes	**Surface area**	**Volume**
Rectangular solid	$2lw + 2hw + 2lh$	lwh
Cylinder	$2\pi r^2 + 2\pi rh$	$\pi r^2 h$
Sphere	$4\pi r^2$	$\frac{4}{3}\pi r^3$
Cone	$\pi rs + \pi r^2$	$\frac{\pi r^2 h}{3}$

Quadratic equation		$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Graphs		$y = mx + c$
Arithmetic progression		$a_n = a + (n-1)d$
Geometric progression		$a_n = ar^{n-1}$
Statistics	**Mean value**	$\bar{x} = \frac{\sum(x)}{n}$
	Standard deviation	$\sigma = \sqrt{\frac{\sum(x-\bar{x})^2}{n}}$
Pressure		$P = \frac{F}{A}$
Hydrostatic thrust		$F = \rho g A x$
Bernoulli's equation		$P + \frac{1}{2}\rho v^2 + \rho g h = constant$
Specific heat		$Q = m\ c\ \Delta t$
Latent heat		$Q = mh$
Thermal expansion		$\Delta L = \alpha\ L\ \Delta t$
Polar to cartesian conversion		$x = r\ cos\theta$
		$y = r\ sin\theta$
Potential energy		$PE = mgh$
Kinetic energy		$KE = \frac{1}{2}mv^2$
Stress		$\sigma = \frac{F}{A}$
Strain		$\varepsilon = \frac{\Delta L}{L}$
Young's modulus		$E = \frac{\sigma}{\varepsilon}$
Gas laws	**Boyle's Law**	$P_1V_1 = P_2V_2$
	Charles' Law	$\frac{V_1}{T_1} = \frac{V_2}{T_2}$
	General gas equation	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
	Characteristic gas equation	$pV = mRT$
Resistance in series		$R_T = R_1 + R_2$
Resistance in parallel		$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$
Capacitance in series		$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2}$
Capacitance in parallel		$C_T = C_1 + C_2$
Electrical theory		Ohm's law $V = IR$
		$P = IV$