```
(*problem solve the differentional equation where g is the gravitational
  acceleration  using the initional coditions t=0,y=h,t=0,y'=0*)
deq = y''[t] == g;
sol = DSolve[deq, y[t], t]
```

$$\left\{\left\{y[t] \to \frac{g\,t^2}{2} + C[1] + t\,C[2]\right\}\right\}$$

```
yt = y[t] /. sol[[1]]
```

$$\frac{g\,t^2}{2} + C[1] + t\,C[2]$$

```
vt = D[yt, t]
```

$$g\,t + C[2]$$

```
yt = yt /. g → 9.8
```

$$4.9\,t^2 + C[1] + t\,C[2]$$

```
vt = vt /. g → 9.8
```

$$9.8\,t + C[2]$$

```
eq1 = (yt /. t → 0) == 5
eq2 = (vt /. t → 0) == 0
```

$$C[1] == 5$$

$$C[2] == 0$$

```
constant = Solve[{eq1, eq2}, {C[1], C[2]}]
```

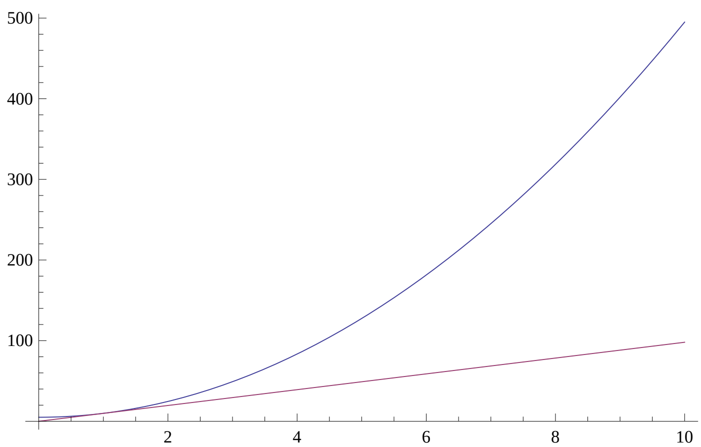
$$\{\{C[1] \to 5,\ C[2] \to 0\}\}$$

```
yt = yt /. constant[[1]]
vt = vt /. constant[[1]]
```

$$5 + 4.9\,t^2$$

$$9.8\,t$$

```
Plot[{yt, vt}, {t, 0, 10}]
```



```
(*problem#2:Solve the differntial equation using the initial conditions at t=0,
x=0,t=0,v=0,0.1*)
```

```
deq = x''[t] == p / (m * x'[t]);
sol = DSolve[deq, x[t], t]
```

$$\left\{\left\{x[t] \to -\frac{2\sqrt{2}\, m \left(\frac{p\, t}{m} + C[1]\right)^{3/2}}{3\, p} + C[2]\right\}, \left\{x[t] \to \frac{2\sqrt{2}\, m \left(\frac{p\, t}{m} + C[1]\right)^{3/2}}{3\, p} + C[2]\right\}\right\}$$

```
xt = x[t] /. sol[[1]]
```

$$-\frac{2\sqrt{2}\, m \left(\frac{p\, t}{m} + C[1]\right)^{3/2}}{3\, p} + C[2]$$

```
xt2 = x[t] /. sol[[2]] /. {p → 100, m → 50}
```

$$\frac{1}{3}\sqrt{2}\,(2\, t + C[1])^{3/2} + C[2]$$

```
vt = D[xt2, t]
```

$$\sqrt{2}\,\sqrt{2\, t + C[1]}$$

```
eq1 = (xt2 /. t → 0) == 0
eq2 = (vt /. t → 0) == 0
```

$$\frac{1}{3}\sqrt{2}\, C[1]^{3/2} + C[2] == 0$$

$$\sqrt{2}\,\sqrt{C[1]} == 0$$

```
const = Solve[{eq1, eq2}, {C[1], C[2]}]
```

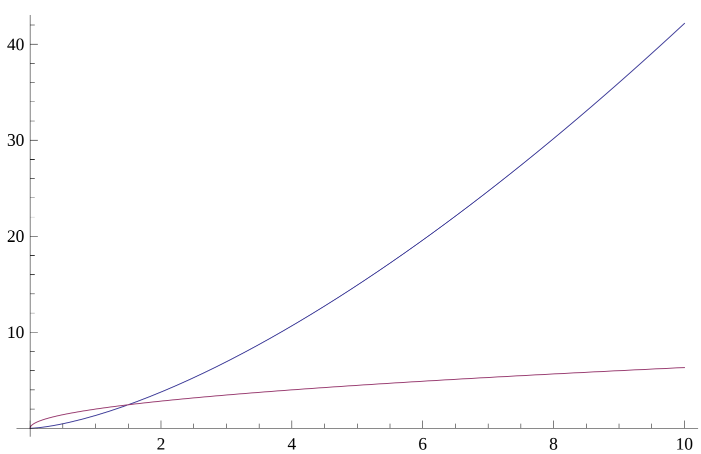
{{C[1] → 0, C[2] → 0}}

```
xt2 = xt2 /. const[[1]]
vt = vt /. const[[1]]
```

$$\frac{4\, t^{3/2}}{3}$$

$$2\sqrt{t}$$

```
Plot[{xt2, vt}, {t, 0, 10}]
```



```
(*problem#3:solve teh differential equation using the initial condition t=0,
y=0,t=0,y'=1*)

deq = y''[t] + 2 y'[t] + y[t] == 0;
sol = DSolve[deq, y[t], t]
```

$\{\{y[t] \to e^{-t} C[1] + e^{-t} t C[2]\}\}$

```
yt = y[t] /. sol[[1]]
```

$e^{-t} C[1] + e^{-t} t C[2]$

```
vt = D[yt, t]
```

$-e^{-t} C[1] + e^{-t} C[2] - e^{-t} t C[2]$

```
eq1 = (yt /. t → 0) == 0
eq2 = (vt /. t → 0) == 1
```

$C[1] == 0$

$-C[1] + C[2] == 1$

```
const = Solve[{eq1, eq2}, {C[1], C[2]}]
```

$\{\{C[1] \to 0, C[2] \to 1\}\}$

```
yt = yt /. const[[1]]
vt = vt /. const[[1]]
```

$e^{-t} t$

$e^{-t} - e^{-t} t$

```
Plot[{yt, vt}, {t, 0, 10}]
```