```
? CrossProduct
? Cross
```

Out[22]=

Symbol	
Global`CrossProduct	
Full Name	Global`CrossProduct

Out[23]=

Symbol	
Cross[a, b] gives the vector cross product of a and b.	
Documentation	Local » | Web »
Attributes	{Protected, ReadProtected}
Full Name	System`Cross

In[97]:=

```
CrossProduct[input1_, input2_] :=
 Cross[input1, input2]
DotProduct[input1_, input2_] :=
 Dot[input1, input2]
```

```
In[126]:= e1 = {1, 0, 0};
e2 = {0, 1, 0};
e3 = {0, 0, 1};
Cross[e1 + e2, e2]
Cross[{a, b, c} + {d, e, f}, {g, h, k}] -
  (Cross[{a, b, c} , {g, h, k}] +
    Cross[{d, e, f}, {g, h, k}])

Out[129]= {0, 0, 1}

Out[130]= {0, 0, 0}

In[145]:= Dot[e1 + e2, e2]
Expand[Dot[{a, b, c} + {d, e, f}, {g, h, k}] -
   (Dot[{a, b, c} , {g, h, k}] +
     Dot[{d, e, f}, {g, h, k}])]
Print["Go to wolfram alpha"]

Out[145]= 1

Out[146]= 0

Go to wolfram alpha

In[137]:= M = {{1, 2}, {3, 4}};
MatrixForm[M]
Det[M]
```

Out[138]//MatrixForm=

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

Out[139]= -2

```
In[152]:= onetonsquare[n_] := Module[{},
    M = {}; (* initializes M to be empty,
    this will be our matrix *)
    For[i = 1, i ≤ n, i++,
     {
      temp = {};
      (* where I will store the entries
       of the row we are constructing *)
      For[j = 1, j ≤ n, j++,
       temp = AppendTo[temp, (i - 1) * n + j]];
      M = AppendTo[M, temp];
      (* append the new row to M *)
     }]; (* end of i loop *)
    Print["We have n = ", n,
     " and the matrix is ", MatrixForm[M], "."];
    Print["The determinant is ", Det[M], "."];
    Return[M]; (* passes out the value M *)
   ];

In[157]:= onetonsquare[5]
```

We have n = 5 and the matrix is

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 6 & 7 & 8 & 9 & 10 \\ 11 & 12 & 13 & 14 & 15 \\ 16 & 17 & 18 & 19 & 20 \\ 21 & 22 & 23 & 24 & 25 \end{pmatrix}.$$

The determinant is 0.

Out[157]=
```
{{1, 2, 3, 4, 5}, {6, 7, 8, 9, 10},
 {11, 12, 13, 14, 15}, {16, 17, 18, 19, 20}, {21, 22, 23, 24, 25}}
```

In[158]:=
```
MatrixForm[NoOne]
```

Out[158]//MatrixForm=

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

In[150]:=
```
For[n = 3, n ≤ 10, n++, onetonsquare[n]]
```

We have n = 3 and the matrix is $\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$.

The determinant is 0.

We have n = 4 and the matrix is $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \\ 13 & 14 & 15 & 16 \end{pmatrix}$.

The determinant is 0.

We have n = 5 and the matrix is $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 6 & 7 & 8 & 9 & 10 \\ 11 & 12 & 13 & 14 & 15 \\ 16 & 17 & 18 & 19 & 20 \\ 21 & 22 & 23 & 24 & 25 \end{pmatrix}$.

The determinant is 0.

We have n = 6 and the matrix is $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 7 & 8 & 9 & 10 & 11 & 12 \\ 13 & 14 & 15 & 16 & 17 & 18 \\ 19 & 20 & 21 & 22 & 23 & 24 \\ 25 & 26 & 27 & 28 & 29 & 30 \\ 31 & 32 & 33 & 34 & 35 & 36 \end{pmatrix}$.

The determinant is 0.

