```
(*omega := 10.0;*)
(*m := 4.0;*)
(*epsilon := 0.5;*)
(*amp = 18.0*)
f[x_] := -amp * Sin[omega * x] - m * x
oldf[x_] := -4 * x
```

```
v[x_] :=  Integrate[ -f[t]*(-t), {t, 0, x} ] + Integrate[ -f[t]*(-x), {t, x, 1} ];
Simplify[v[x]]
```

$$\frac{m\ \text{omega}^2\ x\ \left(-3+x^2\right)+6\ \text{amp}\ \text{omega}\ x\ \text{Cos}[\text{omega}]-6\ \text{amp}\ \text{Sin}[\text{omega}\ x]}{6\ \text{omega}^2}$$

```
u[x_] := v[x] + epsilon * x + 1
```

```
Simplify[u[x]]
```

$$1+\text{epsilon}\ x-\frac{m\ x}{2}+\frac{m\ x^3}{6}+\frac{\text{amp}\ x\ \text{Cos}[\text{omega}]}{\text{omega}}-\frac{\text{amp}\ \text{Sin}[\text{omega}\ x]}{\text{omega}^2}$$

```
Simplify[D[u[x], x]]
```

$$\text{epsilon}-\frac{m}{2}+\frac{m\ x^2}{2}+\frac{\text{amp}\ \text{Cos}[\text{omega}]}{\text{omega}}-\frac{\text{amp}\ \text{Cos}[\text{omega}\ x]}{\text{omega}}$$

```
v[0] // N
D[v[x], x] /. x → 1 // N
Simplify[D[D[v[x], x], x] + f[x]]
```

```
0.
```

$$-1.\ m-1.\ \text{amp}\ \text{Sin}[\text{omega}]+\frac{0.5\ (2.\ m\ \text{omega}+2.\ \text{amp}\ \text{omega}\ \text{Sin}[\text{omega}])}{\text{omega}}$$

```
0
```

```
u[0]
D[u[x], x] /. x → 1
Simplify[D[D[u[x], x], x] + f[x]]
```

```
1
```

$$\text{epsilon}-m-\text{amp}\ \text{Sin}[\text{omega}]+\frac{2\ m\ \text{omega}+2\ \text{amp}\ \text{omega}\ \text{Sin}[\text{omega}]}{2\ \text{omega}}$$

```
0
```