```
> restart
>
```

PROBLEMA DEL ARCO Y LA FLECHA

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

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

```
> Condicion := s(0) = -392/1000, D(s)(0) = 0; evalf(%, 5)
```

$$Condicion := s(0) = -\frac{49}{125}, \mathrm{D}(s)(0) = 0$$

$$s(0) = -0.39200, \mathrm{D}(s)(0) = 0. \tag{2}$$

```
> Hooke := (1348/100)/(35/100); Masa := (16/1000)/(981/100);
```

$$Hooke := \frac{1348}{35}$$

$$Masa := \frac{8}{4905} \tag{3}$$

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

$$-\frac{1348}{35} s(t) = \frac{8}{4905} \frac{d^2}{dt^2} s(t)$$

$$-38.5\, s(t) = 0.00163 \left(\frac{d^2}{dt^2} s(t) \right) \tag{4}$$

```
> SolucionGeneral := dsolve(EcuaDinamica); evalf(%, 3)
```

$$SolucionGeneral := s(t) = \_C1 \sin\left(\frac{3}{14} \sqrt{514262}\, t \right) + \_C2 \cos\left(\frac{3}{14} \sqrt{514262}\, t \right)$$

$$s(t) = \_C1 \sin(153.\, t) + \_C2 \cos(153.\, t) \tag{5}$$

```
> Solucion := dsolve({EcuaDinamica, Condicion}); evalf(%, 3); subs(t = 0, rhs(Solucion));
  evalf(%, 3)
```

$$Solucion := s(t) = -\frac{49}{125} \cos\left(\frac{3}{14} \sqrt{514262}\, t \right)$$

$$s(t) = -0.392 \cos(153.\, t)$$

$$-\frac{49}{125} \cos(0)$$

$$-0.392 \tag{6}$$

```
> DerSol := diff(Solucion, t); evalf(%, 3); subs(t = 0, rhs(DerSol)); evalf(%, 3)
```

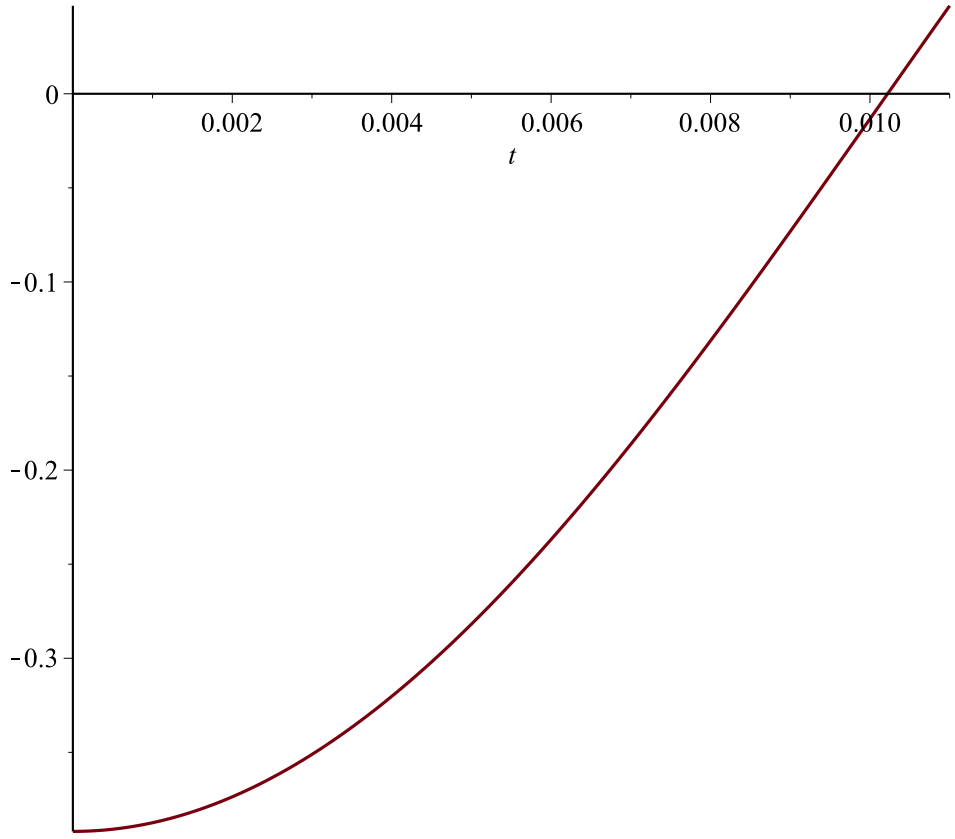
$$DerSol := \frac{d}{dt} s(t) = \frac{21}{250} \sin\left(\frac{3}{14} \sqrt{514262}\, t \right) \sqrt{514262}$$

