1. **Graph each plot in 2-dimensional space**
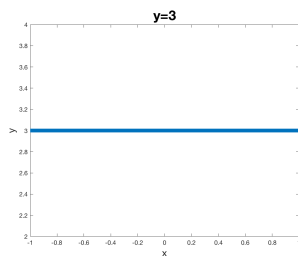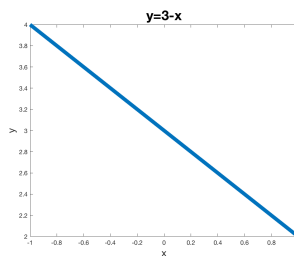
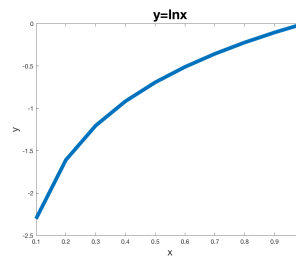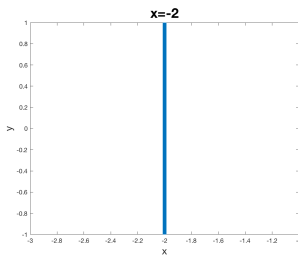**a.) $y = 3$**

d.) $y = 3 - x$
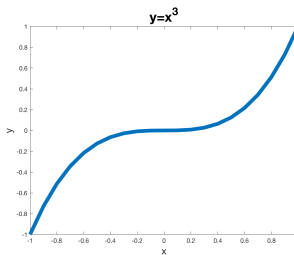
g.) $y = \ln x$

y=lnx

y=3

y=3-x

h.) $y = \sqrt{x}$

y=x^{1/2}

b.) $x = -2$

e.) $y = x^3$

i.) $x = y^2$

x=-2

y=x^3

x=y^2

c.) $y = x$

f.) $y = e^x$

j.) $y = \frac{1}{x}$

y=x

y=e^x

y=1/x

1
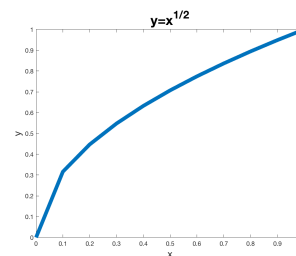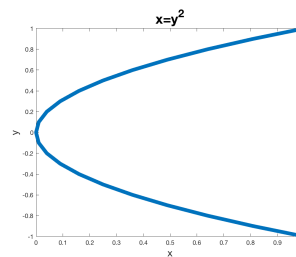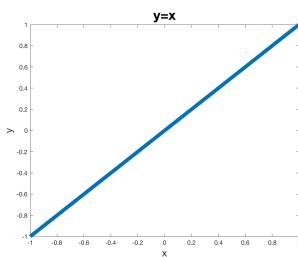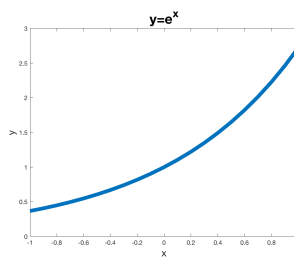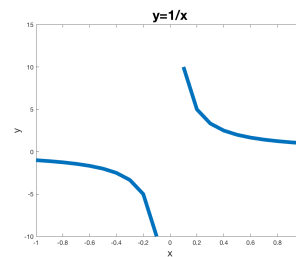
2. Sketch the level curves for each of the following equations (surfaces) using the following values of $z : -3, -2, -1, 0, 1, 2, 3$.

a.) $\mathbf{z = y}$
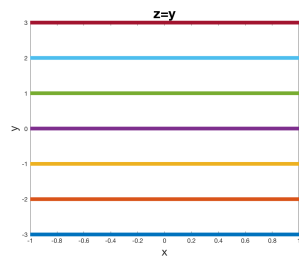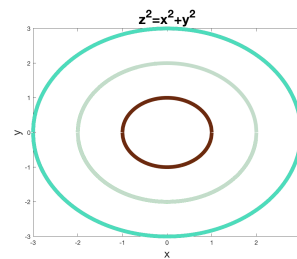
b.) $\mathbf{z = 1 - x - y}$
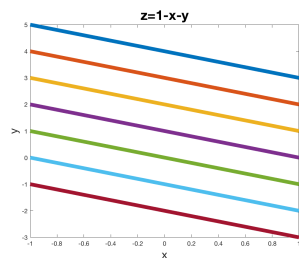
c.) $\mathbf{z^2 = x^2 + y^2}$

