Question:

The potential energy of a particle is given by the expression $U(r) = 2r^{5/2} + 3$, where r is the position of the particle. What is the function that describes the conservative force F acting on this particle?

a. $\frac{4}{7}r^{7/2} + 3r$

b. $-\frac{4}{7}r^{7/2} - 3r$

c. $5r^{3/2}$

d. $-5r^{3/2}$

e. $5r^{3/2} + 3r$

Answer:

The correct answer is ***d***. For conservative forces, potential energy is described using the work integral, $\Delta U = -\int_{x_i}^{x_f} F \bullet dx$. The force F, then, can be described by the integral $F = -\frac{dU}{dx}$. In this case:

$$F = -\frac{dU}{dx}$$

$$F = -\frac{d}{dx}\left(2r^{5/2} + 3\right)$$

$$F = -5r^{3/2}$$