We have n = 7 and the matrix is $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 8 & 9 & 10 & 11 & 12 & 13 & 14 \\ 15 & 16 & 17 & 18 & 19 & 20 & 21 \\ 22 & 23 & 24 & 25 & 26 & 27 & 28 \\ 29 & 30 & 31 & 32 & 33 & 34 & 35 \\ 36 & 37 & 38 & 39 & 40 & 41 & 42 \\ 43 & 44 & 45 & 46 & 47 & 48 & 49 \end{pmatrix}$.

The determinant is 0.

We have n = 8 and the matrix is $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 & 13 & 14 & 15 & 16 \\ 17 & 18 & 19 & 20 & 21 & 22 & 23 & 24 \\ 25 & 26 & 27 & 28 & 29 & 30 & 31 & 32 \\ 33 & 34 & 35 & 36 & 37 & 38 & 39 & 40 \\ 41 & 42 & 43 & 44 & 45 & 46 & 47 & 48 \\ 49 & 50 & 51 & 52 & 53 & 54 & 55 & 56 \\ 57 & 58 & 59 & 60 & 61 & 62 & 63 & 64 \end{pmatrix}$.

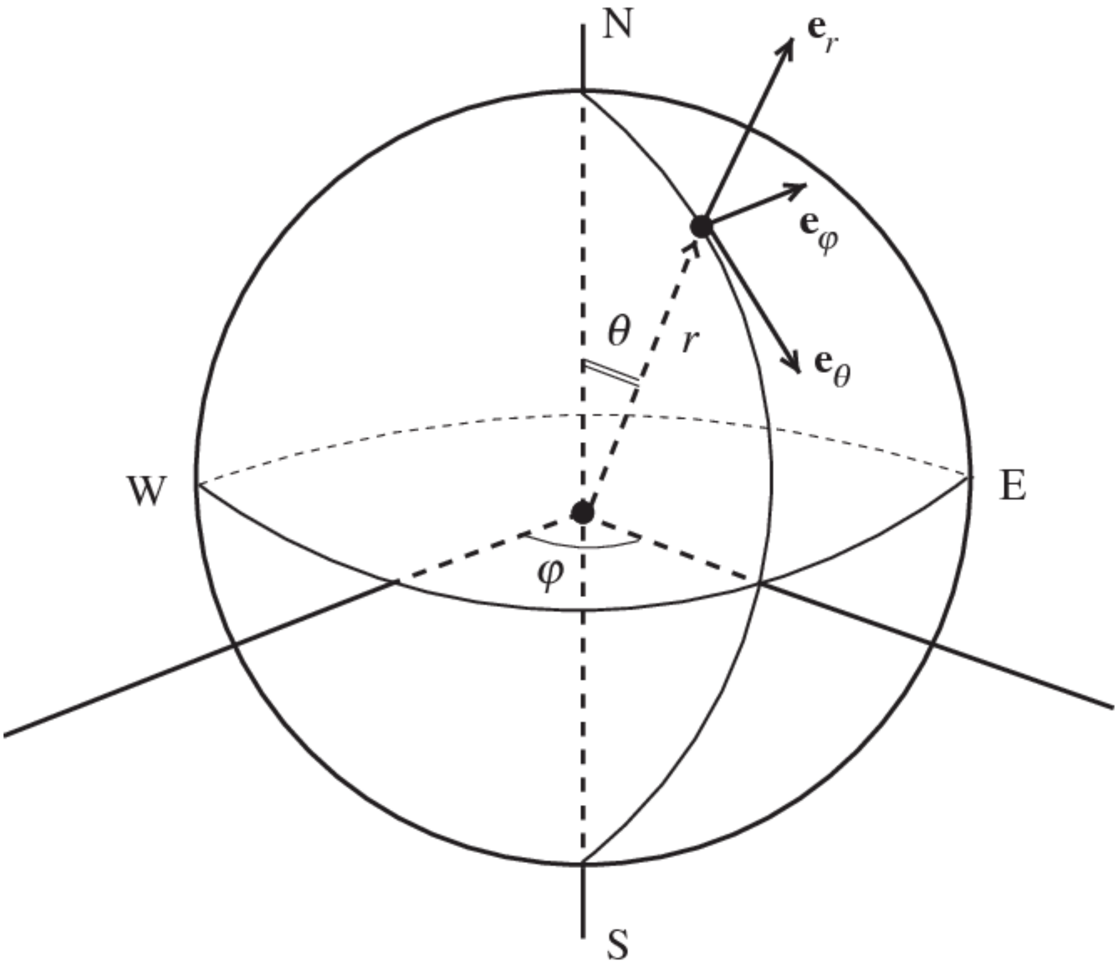
The determinant is 0.

