Take, for instance, problem `e`. From taking two partial derivatives in the x and y dimensions, we deduce that the partial derivative values are…

$$\frac{\partial f}{\partial x} = 10 \tag{1}$$

$$\frac{\partial f}{\partial y} = 10\sqrt{3} \tag{2}$$

We could, therefore, treat these terms as two separate vectors lying at the x and y directions. That is, we know that the multidimentional "slope" of the function could be represented by a combination of vectors…

$$\left\{ \begin{pmatrix} 10 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ 10\sqrt{3} \end{pmatrix} \right\} \tag{3}$$

The "slope" created by the two slope values at a $60°$ angle is essential the sums of the two partial derivative vectors projected at $60°$. Hence, we have to project the two vectors' magnitudes to a shared $60°$ angle, and sum it up.

We first note that, to project the two *orthogonal* vectors to the same, shared "60-degrees" direction, we must project one vector to $60°$ and the other to $(90 - 60)°$ to actually result in the projections' alignment.

Conventionally, we will project the x-direction vector to $60°$. and the y-direction vector to $(90 - 60)°$, but the 60 degree direction that we aim to share is actual arbitrary.

To perform the actual magnitude projection, we perform the follows.

$$\begin{aligned}
let\ \vec{X} &= \begin{pmatrix} 10 \\ 0 \end{pmatrix} && (4)\\
\vec{Y} &= \begin{pmatrix} 0 \\ 10\sqrt{3} \end{pmatrix} && (5)\\
\vec{X_p} &= \|X\| cos(60°) && (6)\\
&= 10 \times \frac{1}{2} && (7)\\
&= 5 && (8)\\
\vec{Y_p} &= \|Y\| cos((90 - 60)°) && (9)\\
&= \|Y\| sin(60°) && (10)\\
&= 10\sqrt{3} \times \frac{\sqrt{3}}{2} && (11)\\
&= \frac{30}{2} = 15 && (12)
\end{aligned}$$

Finally, the sum of slopes in that shared direction would therefore be 20.