```
> restart
> EcuacionDinamica := Masa·diff(s(t), t$2) =-Hooke·s(t)
```

$$EcuacionDinamica := Masa\left(\frac{d^2}{dt^2}\,s(t)\right) = -Hooke\,s(t) \tag{1}$$

```
> CondicionesIniciales := s(0) =- (620 — 203)/1000, D(s)(0) =0;
```

$$CondicionesIniciales := s(0) = -\frac{417}{1000}, D(s)(0) = 0 \tag{2}$$

```
> gravedad := 981/100; Masa := (16/1000)/gravedad; Hooke := (1914/100)/(5/10)
```

$$gravedad := \frac{981}{100}$$

$$Masa := \frac{8}{4905}$$

$$Hooke := \frac{957}{25} \tag{3}$$

```
> EcuacionDinamica; evalf(%, 3)
```

$$\frac{8}{4905}\,\frac{d^2}{dt^2}\,s(t) = -\frac{957}{25}\,s(t)$$

$$0.00163\left(\frac{d^2}{dt^2}\,s(t)\right) = -38.3\,s(t) \tag{4}$$

```
> Solucion := dsolve({EcuacionDinamica, CondicionesIniciales}); evalf(%, 5)
```

$$Solucion := s(t) = -\frac{417}{1000}\cos\left(\frac{3}{20}\sqrt{1043130}\,t\right)$$

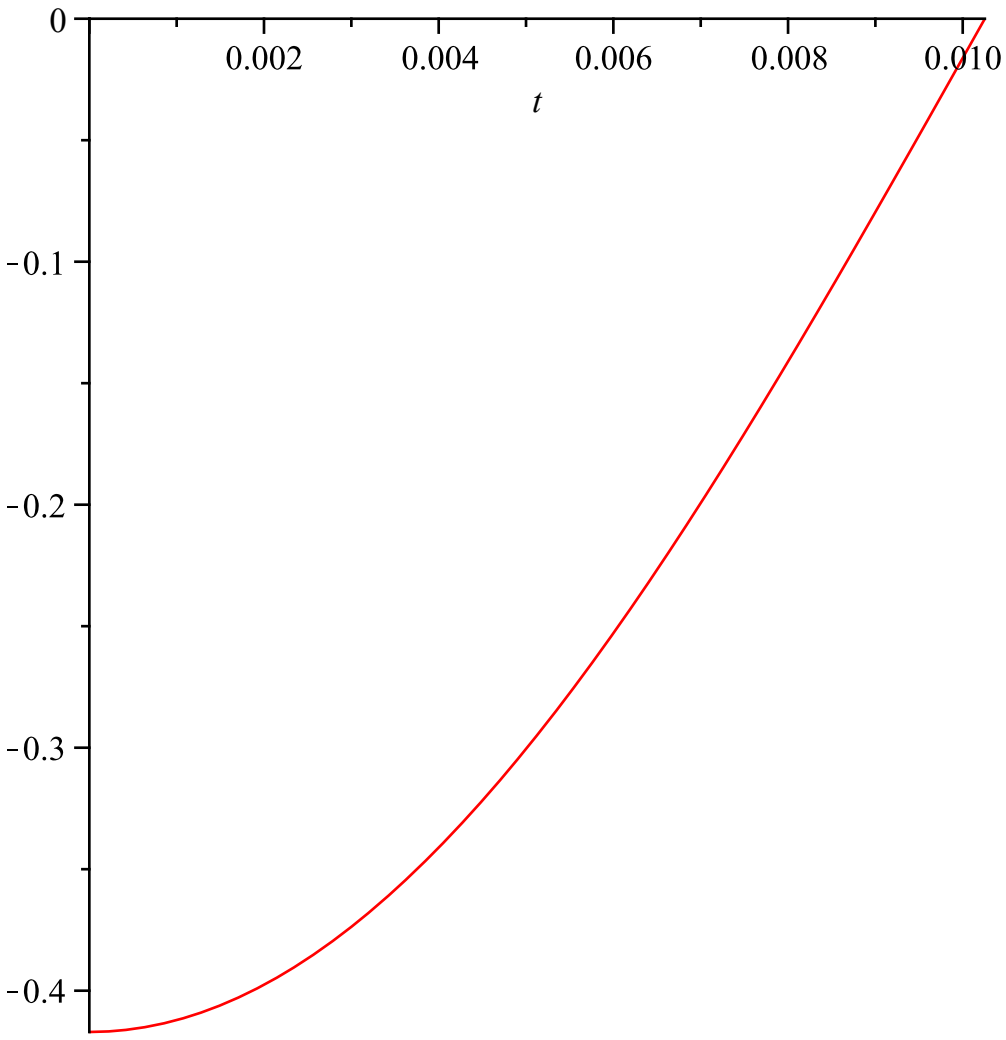
$$s(t) = -0.41700\cos(153.20\,t) \tag{5}$$

```
> TiempoEscape := solve(rhs(Solucion) =0, t); evalf(%, 5)
```