We have n = 9 and the matrix is $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 10 & 11 & 12 & 13 & 14 & 15 & 16 & 17 & 18 \\ 19 & 20 & 21 & 22 & 23 & 24 & 25 & 26 & 27 \\ 28 & 29 & 30 & 31 & 32 & 33 & 34 & 35 & 36 \\ 37 & 38 & 39 & 40 & 41 & 42 & 43 & 44 & 45 \\ 46 & 47 & 48 & 49 & 50 & 51 & 52 & 53 & 54 \\ 55 & 56 & 57 & 58 & 59 & 60 & 61 & 62 & 63 \\ 64 & 65 & 66 & 67 & 68 & 69 & 70 & 71 & 72 \\ 73 & 74 & 75 & 76 & 77 & 78 & 79 & 80 & 81 \end{pmatrix}$.

The determinant is 0.

We have n = 10 and the matrix is $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ 11 & 12 & 13 & 14 & 15 & 16 & 17 & 18 & 19 & 20 \\ 21 & 22 & 23 & 24 & 25 & 26 & 27 & 28 & 29 & 30 \\ 31 & 32 & 33 & 34 & 35 & 36 & 37 & 38 & 39 & 40 \\ 41 & 42 & 43 & 44 & 45 & 46 & 47 & 48 & 49 & 50 \\ 51 & 52 & 53 & 54 & 55 & 56 & 57 & 58 & 59 & 60 \\ 61 & 62 & 63 & 64 & 65 & 66 & 67 & 68 & 69 & 70 \\ 71 & 72 & 73 & 74 & 75 & 76 & 77 & 78 & 79 & 80 \\ 81 & 82 & 83 & 84 & 85 & 86 & 87 & 88 & 89 & 90 \\ 91 & 92 & 93 & 94 & 95 & 96 & 97 & 98 & 99 & 100 \end{pmatrix}$.

