Correction to the solutions of Preptest 1B

I made a mistake in the solution of Problem 1c) and d): Discard the previous solutions to these two problems.

The gradient $\nabla f(1,2,1)$ is perpendicular the the surface $f(x,y,z) = f(1,2,1)$ and hence perpendicular to the tangent plane at that point. Further the point $(1,2,1)$ is on the surface and also on the tangent plane. Thus the equation for the tangent plane is

$$\nabla f(\mathbf{x_0}) \cdot (\mathbf{x} - \mathbf{x_0}) = 0$$

or

$$6(x-1) + 33(x-2) + 6(z-1) = 0$$

which is the answer. Note also that the gradient $\nabla f(1,2,1)$ was calculated incorrectly in the solutions before. It is

$$\nabla f(1,2,1) = \begin{bmatrix} 6 \\ 33 \\ 6 \end{bmatrix}$$

and NOT

$$\begin{bmatrix} 6 \\ 5 \\ 6 \end{bmatrix} .$$

To solve d) we must find two vectors perpendicular to

$$\begin{bmatrix} 6 \\ 33 \\ 6 \end{bmatrix} .$$

One vector is

$$\begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} .$$

and another one is

$$\begin{bmatrix} -33 \\ 6 \\ 0 \end{bmatrix} .$$

Clearly these two vectors are linearly independent.