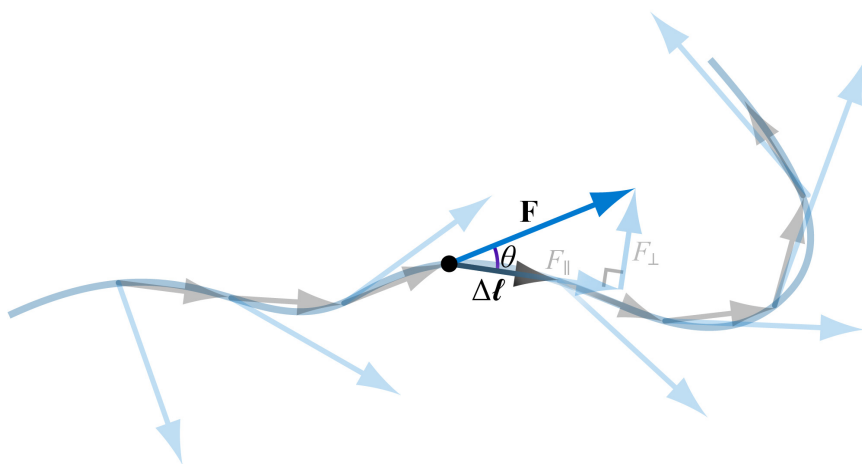


Work performed along a path

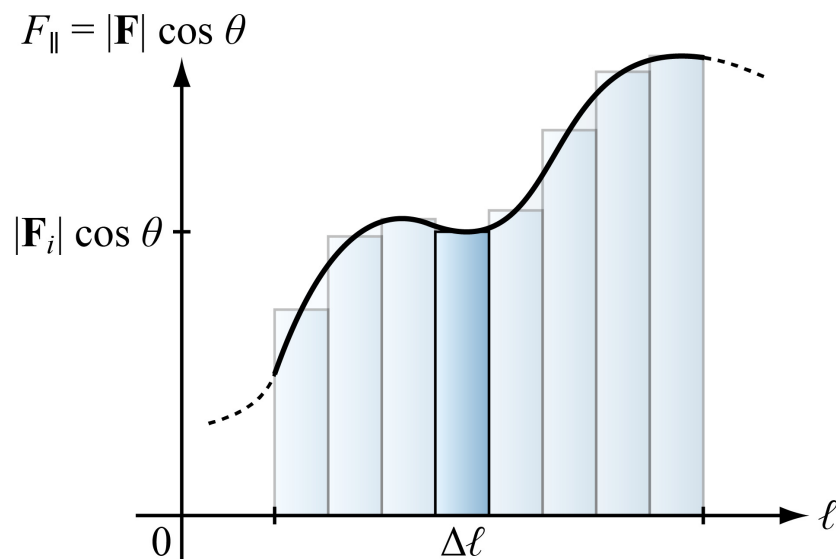


$$\Delta W = \vec{\mathbf{F}} \cdot \Delta \vec{\ell}$$

$$\Delta W = (|\vec{\mathbf{F}}| \cos \theta) \Delta \ell$$

Steps for calculating work done on paths

1. Draw a large figure of the path (large means that an icon for a differential displacement element will be easy to see).
2. Indicate a representative position.
3. Draw and label a differential displacement $d\vec{\ell}$ from that position.
4. Draw and label a force vector $\vec{\mathbf{F}}$ applied at the representative position.
5. Obtain an expression for $\vec{\mathbf{F}}$.
6. Obtain an expression for $d\vec{\ell}$.
7. Calculate $\vec{\mathbf{F}} \cdot d\vec{\ell}$.
8. Integrate the resulting expression.



$$\Delta W_i = (|\vec{\mathbf{F}}_i| \cos \theta) \Delta \ell$$

$$\Delta W = \sum_{i=1}^N (|\vec{\mathbf{F}}_i| \cos \theta) \Delta \ell$$

$$\Delta W = \int_{\vec{\mathbf{r}}=\vec{\mathbf{r}}_i}^{\vec{\mathbf{r}}=\vec{\mathbf{r}}_f} (|\vec{\mathbf{F}}| \cos \theta) d\ell$$

$$\Delta W = \int_{\vec{\mathbf{r}}=\vec{\mathbf{r}}_i}^{\vec{\mathbf{r}}=\vec{\mathbf{r}}_f} \vec{\mathbf{F}} \cdot d\vec{\ell}$$