The determinant is 0.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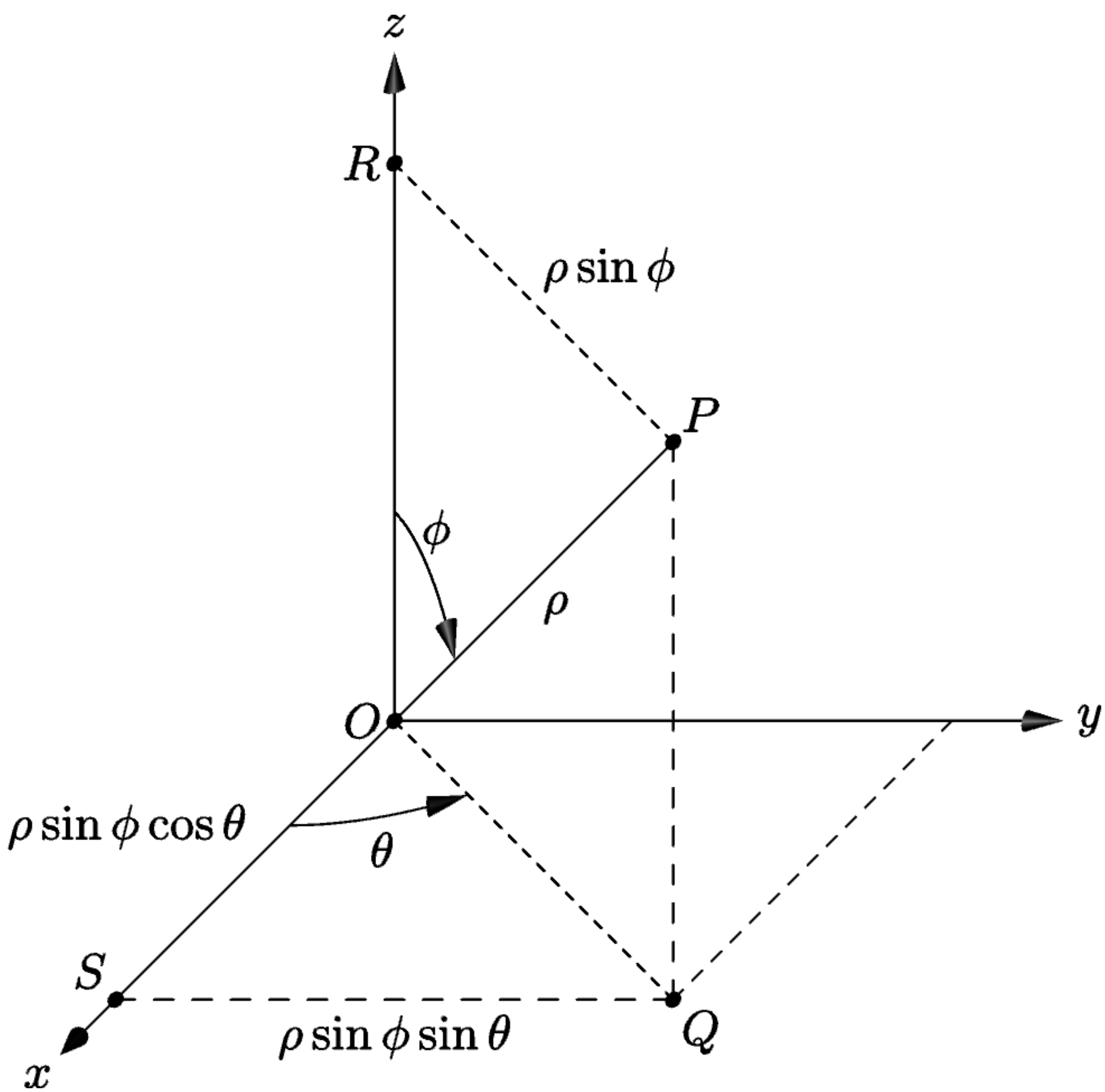

In[159]:= **Hyperlink["https://en.wikipedia.org/wiki/Spherical_coordinate_system"]**

Out[159]= https://en.wikipedia.org/wiki/Spherical_coordinate_system

In[96]:= **Hyperlink["https://web.williams.edu/Mathematics/sjmiller/public_html/150Sp20/winninglotterynumbersonedayearly.htm"]**

Out[96]= https://web.williams.edu/Mathematics/sjmiller/public_html/150Sp20/winninglotterynumbersonedayearly.htm

```
x^2 + y^2 + z^2 - 3 x y z = C
rho^2 - 3 (rho Sin[phi] Cos[theta])
   (rho Sin[phi] Sin[theta]) (rho Cos[phi]) = C
x = r Cos[theta]  and  y = r Sin[theta]
r = Sqrt[x^2 + y^2] and theta = ArcTan[y / x]
```

In[163]:=
```
D[Cos[x^3 + 2 x y + 17], y]
```

Out[163]= $-2 x \operatorname{Sin}\left[17 + x^3 + 2 x y\right]$

In[167]:=
```
Simplify[
 Integrate[x^4 + 2 x, y]]
```

Out[167]= $x \left(2 + x^3\right) y$

In[168]:=
```
Integrate[x^4 + 2 x, {x, 0, 1}]
```

Out[168]= $\frac{6}{5}$