d.) $\mathbf{x^2 + y^2 + z^2 = 9}$
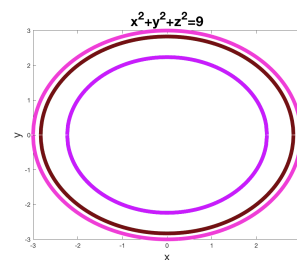
3. Sketch all three coordinate plane traces for each of the following equations (surfaces).

a.) $\mathbf{x + 2y + 3z = 6}$
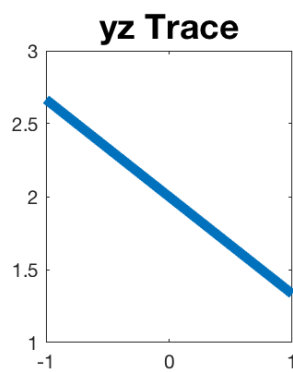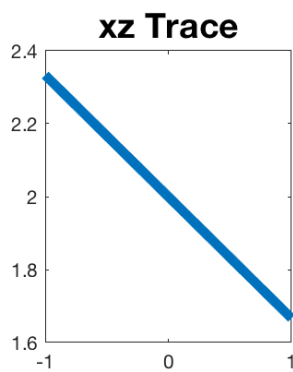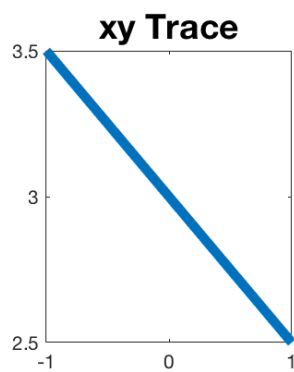
b.) $z = x^2 + y^2$

c.) $z = y^2 - x^2$

d.) $z^2 = x^2 + y^2$

3
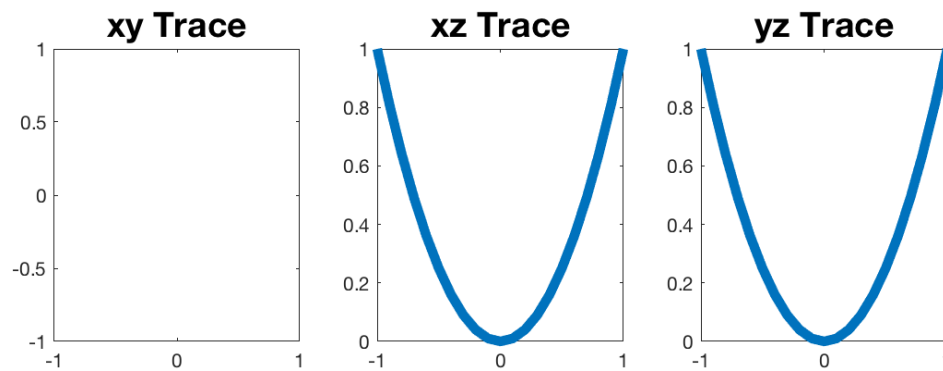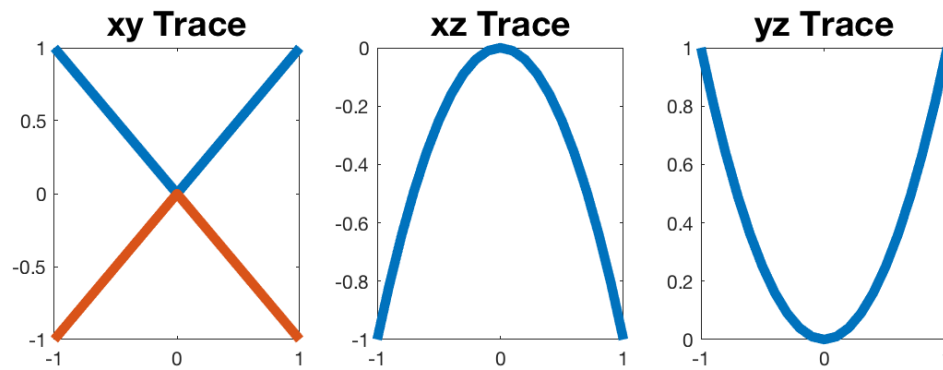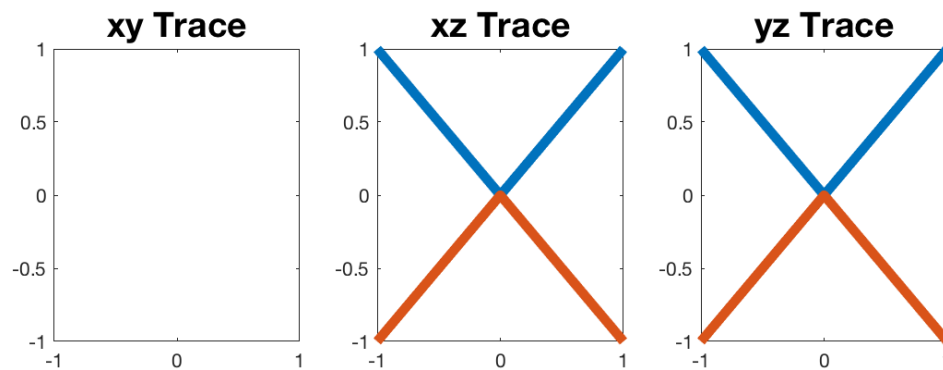
4. Sketch in three-dimensional space each of the following equations (surfaces). Use intercepts, traces, and/or level curves, if necessary.