$$TiempoEscape := \frac{1}{312939}\,\pi\sqrt{1043130}$$

$$0.010253 \tag{6}$$

```
> plot(rhs(Solucion), t =0 ..TiempoEscape)
```

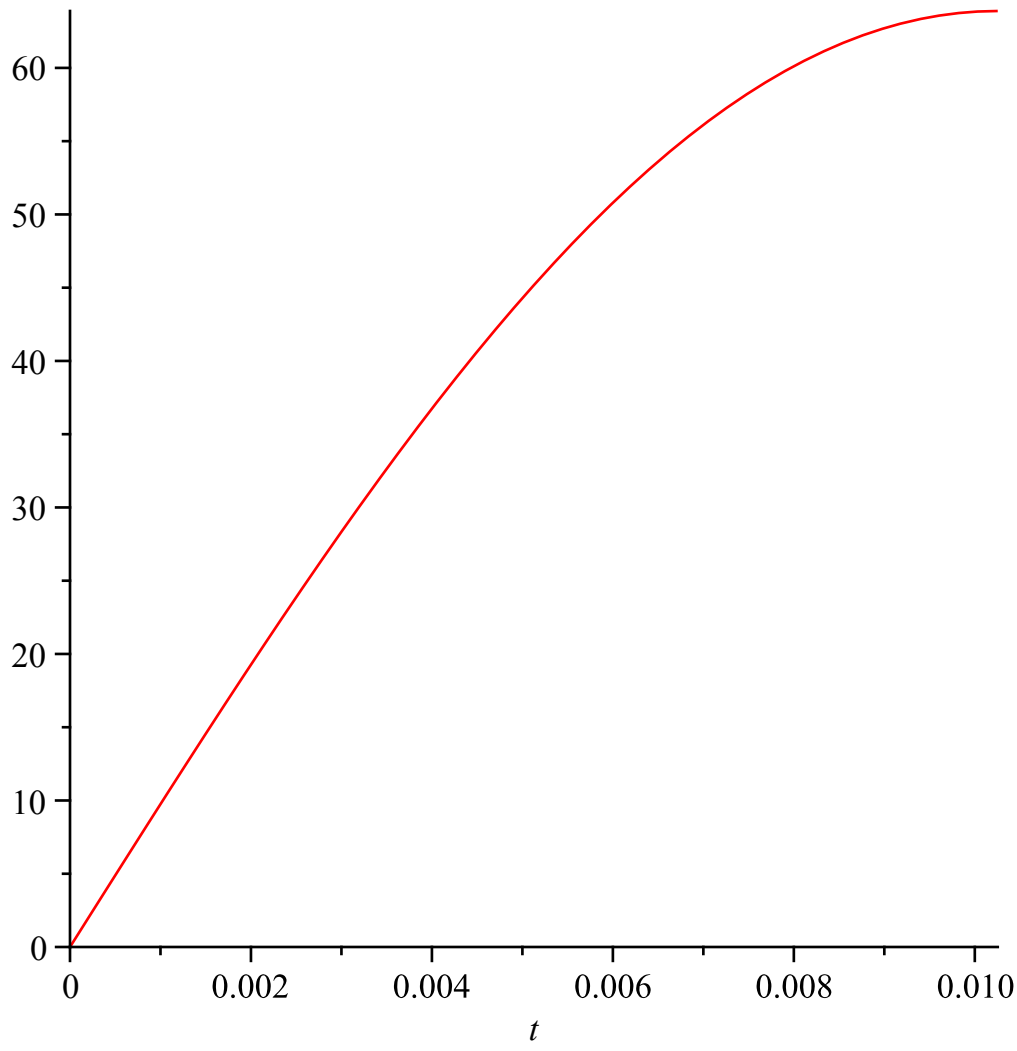


> $DerSolucion := diff(Solucion, t); evalf(\%, 5)$

$$DerSolucion := \frac{d}{dt} s(t) = \frac{1251}{20000} \sin\left(\frac{3}{20} \sqrt{1043130}\ t \right) \sqrt{1043130}$$

$$\frac{d}{dt} s(t) = 63.882 \sin(153.20\ t) \quad \textbf{(7)}$$

> $plot(rhs(DerSolucion), t = 0..TiempoEscape)$



> $VelocidadInicial := subs(t = TiempoEscape, rhs(DerSolucion)); evalf(\%, 5);$
> $\frac{evalf(\%\%, 5) \cdot 3600}{1000};$

$$VelocidadInicial := \frac{1251}{20000} \sin\left(\frac{1}{2}\pi\right) \sqrt{1043130}$$

$$63.882$$

$$229.9752000 \quad \textbf{(8)}$$

>

TIRO PARABOLICO

> $EcuacionVertical := diff(y(t), t\$2) = -gravedad; evalf(\%, 3)$

$$EcuacionVertical := \frac{d^2}{dt^2} y(t) = -\frac{981}{100}$$

$$\frac{d^2}{dt^2} y(t) = -9.81 \quad \textbf{(9)}$$

