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SCHEDULE I / ITEM 1   **March 2002**
MATHEMATICS

Note: **This examination consists of 10 questions on 1 page.**   **Marks**

Q. No   Time: 3 hours   Value   Earned

Q. No		Value	Earned
1. a)	Given a curve $y = f(x)$, what is the slope angle θ of its tangent at some point $x = x_o$?	5	
b)	Given the same curve $y = f(x)$, what is the equation of the normal to the curve at $x = x_o$?	5	
2. a)	What is the equation of the line defined by two points (x_1, y_1) and (x_2, y_2)?	5	
b)	What is the equation of a plane defined by three noncollinear points (x_k, y_k), $k = 1, 2, 3$?	5	
3. a)	What is the equation of a circle of radius R with center at (x_o, y_o)?	5	
b)	What is the equation of a sphere of radius R with center at (x_o, y_o, z_o)?	5	
4. a)	Expand the expression $(1+3x)^{1/2}$ into a series about $x = 0$. Evaluate the first three terms only.	5	
b)	Expand the expression $(1-3x)^{1/2}$ into a series about $x = 1$. Evaluate the first three terms only.	5	
5. a)	Given two vectors $u = (1\ 3\ 5)^T$ and $v = (2\ 4\ 6)^T$, what is their dot or scalar product? (The superscript T means transpose)	5	
b)	Given the same two vectors $u = (1\ 3\ 5)^T$ and $v = (2\ 4\ 6)^T$, what is their cross or vector product? (The superscript T means transpose)	5	
6. a)	Given a small matrix $A = [a_{ij} \mid i=1,2,3$ and $j=1,2,3]$ with elements $a_{ij} = (1+i+j)^{-1}$, what is A^2?	5	
b)	Given the same small matrix $A = [a_{ij} \mid i=1,2,3$ and $j=1,2,3]$ with elements $a_{ij} = (1+i+j)^{-1}$, what is the determinant of A?	5	
7. a)	What is the general solution of the differential equation $dy/dx + 1 = 0$?	5	
b)	What is the general solution of the differential equation $d^2y/dx^2 + 2 = 0$?	5	
8. a)	Given three equations: $x + y + z = 12$, $x + y - z = -2$ and $x - y - z = -8$, what is the solution for x, y and z using Gaussian elimination?	5	
b)	Given the same equations: $x + y + z = 12$, $x + y - z = -2$ and $x - y - z = -8$, what is the solution for x, y and z using matrix algebra?	5	
9.	Given three arbitrary noncollinear points on the spherical Earth, what is the perimeter of the enclosed spherical triangle?	10	
10.	Given some star's declination δ and azimuth angle A at an hour angle H, what are the star's zenith distance Z and the observer's latitude φ ?	10	
	Total Marks:	100	