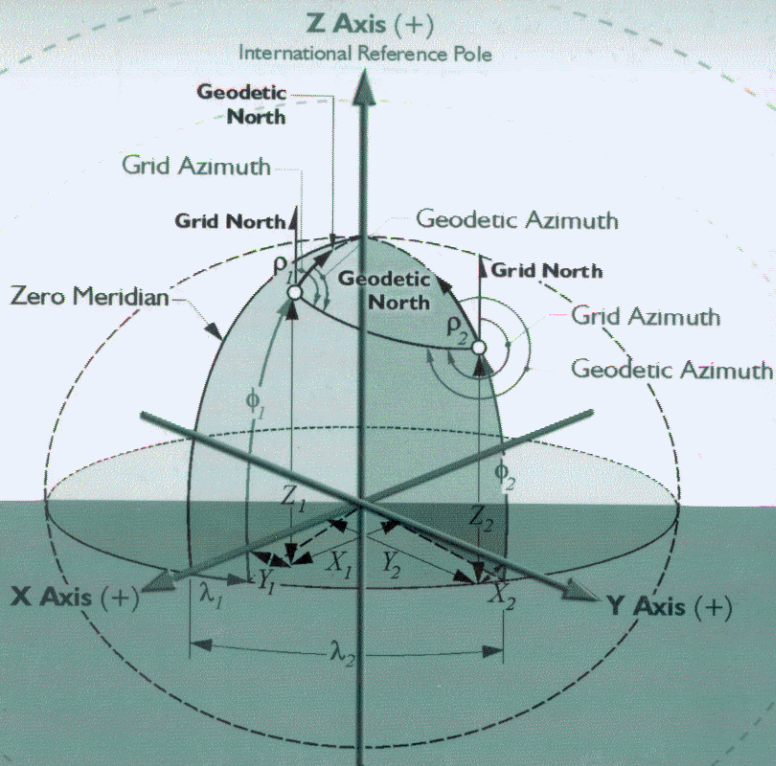


Basic GIS Coordinates



Jan Van Sickle

Contents

Chapter one Foundation of a coordinate system

Datums to the rescue	1
René Descartés	2
Cartesian coordinates	2
Attachment to the real world	4
Cartesian coordinates and the Earth.....	4
The shape of the Earth	6
Latitude and longitude	8
Between the lines	9
Longitude	10
Latitude	12
Categories of latitude and longitude	12
The deflection of the vertical	13
Directions	18
Azimuths	18
Bearings	18
Astronomic and geodetic directions	19
North	21
Magnetic north	21
Grid north	22
Polar coordinates	22
Summary	26
Exercises	28
Answers and explanations	31

Chapter two Building a coordinate system

Legacy geodetic surveying	35
Ellipsoids	36
Ellipsoid definition	37
Ellipsoid orientation	40
The initial point	41
Five parameters	42
Datum realization	43
The terrestrial reference frame	44
A new geocentric datum	45

Geocentric three-dimensional Cartesian coordinates	48
The IERS	51
Coordinate transformation	53
Common points	55
Molodenski transformation	55
Seven-parameter transformation	56
Surface fitting	57
Exercises	59
Answers and explanations	61

Chapter three Heights

Two techniques	67
Trigonometric leveling	67
Spirit leveling	69
Evolution of a vertical datum	71
Sea level	71
A different approach	73
The zero point	74
The GEOID	75
Measuring gravity	77
Orthometric correction	78
GEOID99	82
Dynamic heights	83
Exercises	85
Answers and explanations	87

Chapter four Two-coordinate systems

State plane coordinates	91
Map projection	91
Polar map projections	94
Choices	98
SPCS27 to SPCS83	102
Geodetic lengths to grid lengths	105
Geographic coordinates to grid coordinates	113
Conversion from geodetic azimuths to grid azimuths	114
SPCS to ground coordinates	117
Common problems with state plane coordinates	119
UTM coordinates	120
Exercises	125
Answers and explanations	128

Chapter five The Rectangular System

Public lands	133
The initial points	134
Quadrangles	137
Townships	140

Sections	143
The subdivision of sections	146
Township plats	147
Fractional lots	148
Naming aliquot parts and corners	151
System principles	153
Exercises	158
Answers and explanations	161
Bibliography	165
Index	167