> $EcuacionHorizontal := diff(x(t), t) = VelocidadInicial \cdot \cos\left(\frac{Pi}{4}\right); evalf(\%, 3)$

$$EcuacionHorizontal := \frac{d}{dt} x(t) = \frac{1251}{40000} \sqrt{1043130}\, \sqrt{2}$$

$$\frac{d}{dt}x(t) = 45.1 \quad (10)$$

> $CondicionesVerticales := y(0) = 2, D(y)(0) = VelocidadInicial \cdot \sin\left(\frac{Pi}{4}\right); evalf(\%, 5)$

$$CondicionesVerticales := y(0) = 2, D(y)(0) = \frac{1251}{40000}\sqrt{1043130}\sqrt{2}$$

$$y(0) = 2., D(y)(0) = 45.170 \quad (11)$$

> $CondicionHorizontal := x(0) = 5$

$$CondicionHorizontal := x(0) = 5 \quad (12)$$

> $SolucionVertical := dsolve(\{EcuacionVertical, CondicionesVerticales\}); evalf(\%, 3)$

$$SolucionVertical := y(t) = -\frac{981}{200}t^2 + \frac{1251}{40000}\sqrt{1043130}\sqrt{2}\,t + 2$$

$$y(t) = -4.90\,t^2 + 45.1\,t + 2. \quad (13)$$

> $SolucionHorizontal := dsolve(\{EcuacionHorizontal, CondicionHorizontal\}); evalf(\%, 5)$

