1) a. 6 b. 4 c. $\sqrt{4^2+6^2}=\sqrt{52}$ d. $\sqrt{4^2+(-2)^2+6^2}=\sqrt{56}$

2) Let $A=(0,-5,5)$ so $d(A,B)=\sqrt{(0-1)^2+(-5-(-2))^2+(5-4)^2}=\sqrt{11}$

$B=(1,-2,4)$ $d(A,C)=\sqrt{(0-3)^2+(-5-4)^2+(5-2)^2}=3\sqrt{11}$

$C=(3,4,2)$ $d(B,C)=\sqrt{(1-3)^2+(-2-4)^2+(4-2)^2}=2\sqrt{11}$

Since $d(A,B)+d(B,C)=d(A,C)$, the points lie on the same line

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

4) The distance between the points

$$\sqrt{(4-3)^2+(3-8)^2+(-1-(-1))^2}=\sqrt{1^2+5^2+0^2}=\sqrt{26}$$

will be the radius, so the sphere's equation is

$$(x-3)^2+(y-8)^2+(z+1)^2=26$$

5) $x^2+y^2+z^2-\underline{2z}-4y+8z=0$

$\Leftrightarrow x^2+y^2-4y+z^2+6z=0$

$\Leftrightarrow x^2+y^2-4y+4+z^2+6z+9=13$

$\Leftrightarrow x^2+(y-2)^2+(z+3)^2=13$

or

$x^2+y^2+z^2-\underline{2x}-4y+8z=0$

$\Leftrightarrow x^2-2x+1+y^2-4y+4+z^2+4z+16=21$

$\Leftrightarrow (x-1)^2+(y-2)^2+(z+4)^2=21$

6) The point halfway

$$\left(\frac{2+4}{2},\frac{-1+5}{2},\frac{1-4}{2}\right)=\left(3,2,\frac{-3}{2}\right)$$

will be the center.

The radius will be

$$\frac{1}{2}\sqrt{(2-4)^2+(-1-5)^2+(1-(-4))^2}$$
$$=\frac{1}{2}\sqrt{4+36+25}=\frac{1}{2}\sqrt{65}$$

(this is half the diameter)

Equation: $(x-3)^2+(y-2)^2+(z+\frac{3}{2})^2=\frac{65}{4}$

7) The closest coordinate plane is the xz-plane $(y=0)$,

so the sphere will have radius 1.

Equation: $(x-5)^2+(y-1)^2+(z-9)^2=1$

8) a) $x^2+y^2+z^3=4$ or, equivalently, $x^2+y^2=4-z^3$

Let z be fixed. For $z>\sqrt[3]{4}$, no choice of x and y will satisfy the equation. At $z=\sqrt[3]{4}$, $x=y=0$.
For $z<\sqrt[3]{4}$, the possible x and y coordinates form a circle of radius $\sqrt{4-z^3}$. As z decreases, this radius increases.
Piecing the circles together, we have a circular surface widening as its height decreases, coming to a peak at $z=4$.

b) $z=\sin(x)$

z will range between 1 and -1 like a wave, according to the value of x.
y can take any value, so our surface will be an endless wave rising and falling across the x-axis.

c) $(y-1)^2+(z+2)^2=4$

In the yz-plane, we have a circle of radius 2.
Since x can take any value, this will form a cylinder of radius 2 around the x-axis.