a.) $y = 3$
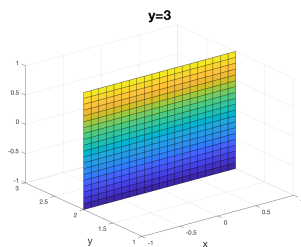
d.) $y = 3 - x$
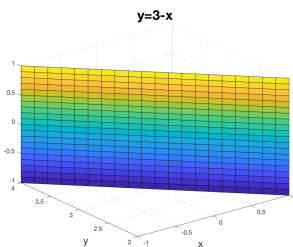
g.) $y = \ln x$
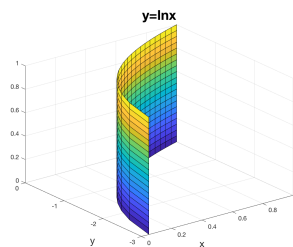
b.) $x = -2$
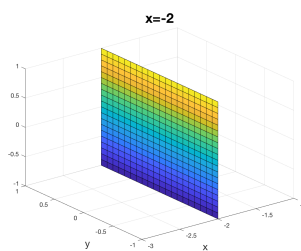
e.) $y = x^3$

h.) $y = \sqrt{x}$

c.) $y = x$

f.) $y = e^x$

i.) $x = y^2$

4
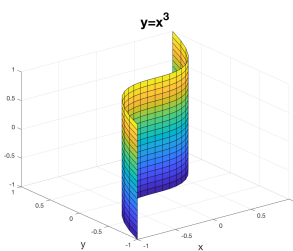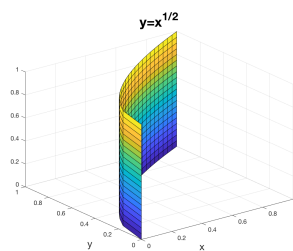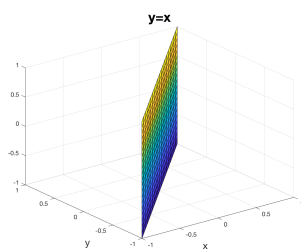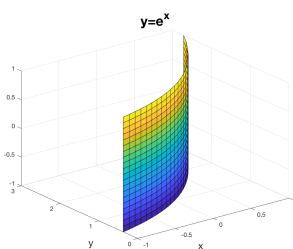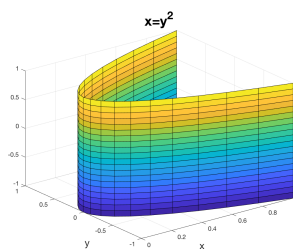
j.) $y = \frac{1}{x}$

