

Contents

Introduction	viii
1 Geometrical Foundations	1
The nature of geometry. Plane surfaces. Angles and their measurement. Geometrical theorems; lines and triangles. Quadrilaterals. The circle. Solid geometry. Angles of elevation and depression.	
2 Using your Calculator	28
Arithmetic and algebraic calculators. Rounding or truncating calculators. Differing calculator displays. Using your calculator for simple calculations. The clear keys. Handling minus signs and negative numbers. Calculations involving brackets. Using the memory. Using other mathematical functions. Functions and their inverses. Changing degrees to degrees, minutes and seconds. Changing degrees to radians. Finding trigonometrical functions. Finding inverse trigonometrical functions.	
3 The Trigonometrical Ratios	39
The tangent. Changes of tangents in the first quadrant. Tables of tangents. Uses of tangents. The sine and cosine. Changes of sines and cosines in the first quadrant. Uses of sines and cosines. The cosecant, secant and cotangent. Using your calculator for other trigonometrical ratios. Graphs of trigonometrical ratios. Uses of other trigonometrical ratios. Solution of right-angled triangles. Slope and gradient. Projections.	

4	Relations between the Trigonometrical Ratios	72
	$\tan \theta = \frac{\sin \theta}{\cos \theta} \quad \sin^2 \theta + \cos^2 \theta = 1$	
	$\tan^2 \theta + 1 = \sec^2 \theta$	
	$\cot^2 \theta + 1 = \operatorname{cosec}^2 \theta$	
5	Ratios of Angles in the Second Quadrant	75
	Positive and negative lines	
	Direction of rotation of angle	
	The sign convention for the hypotenuse	
	To find the ratio of angles in the second quadrant from the tables	
	To find an angle when a ratio is given	
	The inverse notation	
	Graphs of the sine, cosine and tangent between 0° and 360°	
6	Trigonometrical Ratios of Compound Angles	87
	$\sin (A + B) = \sin A \cos B + \cos A \sin B$, etc	
	$\sin (A - B) = \sin A \cos B - \cos A \sin B$, etc	
	$\tan (A + B)$ and $\tan (A - B)$ Multiple and sub-multiple formulae Product formulae	
7	Relations between the Sides and Angles of a Triangle	100
	The sine rule The cosine rule The half-angle formulae	
	Formula for $\sin \frac{A}{2}$ in terms of the sides	
	Formula for $\cos \frac{A}{2}$ in terms of the sides	
	Formula for $\tan \frac{A}{2}$ in terms of the sides	
	Formula for $\sin A$ in terms of the sides	
	$\tan \frac{B - C}{2} = \frac{b - c}{b + c} \cot \frac{A}{2} \quad a = b \cos C + c \cos B$	
8	The Solution of Triangles	114
	Case I Three sides known Case II Two sides and contained angle known Case III Two angles and a side known Case IV The ambiguous case The area of a triangle	
9	Practical problems involving the Solution of Triangles	127
	Determination of the height of a distant object	

	Distance of an inaccessible object	Distance
	between two visible but inaccessible objects	
	Triangulation	Worked examples
10	Circular Measure	141
	Ratio of circumference of a circle to its diameter	
	The radian	To find the circular measure of an angle
		The length of an arc
11	Trigonometrical Ratios of Angles of any Magnitude	147
	Angles in the 3rd and 4th quadrants	
	Variations in the sine between 0° and 360°	
	Variations in the cosine between 0° and 360°	
	Variations in the tangent between 0° and 360°	
	Ratios of angles greater than 360°	
	Ratios of $(-\theta)$	
	Ratios of θ and $(180^\circ + \theta)$	
	Ratios of θ and $(360^\circ - \theta)$	
	Angles with given trigonometrical ratios	
12	Trigonometrical Equations	164
	Types of equations	
	The form $a \cos \theta - b \sin \theta = c$	
	Summary of Trigonometrical Formulae	171
	Tables	174
	Answers	186