12. We note that r_A (the distance from the origin to sphere A, which is the same as the separation between A and B) is 0.5, $r_C = 0.8$, and $r_D = 0.4$ (with SI units understood). The force $\vec{F}_k$ that the k^{th} sphere exerts on m_B has magnitude $Gm_k m_B/r_k^2$ and is directed from the origin towards m_k so that it is conveniently written as

$$\vec{F}_k = \frac{Gm_k m_B}{r_k^2}\left(\frac{x_k}{r_k}\,\hat{\mathrm{i}} + \frac{y_k}{r_k}\,\hat{\mathrm{j}}\right) = \frac{Gm_k m_B}{r_k^3}\left(x_k\hat{\mathrm{i}} + y_k\hat{\mathrm{j}}\right) .$$

Consequently, the vector addition (where k equals A, B and D) to obtain the net force on m_B becomes

$$\begin{aligned}
\vec{F}_{\text{net}} &= \sum_k \vec{F}_k \\
&= Gm_B\left(\left(\sum_k \frac{m_k x_k}{r_k^3}\right)\hat{\mathrm{i}} + \left(\sum_k \frac{m_k y_k}{r_k^3}\right)\hat{\mathrm{j}}\right) \\
&= 3.7\times 10^{-5}\,\hat{\mathrm{j}}\ \mathrm{N} .
\end{aligned}$$