m.) $z = x^2 + y^2$

p.) $z^2 = x^2 + y^2 + 1$

y=1/x
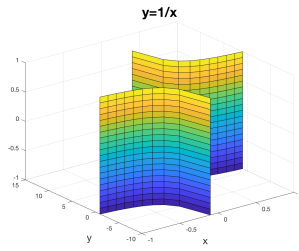
z=x²+y²
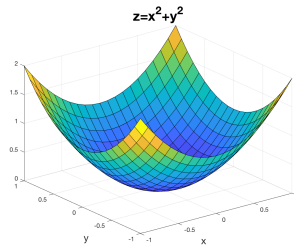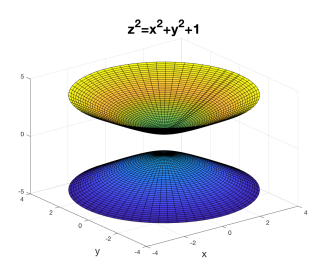
z²=x²+y²+1

k.) $x^2 + y^2 + z^2 = 4$

n.) $z^2 = x^2 + y^2$

q.) $z = y^2 - x^2$

x²+y²+z²=4

z²=x²+y²
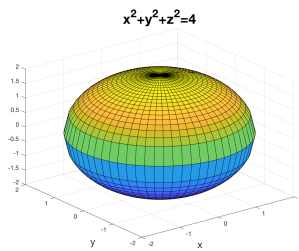
z²=x²+y²+1
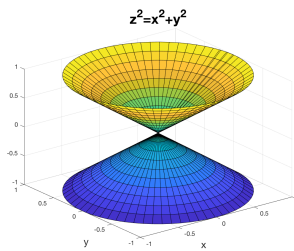
l.) $x + 2y + 3z = 6$
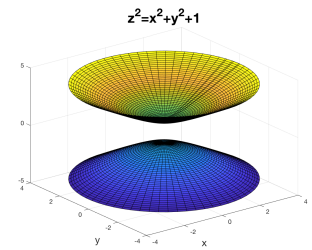
o.) $z^2 = x^2 + y^2 - 1$

