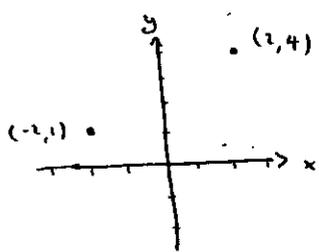


SOLUTIONS : 2 AND 3-DIMENSIONAL SPACE

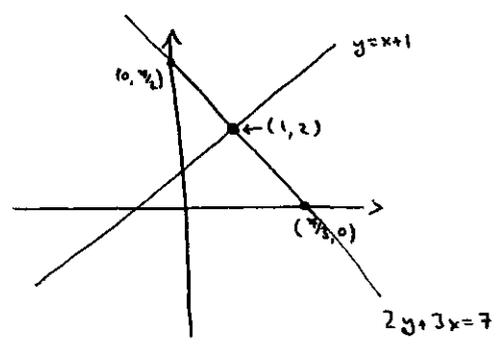
①

(1)



$$\begin{aligned} \text{distance} &= \sqrt{(2 - (-2))^2 + (4 - 1)^2} \\ &= \sqrt{25} \\ &= 5 \end{aligned}$$

(2)



$$2y + 3x = 7 \quad \text{is} \quad y = \frac{7}{2} - \frac{3}{2}x$$

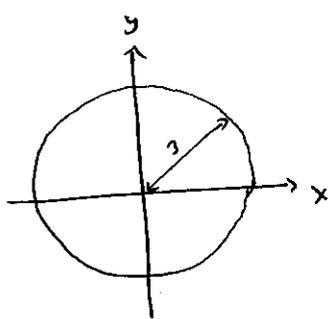
To find where they meet, solve

$$\begin{cases} 2y + 3x = 7 \\ y - x = 1 \end{cases}$$

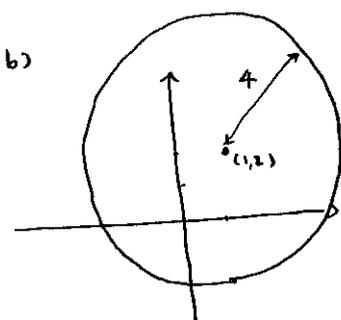
b find $x = 1, y = 2$.

i.e. they meet at (1, 2)

(3) (a)



(b)



(c) Completing the square, we find $(x-2)^2 + (y+3)^2 = 16$ (2)

To find the points common to (a) and (b) we solve

$$\begin{cases} x^2 + y^2 = 9 \\ (x-1)^2 + (y-2)^2 = 16 \end{cases}$$

or in other words

$$\begin{cases} x^2 + y^2 = 9 \\ x^2 - 2x + y^2 - 4y = 11 \end{cases}$$

$$\Rightarrow \begin{cases} x^2 + y^2 = 9 \\ -2x - 4y = 2 \end{cases}$$

Solving this, we find $(x, y) = \left(\frac{-1-4\sqrt{11}}{5}, \frac{-2+2\sqrt{11}}{5} \right)$
 or $\left(\frac{-1+4\sqrt{11}}{5}, \frac{-2-2\sqrt{11}}{5} \right)$

SECTION 2

(1) (a) $x^2 + y^2 + z^2 = 4$

(b) $(x-2)^2 + (y+1)^2 + (z-3)^2 = 16$

(c) $(x-2)^2 + (y+1)^2 + (z-3)^2 \geq 16$

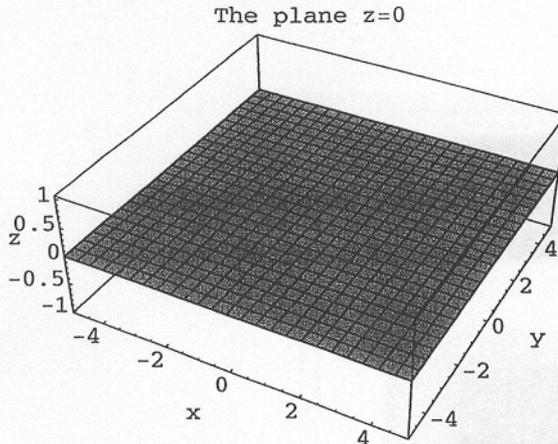
(2) see attached Mathematica output

(3) We solve $\begin{cases} (x-1)^2 + (y-2)^2 + (z-3)^2 = 25 \\ z = 0 \end{cases}$

i.e. $\begin{cases} (x-1)^2 + (y-2)^2 = 16 \\ z = 0 \end{cases}$] ← this is (b)

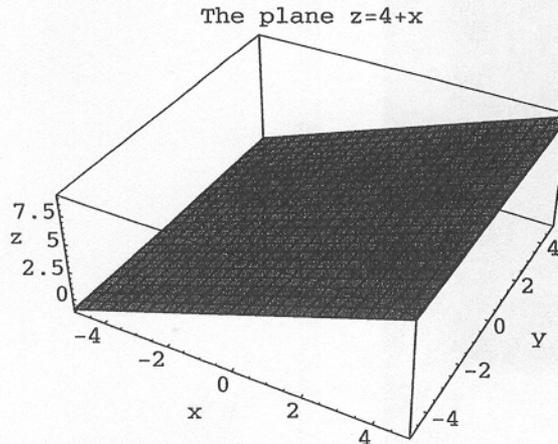
(a) This is a circle of radius 4 in the xy -plane, centred at $(1, 2, 0)$

```
In[1]:= Plot3D[0, {x, -5, 5}, {y, -5, 5}, AxesLabel -> {x, y, z}, PlotLabel -> "The plane z=0"]
```



```
Out[1]= - SurfaceGraphics -
```

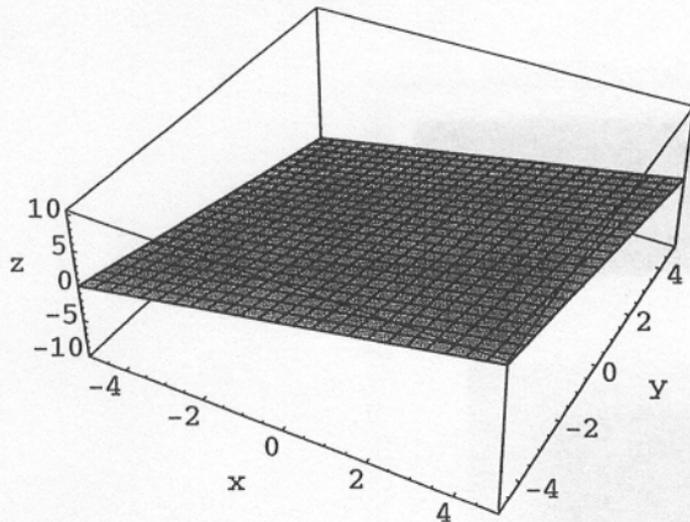
```
In[2]:= Plot3D[4+x, {x, -5, 5}, {y, -5, 5},  
  AxesLabel -> {x, y, z}, PlotLabel -> "The plane z=4+x"]
```



```
Out[2]= - SurfaceGraphics -
```

```
In[3]:= Plot3D[x-y, {x, -5, 5}, {y, -5, 5},  
  AxesLabel -> {x, y, z}, PlotLabel -> "The plane x=y+z"]
```

The plane $x=y+z$



```
Out[3]= - SurfaceGraphics -
```