

Plane Geometry

Circle

Circumference = πd
Area = πr^2



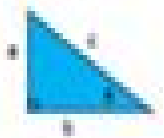
Parallelogram

Area = bh



Right Triangle

$a^2 + b^2 = c^2$
area = $\frac{1}{2}ab$
circ = $\frac{1}{2}ab$
hyp = c



Solid Geometry

Cube

Volume = s^3
Surface Area = $6s^2$



Rectangular Prism

Volume = lwh
Surface Area = $2(lw + wh + lh)$



Right Circular Cone

Volume = $\frac{\pi r^2 h}{3}$
Surface Area = $\pi r \sqrt{r^2 + h^2}$



Pyramid

Volume = $\frac{Ah}{3}$
A = area of base



Ellipse

Area = πab



Rectangle

Perimeter = $2a + 2b$
Area = ab



Triangle

Area = $\frac{1}{2}bh$
 $a^2 = b^2 + c^2 - 2bc \cos A$
 $b^2 = a^2 + c^2 - 2ac \cos B$
 $c^2 = a^2 + b^2 - 2ab \cos C$



Regular Polygon

Area = $\frac{n s^2}{4 \tan(\frac{\pi}{n})}$
n = number of sides



Trapezoid

Area = $\frac{1}{2}(b_1 + b_2)h$



Sphere

Volume = $\frac{4}{3}\pi r^3$
Surface Area = $4\pi r^2$



Cylinder

Volume = $\pi r^2 h$
Surface Area = $2\pi r^2 + 2\pi rh$



Angular Prism

Volume = As
A = area of base



Constants

$g = 9.8 \text{ m/s}^2 = 32.2 \text{ ft/s}^2$
 $G = 6.67 \times 10^{-11} \text{ m}^3/\text{kg s}^2$
 $\pi = 3.14159$

Material Properties

Stress (axial)

$\sigma = \frac{F}{A}$

σ = stress
 F = axial force
 A = cross-sectional area

Strain (axial)

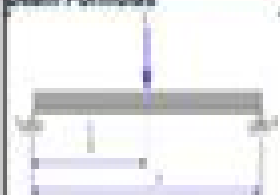
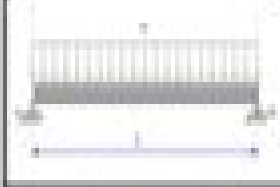
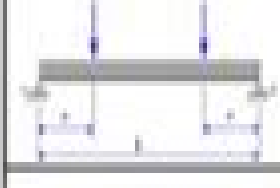
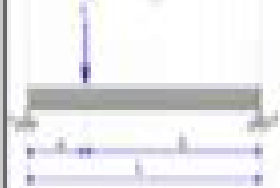
$\epsilon = \frac{\Delta L}{L_0}$
 ϵ = strain
 L_0 = original length
 Δ = change in length

Modulus of Elasticity

$E = \frac{\sigma}{\epsilon}$
 $E = \frac{dF/dL}{(L_1 - L_0)/A}$

E = modulus of elasticity
 σ = stress
 ϵ = strain
 A = cross-sectional area
 F = axial force
 Δ = deformation

Structural Analysis

Beam Formulas	
	Reaction $R_1 = R_2 = \frac{P}{2}$ Moment $M_{max} = \frac{PL}{4}$ (at point of load) Deflection $\Delta_{max} = \frac{PL^3}{48EI}$ (at point of load)
	Reaction $R_1 = R_2 = \frac{wL}{2}$ Moment $M_{max} = \frac{wL^2}{8}$ (at center) Deflection $\Delta_{max} = \frac{5wL^4}{384EI}$ (at center)
	Reaction $R_1 = R_2 = P$ Moment $M_{max} = P_1 a$ (between loads) Deflection $\Delta_{max} = \frac{P_1 a^2}{24EI} (3L^2 - 4a^2)$ (at center)
	Reaction $R_1 = \frac{Pb}{L}$ and $R_2 = \frac{Pa}{L}$ Moment $M_{max} = \frac{Pab}{L}$ (at Point of Load) Deflection $\Delta_{max} = \frac{Pab(L^2 - a^2 - b^2)}{24EI}$ (at $x = \sqrt{\frac{ab(L+a+b)}{3}}$ when $a \neq b$)

Deformation: Axial

$\Delta = \frac{FL_0}{AE}$

Δ = deformation
 F = axial force
 L_0 = original length
 A = cross-sectional area
 E = modulus of elasticity

Truss Analysis

$2J = M + R$

J = number of joints
 M = number of members
 R = number of reaction forces

Civil Engineering Mathematics Formulas

**Mohammad Heidarzadeh, Theodosios
K. Papathanasiou, Yurui Fan, Hamid
Bahai**

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Department of the Army Pamphlet ,1949 Engineering Formulas Kurt Gieck,1971 **Practical Civil**

Engineering P.K. Jayasree,K Balan,V Rani,2021-05-03 The book provides primary information about civil engineering to both a civil and non civil engineering audience in areas such as construction management estate management and building Basic civil engineering topics like surveying building materials construction technology and management concrete technology steel structures soil mechanics and foundations water resources transportation and environment engineering are explained in detail Codal provisions of US UK and India are included to cater to a global audience Insights into techniques like modern surveying equipment and technologies sustainable construction materials and modern construction materials are also included Key features Provides a concise presentation of theory and practice for all technical in civil engineering Contains detailed theory with lucid illustrations Focuses on the management aspects of a civil engineer s job Addresses contemporary issues such as permitting globalization sustainability and emerging technologies Includes codal provisions of US UK and India The book is aimed at professionals and senior undergraduate students in civil engineering non specialist civil engineering audience

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