x+2y+3z=6
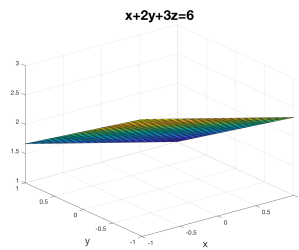
z²=x²+y²-1
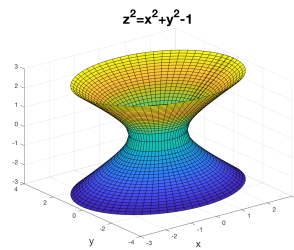
Code

```matlab
1  % ————————————————————————————————————
2  % Problem 1 − Plot the following on 2D plots
3  % ————————————————————————————————————
4  % a) y=3
5  figure;
6  x = −1:.1:1; y = zeros(length(x),1)+3;
7  plot(x,y,'Linewidth',6); title('y=3','Fontsize',22);
8  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
9  saveas(gcf,'1a.png')
10 % b) x=−2
11 figure;
12 y = −1:.1:1; x = zeros(length(x),1)−2;
13 plot(x,y,'Linewidth',6); title('x=−2','Fontsize',22);
14 xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
15 saveas(gcf,'1b.png')
16 % c) y=x
17 figure;
18 x = −1:.1:1; y = x;
19 plot(x,y,'Linewidth',6); title('y=x','Fontsize',22);
20 xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
21 saveas(gcf,'1c.png')
22 % d) y=3−x
23 figure;
24 x = −1:.1:1; y = 3−x;
25 plot(x,y,'Linewidth',6); title('y=3−x','Fontsize',22);
26 xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
27 saveas(gcf,'1d.png')
28 % e) y=x^3
29 figure;
30 x = −1:.1:1; y = x.^3;
31 plot(x,y,'Linewidth',6); title('y=x^3','Fontsize',22);
32 xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
33 saveas(gcf,'1e.png')
34 % f) y=e^x
35 figure;
36 x = −1:.1:1; y = exp(x);
37 plot(x,y,'Linewidth',6); title('y=e^x','Fontsize',22);
38 xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
39 saveas(gcf,'1f.png')
40 % g) y=lnx
41 figure;
42 x = 0:.1:1; y = log(x); % Note log(x) = ln(x)
43 plot(x,y,'Linewidth',6); title('y=lnx','Fontsize',22);
44 xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
45 saveas(gcf,'1g.png')
46 % h) y=sqrt(x)
47 figure;
48 x = 0:.1:1; y = sqrt(x);
49 plot(x,y,'Linewidth',6); title('y=x^{1/2}','Fontsize',22);
50 xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
51 saveas(gcf,'1h.png')
52 % i) x=y^2
53 figure;
54 y = −1:.1:1; x = y.^2;
55 plot(x,y,'Linewidth',6); title('x=y^2','Fontsize',22);
56 xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
57 saveas(gcf,'1i.png')
58 % j) y=1/x
59 figure;
60 x = −1:.1:1; y = 1./x;
61 plot(x,y,'Linewidth',6); title('y=1/x','Fontsize',22);
62 xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
63 saveas(gcf,'1j.png')
```

```matlab
% —————————————————————————————————————————————
% Problem 2 — Plot level curves of the following
% —————————————————————————————————————————————
zs = -3:3;
% a) z=y
figure;
x = -1:.1:1;
for z=zs
    y=zeros(1,length(x))+z;
    plot(x,y,'Linewidth',6);hold on;
end
title('z=y','Fontsize',22);
xlabel('x','Fontsize',18);ylabel('y','Fontsize',18);
saveas(gcf,'2a.png')
% b) z=1-x-y
figure;
x = -1:.1:1;
for z=zs
    y=1-zeros(1,length(x))-z-x;
    plot(x,y,'Linewidth',6);hold on;
end
title('z=1-x-y','Fontsize',22);
xlabel('x','Fontsize',18);ylabel('y','Fontsize',18);
saveas(gcf,'2b.png')
% c) z^2=x^2+y^2
figure;
x = -3:.00001:3;
for z=zs
    col = [rand(1),rand(1),rand(1)];
    % Plot top of circle
    y=sqrt((zeros(1,length(x))-z).^2-x.^2);
    y(real(y)==0)=NaN;
    plot(x,y,'Linewidth',6,'Color',col);hold on;
    % Plot bottom of circle
    y=-sqrt((zeros(1,length(x))-z).^2-x.^2);
    y(real(y)==0)=NaN;
    plot(x,y,'Linewidth',6,'Color',col);hold on;
end
title('z^2=x^2+y^2','Fontsize',22);
xlabel('x','Fontsize',18);ylabel('y','Fontsize',18);
saveas(gcf,'2c.png')
% d) x^2+y^2+z^2=9
figure;
x = -3:.00001:3;
for z=zs
    col = [rand(1),rand(1),rand(1)];
    % Plot top of circle
    y=sqrt(9-(zeros(1,length(x))-z).^2-x.^2);
    y(real(y)==0)=NaN;
    plot(x,y,'Linewidth',6,'Color',col);hold on;
