a = 7, b = 3

**Problem #1:**

Using dot and cross products, determine whether the given planes are parallel, perpendicular or neither.

(a) 5x + 7y − 5z = 3 and 3x + 4y − 6z = 7

n1 = [5 7 -5]; n2 = [3 4 -6];

dot\_a = dot(n1,n2)

cross\_a = cross(n1,n2)

dot\_a =  
  
 73  
  
  
cross\_a =  
  
 -22 15 -1

Neither Parallel nor Perpendicular.

(b) x + 4y – 3(7)z = 2 and −3x − 12y + 9(7)z = 11

n1 = [1 4 -21]; n2 = [-3 -12 63];

dot\_b = dot(n1,n2)

cross\_b = cross(n1,n2)

dot\_b =  
  
 -1374  
  
  
cross\_b =  
  
 0 0 0

Parallel.

(c) 7x + 4(7)y – 7(7)z = −13 and −x + 2y + z = 5

n1 = [7 28 -49]; n2 = [-1 2 1];

dot\_c = dot(n1,n2)

cross\_c = cross(n1,n2)

dot\_c =  
  
 0  
  
  
cross\_c =  
  
 126 42 42

**Problem #2:**

Let z = a(y^3)\* e^(bxy^2)+x^3(y). Find the following partial derivatives: zx, zy, zyyx, zxxy, and zyyxyx.

syms x y

z = 7\*y^3\*exp(3\*x\*y^2 + x^3\*y);

zx = diff(z, x)

zy = diff(z, y)

zyyx = diff(diff(z, y, 2), x)

zxxy = diff(diff(z, x, 2), y)

zyyxyx = diff(diff(diff(diff(diff(diff(z, y, 2), x), y), x), y), x)

* zx = 7\*y^3\*exp(x^3\*y + 3\*x\*y^2)\*(3\*x^2\*y + 3\*y^2)
* zy = 21\*y^2\*exp(x^3\*y + 3\*x\*y^2) + 7\*y^3\*exp(x^3\*y + 3\*x\*y^2)\*(x^3 + 6\*y\*x)
* zyyx =  
     
  21\*y^2\*exp(x\*y\*(x^2 + 3\*y))\*(x^8\*y^2 + 13\*x^6\*y^3 + 8\*x^5\*y + 48\*x^4\*y^4 + 64\*x^3\*y^2 + 36\*x^2\*y^5 + 12\*x^2 + 66\*x\*y^3 + 20\*y)
* zxxy =  
     
  21\*y^3\*exp(x\*y\*(x^2 + 3\*y))\*(3\*x^7\*y^2 + 24\*x^5\*y^3 + 17\*x^4\*y + 39\*x^3\*y^4 + 48\*x^2\*y^2 + 18\*x\*y^5 + 8\*x + 21\*y^3)
* zyyxyx =  
     
  21\*exp(x\*y\*(x^2 + 3\*y))\*(9\*x^18\*y^6 + 243\*x^16\*y^7 + 234\*x^15\*y^5 + 2619\*x^14\*y^8 + 5418\*x^13\*y^6 + 14265\*x^12\*y^9 + 1982\*x^12\*y^4 + 46980\*x^11\*y^7 + 41040\*x^10\*y^10 + 37740\*x^10\*y^5 + 187920\*x^9\*y^8 + 6512\*x^9\*y^3 + 60264\*x^8\*y^11 + 242460\*x^8\*y^6 + 348300\*x^7\*y^9 + 94608\*x^7\*y^4 + 42768\*x^6\*y^12 + 615060\*x^6\*y^7 + 7704\*x^6\*y^2 + 283824\*x^5\*y^10 + 382752\*x^5\*y^5 + 11664\*x^4\*y^13 + 594540\*x^4\*y^8 + 72504\*x^4\*y^3 + 81648\*x^3\*y^11 + 465048\*x^3\*y^6 + 2352\*x^3\*y + 175932\*x^2\*y^9 + 125496\*x^2\*y^4 + 132192\*x\*y^7 + 8496\*x\*y^2 + 27216\*y^5 + 48)

**Problem #3:** (a)Write down a set of equations for computing the values of x, y and z that minimize f (x, y, z) subject to the constraint xyz = 4000a^3.

(b)Find the values of x, y and z that minimize f (x, y, z) subject to the given constraint. You can use MATLAB to find the critical point. Then demonstrate (with or without MATLAB) that the critical point you obtain is really a minimum, not a maximum of the objective. Make your final conclusion about the x, y and z values.

syms x y z l

f = x\*y + 2\*x\*z + 2\*y\*z;

g = x\*y\*z - 4000\*7^3;

L = f - l\*g;

S = solve(diff(L,x), diff(L,y), diff(L,z), g)

S.x(1)

S.y(1)

S.z(1)

f\_val = subs(f, [x y z], [S.x(1) S.y(1) S.z(1)])

ans =  
   
140  
   
   
ans =  
   
140  
   
   
ans =

70  
   
   
f\_val =  
   
58800

**Problem #4:**

% (a) Paraboloid

syms x y

ezsurf(49 - 9\*x^2 - 9\*y^2, [-7/3 7/3 -7/3 7/3])

figure

A graph of a rainbow colored sphere

AI-generated content may be incorrect.

% (b) Cylinder

syms t h

r = 7/sqrt(3);

ezsurf(r\*cos(t), r\*sin(t), h, [0 49 0 2\*pi])

figure

A rainbow colored cylinder with a graph

AI-generated content may be incorrect.

% (c) Intersection curve

syms t

r = 7/sqrt(3);

ezplot3(r\*cos(t), r\*sin(t), -98, [0 2\*pi])

axis equal

A graph of a circle with a number of numbers

AI-generated content may be incorrect.

**Problem #5:**

(a) Set up a double integral computing the volume of this region. Use polar coordinates if necessary. Then evaluate the integral using MATLAB.

% compute volume symbolic

syms r th

V = int(int((2\*7 - r)\*r, r, 0, 7), th, 0, 2\*pi);

simplify(V)

vpa(V,6)

% plot cone and cylinder boundary (minimal)

syms r t h

hold on

ezsurf(r\*cos(t), r\*sin(t), 2\*7 - r, [0 7 0 2\*pi]) % cone (0<=r<=7)

ezsurf(7\*cos(t), 7\*sin(t), h, [0 7 0 2\*pi]) % cylinder (0<=h<=7)

hold off

axis equal

ans =  
   
(1372\*pi)/3  
   
   
ans =  
   
1436.76

(b) Using hold on and hold off commands and parametric equations of the two given surfaces, graph the boundary of the region whose volume you computed in part.

**A black and white image of a measuring device

AI-generated content may be incorrect.**