$$SolucionHorizontal := x(t) = \frac{1251}{20000}\sqrt{521565}\,t + 5$$

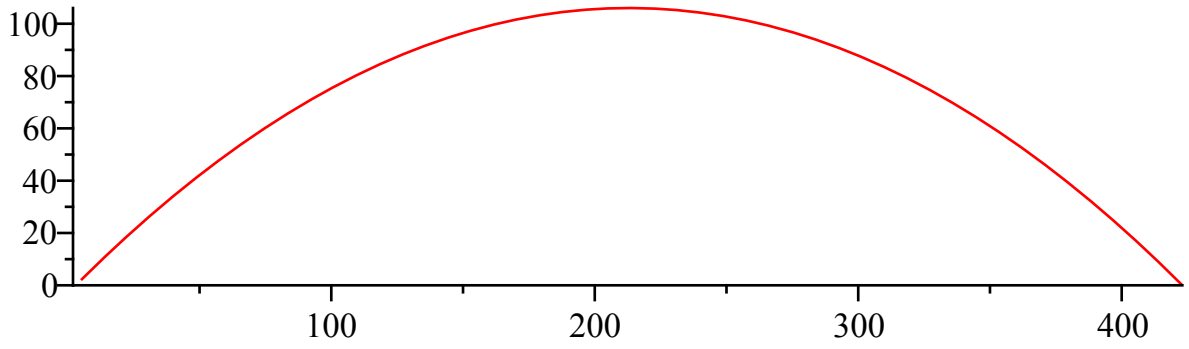
$$x(t) = 45.173\,t + 5. \quad (14)$$

> $TiempoVuelo := solve(rhs(SolucionVertical) = 0, t); evalf(\%, 4)$

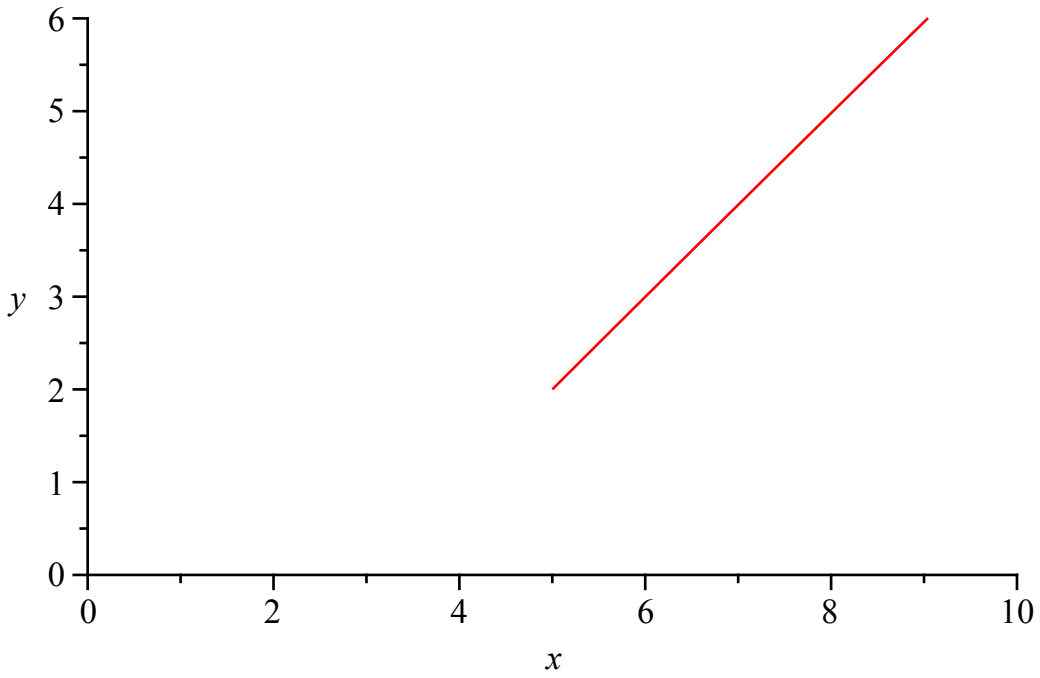
$$TiempoVuelo := \frac{139}{21800}\sqrt{521565} - \frac{1}{65400}\sqrt{92438416285}, \frac{139}{21800}\sqrt{521565} + \frac{1}{65400}\sqrt{92438416285}$$