    % Plot bottom of circle
    y=-sqrt(9-(zeros(1,length(x))-z).^2-x.^2);
    y(real(y)==0)=NaN;
    plot(x,y,'Linewidth',6,'Color',col);hold on;
end
title('x^2+y^2+z^2=9','Fontsize',22);
xlabel('x','Fontsize',18);ylabel('y','Fontsize',18);
saveas(gcf,'2d.png')
```

```matlab
129  % —————————————————————————————————————————————
130  % Problem 3 − Plot the plane traces
131  % —————————————————————————————————————————————
132  % a) x+2y+3z=6
133  a = −1:.1:1;  figure;
134  % Plot xy trace
135  x = a;  y = (1/2)*(6−x);
136  subplot(1,3,1);
137  plot(x,y,'Linewidth',5);
138  title('xy Trace','Fontsize',18);
139  % Plot xz trace
140  x = a;  z = (1/3)*(6−x);
141  subplot(1,3,2);
142  plot(x,z,'Linewidth',5);
143  title('xz Trace','Fontsize',18);
144  % Plot yz trace
145  y = a;  z = (1/3)*(6−2*y);
146  subplot(1,3,3);
147  plot(y,z,'Linewidth',5);
148  title('yz Trace','Fontsize',18);
149  set(gcf, 'Position', [100 200 600 200])
150  saveas(gcf,'3a.png');
151
152  % b) z=x^2+y^2
153  a = −1:.1:1;  figure;
154  % Plot xy trace
155  x = 0;
156  subplot(1,3,1);
157  plot(x,sqrt(−x.^2),'Linewidth',5);hold on;
158  plot(x,−sqrt(−x.^2),'Linewidth',5);
159  title('xy Trace','Fontsize',18);
160  % Plot xz trace
161  x = a;  z = x.^2;
162  subplot(1,3,2);
163  plot(x,z,'Linewidth',5);
164  title('xz Trace','Fontsize',18);
165  % Plot yz trace
166  y = a;  z = y.^2;
167  subplot(1,3,3);
168  plot(y,z,'Linewidth',5);
169  title('yz Trace','Fontsize',18);
170  set(gcf, 'Position', [100 200 600 200])
171  saveas(gcf,'3b.png');
172
173  % c) z=y^2−x^2
174  a = −1:.1:1;  figure;
175  % Plot xy trace
176  x = a;
177  subplot(1,3,1);
178  plot(x,sqrt(x.^2),'Linewidth',5);hold on;
179  plot(x,−sqrt(x.^2),'Linewidth',5);
180  title('xy Trace','Fontsize',18);
181  % Plot xz trace
182  x = a;  z = −x.^2;
183  subplot(1,3,2);
184  plot(x,z,'Linewidth',5);
185  title('xz Trace','Fontsize',18);
186  % Plot yz trace
187  y = a;  z = y.^2;
188  subplot(1,3,3);
189  plot(y,z,'Linewidth',5);
190  title('yz Trace','Fontsize',18);
191  set(gcf, 'Position', [100 200 600 200])
192  saveas(gcf,'3c.png');
193
```

```matlab
194  % d) z^2=x^2+y^2
195  a = -1:.1:1; figure;
196  % Plot xy trace
197  x = a;
198  subplot(1,3,1);
199  plot(0,0,'Linewidth',5);
200  title('xy Trace','Fontsize',18);
201  % Plot xz trace
202  x = a;
203  subplot(1,3,2);
204  plot(x,sqrt(x.^2), 'Linewidth',5); hold on;
205  plot(x,-sqrt(x.^2),'Linewidth',5);
206  title('xz Trace','Fontsize',18);
207  % Plot yz trace
208  y = a; z = y.^2;
209  subplot(1,3,3);
210  plot(y,sqrt(y.^2), 'Linewidth',5); hold on;
211  plot(y,-sqrt(y.^2),'Linewidth',5);
212  title('yz Trace','Fontsize',18);
213  set(gcf, 'Position', [100 200 600 200])
214  saveas(gcf,'3d.png');
215
216
217  % ————————————————————————————————————————
218  % Problem 4 - Plot the following on 3D plots
219  % ————————————————————————————————————————
220  % a) y=3
221  figure;
222  [x,z] = meshgrid(-1:.1:1); y = zeros(size(x))+2;
223  surf(x,y,z); title('y=3','Fontsize',22);
224  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
225  saveas(gcf,'4a.png')
226  % b) x=-2
227  figure;
228  [y,z] = meshgrid(-1:.1:1); x = zeros(size(x))-2;
229  surf(x,y,z); title('x=-2','Fontsize',22);
230  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
231  saveas(gcf,'4b.png')
232  % c) y=x
233  figure;
234  [x,z] = meshgrid(-1:.1:1); y = x;
235  surf(x,y,z); title('y=x','Fontsize',22);
236  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
237  saveas(gcf,'4c.png')
238  % d) y=3-x
239  figure;
240  [x,z] = meshgrid(-1:.1:1); y = 3-x;
241  surf(x,y,z); title('y=3-x','Fontsize',22);
242  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
243  saveas(gcf,'4d.png')
244  % e) y=x^3
245  figure;
246  [x,z] = meshgrid(-1:.1:1); y = x.^3;
247  surf(x,y,z); title('y=x^3','Fontsize',22);
248  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
249  saveas(gcf,'4e.png')
250  % f) y=e^x
251  figure;
252  [x,z] = meshgrid(-1:.1:1); y = exp(x);
253  surf(x,y,z); title('y=e^x','Fontsize',22);
254  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
255  saveas(gcf,'4f.png')
256  % g) y=lnx
257  figure;
258  [x,z] = meshgrid(0:.05:1); y = log(x); % Note log(x) = ln(x)
```

```matlab
259  surf(x,y,z); title('y=lnx','Fontsize',22);
260  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
261  saveas(gcf,'4g.png')
262  % h) y=sqrt(x)
263  figure;
264  [x,z] = meshgrid(0:.05:1); y = sqrt(x);
265  surf(x,y,z); title('y=x^{1/2}','Fontsize',22);
266  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
267  saveas(gcf,'4h.png')
268  % i) x=y^2
269  figure;
270  [y,z] = meshgrid(-1:.1:1); x = y.^2;
271  surf(x,y,z); title('x=y^2','Fontsize',22);
272  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
273  saveas(gcf,'4i.png')
274  % j) y=1/x
275  figure;
276  [x,z] = meshgrid(-1:.1:1); y = 1./x;
277  surf(x,y,z); title('y=1/x','Fontsize',22);
278  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
279  saveas(gcf,'4j.png')
280  % k) x^2+y^2+z^2=4
281  figure;
282  [r,theta] = meshgrid(0:.1:2,0:.1:2*pi); % Polar coords
283  x = r.*cos(theta); y = r.*sin(theta);
284  surf(x,y,real(sqrt(4-x.^2-y.^2)));hold on;
285  surf(x,y,-real(sqrt(4-x.^2-y.^2))); title('x^2+y^2+z^2=4','Fontsize',22);
286  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
287  saveas(gcf,'4k.png')
288  % l) x+2y+3z=6
289  figure;
290  [x,y] = meshgrid(-1:.1:1);
291  z = (1/3)*(6-2*y-x);
292  surf(x,y,z); title('x+2y+3z=6','Fontsize',22);
293  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
294  saveas(gcf,'4l.png')
295  % m) z=x^2+y^2
296  figure;
297  [x,y] = meshgrid(-1:.1:1);
298  z = x.^2+y.^2;
299  surf(x,y,z); title('z=x^2+y^2','Fontsize',22);
300  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
301  saveas(gcf,'4m.png')
302  % n) z^2=x^2+y^2
303  figure;
304  [r,theta] = meshgrid(0:.1:1,0:.1:2.1*pi); % Polar coords
305  x = r.*cos(theta); y = r.*sin(theta);
306  surf(x,y,real(sqrt(x.^2+y.^2)));hold on;
307  surf(x,y,-real(sqrt(x.^2+y.^2))); title('z^2=x^2+y^2','Fontsize',22);
308  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
309  saveas(gcf,'4n.png')
310  % o) z^2=x^2+y^2-1
311  figure;
312  [r,theta] = meshgrid(0:.1:3,0:.1:2.1*pi); % Polar coords
313  x = r.*cos(theta); y = r.*sin(theta);
314  surf(x,y,real(sqrt(x.^2+y.^2-1)));hold on;
315  surf(x,y,-real(sqrt(x.^2+y.^2-1))); title('z^2=x^2+y^2-1','Fontsize',22);
316  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
317  saveas(gcf,'4o.png')
318  % p) z^2=x^2+y^2+1
319  figure;
320  [r,theta] = meshgrid(0:.1:4,0:.1:2.1*pi); % Polar coords
321  x = r.*cos(theta); y = r.*sin(theta);
322  surf(x,y,real(sqrt(x.^2+y.^2+1)));hold on;
323  surf(x,y,-real(sqrt(x.^2+y.^2+1))); title('z^2=x^2+y^2+1','Fontsize',22);
```

```matlab
324  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
325  saveas(gcf,'4p.png')
326  % q) z=y^2-x^2
327  figure;
328  [x,y] = meshgrid(-1:.1:1);
329  z = y.^2-x.^2;
330  surf(x,y,z);  title('z=y^2-x^2','Fontsize',22);
331  xlabel('x','Fontsize',16);ylabel('y','Fontsize',16);
332  saveas(gcf,'4q.png')
```