$$-0.043, 9.253 \quad (15)$$

> $plot([rhs(SolucionHorizontal), rhs(SolucionVertical), t = 0..TiempoVuelo_2], scaling = CONSTRAINED)$




```
> plot( [rhs(SolucionHorizontal), rhs(SolucionVertical), t = 0 ..0.1 ], x = 0 ..10, y = 0 ..6, scaling
      = CONSTRAINED)
```



> $DistanciaHorizontal := subs\left(t = TiempoVuelo_2, rhs(SolucionHorizontal)\right); evalf(\%, 4)$

$$DistanciaHorizontal := \frac{1251}{20000}\sqrt{521565}\left(\frac{139}{21800}\sqrt{521565} + \frac{1}{65400}\sqrt{92438416285}\right) + 5$$

$$423.0 \quad \textbf{(16)}$$

> $DerSol := rhs(diff(SolucionVertical, t)) = 0; evalf(\%, 3)$

$$DerSol := -\frac{981}{100}t + \frac{1251}{40000}\sqrt{1043130}\sqrt{2} = 0$$

$$-9.81\,t + 45.1 = 0. \quad \textbf{(17)}$$

> $TiempoAlturaMaxima := solve(DerSol, t); evalf(\%, 4)$

$$TiempoAlturaMaxima := \frac{139}{43600}\sqrt{1043130}\sqrt{2}$$

$$4.603 \quad \textbf{(18)}$$

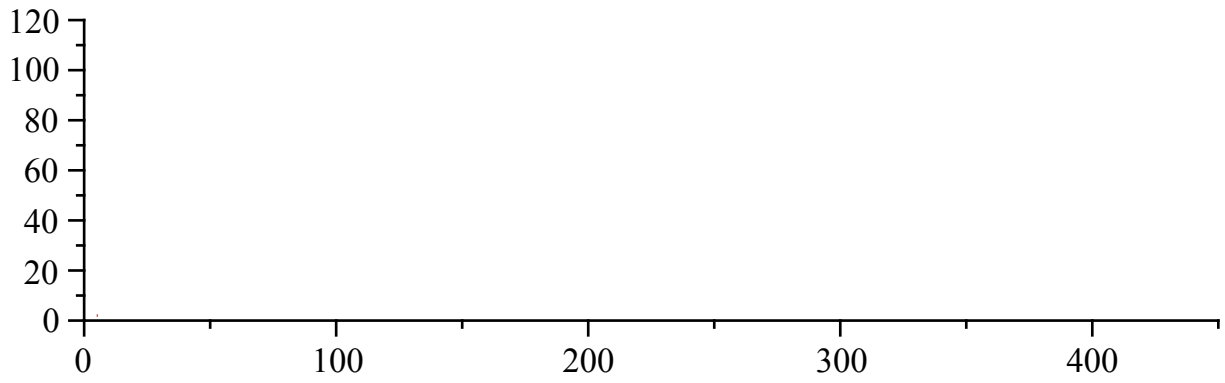
> $AlturaMaxima := subs(t = TiempoAlturaMaxima, rhs(SolucionVertical)); evalf(\%, 4)$

$$AlturaMaxima := \frac{169611773}{1600000}$$

$$106.0 \quad \textbf{(19)}$$

>

```
> with(plots):
> animatecurve([rhs(SolucionHorizontal), rhs(SolucionVertical), t = 0..TiempoVuelo[2]], view
      = [0..450, 0..120], scaling = CONSTRAINED, frames = 100)
```




```
>
```