$$\frac{d}{dt} s(t) = 60.2 \sin(153.\, t)$$

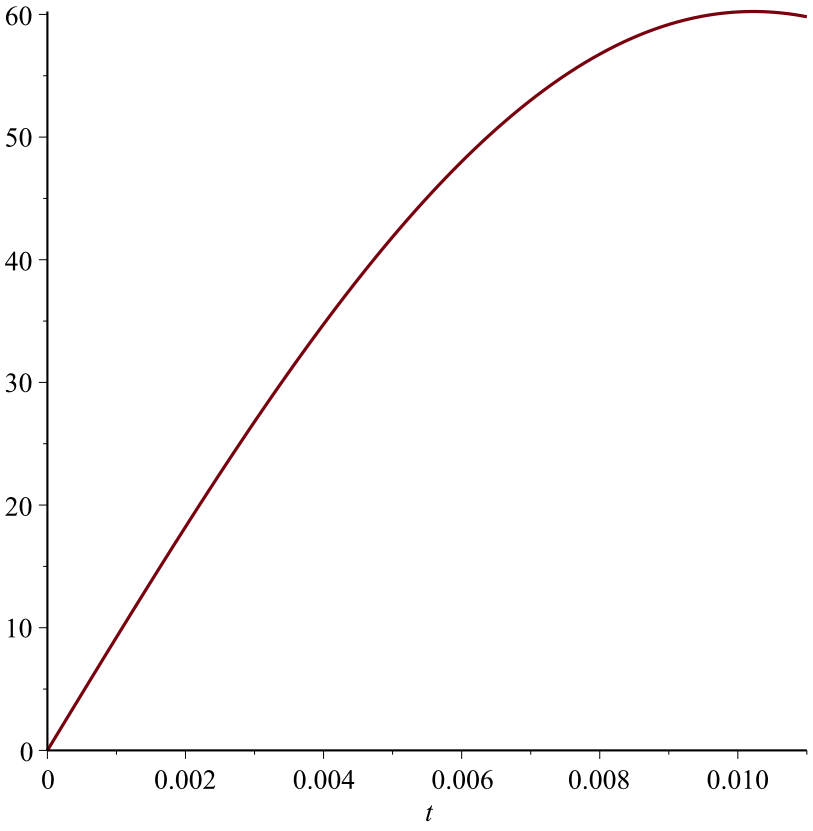
$$\frac{21}{250}\sin(0)\sqrt{514262}$$

$$0. \qquad \textbf{(7)}$$

> $plot(rhs(Solucion), t = 0..0.011)$



> $plot(rhs(diff(Solucion, t)), t = 0..0.011)$



> $TiempoEmpuje := solve(rhs(Solucion) = 0); evalf(\%);$

$$TiempoEmpuje := \frac{1}{220398}\,\pi\sqrt{514262}$$

$$0.01022196621 \quad \textbf{(8)}$$

> $Velocidad := subs(t = TiempoEmpuje, rhs(diff(Solucion, t))); evalf(\%, 4); evalf(\%\%, 4) \cdot 3.6$

$$Velocidad := \frac{21}{250}\,\sin\left(\frac{1}{2}\,\pi\right)\sqrt{514262}$$

$$60.24$$

$$216.864 \quad \textbf{(9)}$$

TIRO PARABÓLICO

> $EcuaVertical := diff(y(t), t\$2) = -\frac{981}{100}; evalf(\%, 3)$

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

$$\frac{d^2}{dt^2}\,y(t) = -9.81 \quad \textbf{(10)}$$

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

$$EcuaHoriz := \frac{d}{dt} x(t) = \frac{21}{500} \sqrt{514262}\, \sqrt{2}$$

$$\frac{d}{dt} x(t) = 42.4 \quad (11)$$

> $SolGralVertical := dsolve(EcuaVertical)$; $evalf(\%, 3)$

$$SolGralVertical := y(t) = -\frac{981}{200} t^2 + \_C1\, t + \_C2$$

$$y(t) = -4.90\, t^2 + \_C1\, t + \_C2 \quad (12)$$

> $SolGralHoriz := dsolve(EcuaHoriz)$; $evalf(\%, 3)$

$$SolGralHoriz := x(t) = \frac{21}{250} \sqrt{257131}\, t + \_C1$$

$$x(t) = 42.6\, t + \_C1 \quad (13)$$

> $CondVertical := y(0) = 2, D(y)(0) = Velocidad \cdot \sin\left(\frac{Pi}{4}\right)$; $evalf(\%, 3)$

$$CondVertical := y(0) = 2, D(y)(0) = \frac{21}{500} \sqrt{514262}\, \sqrt{2}$$

$$y(0) = 2., D(y)(0) = 42.4 \quad (14)$$

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

$$CondHoriz := x(0) = 5 \quad (15)$$

> $SolVert := dsolve(\{EcuaVertical, CondVertical\})$; $evalf(\%, 3)$

$$SolVert := y(t) = -\frac{981}{200} t^2 + \frac{21}{500} \sqrt{514262}\, \sqrt{2}\, t + 2$$

$$y(t) = -4.90\, t^2 + 42.4\, t + 2. \quad (16)$$

> $SolHoriz := dsolve(\{EcuaHoriz, CondHoriz\})$; $evalf(\%, 3)$

$$SolHoriz := x(t) = \frac{21}{250} \sqrt{257131}\, t + 5$$

$$x(t) = 42.6\, t + 5. \quad (17)$$

> $TiempoVuelo := solve(rhs(SolVert) = 0)$; $evalf(\%, 5)$

$$TiempoVuelo := \frac{14}{1635} \sqrt{257131} - \frac{2}{1635} \sqrt{12871919}, \frac{14}{1635} \sqrt{257131} + \frac{2}{1635} \sqrt{12871919}$$

$$-0.0466, 8.7306 \quad (18)$$

> $DistanciaFinal := subs(t = TiempoVuelo[2], rhs(SolHoriz))$; $evalf(\%, 4)$

$$DistanciaFinal := \frac{21}{250} \sqrt{257131} \left(\frac{14}{1635} \sqrt{257131} + \frac{2}{1635} \sqrt{12871919} \right) + 5$$

$$376.8 \quad (19)$$

> $TiempoAlturaMax := solve(rhs(diff(SolVert, t)) = 0)$; $evalf(\%, 4)$

$$TiempoAlturaMax := \frac{7}{1635} \sqrt{514262}\, \sqrt{2}$$

(20)

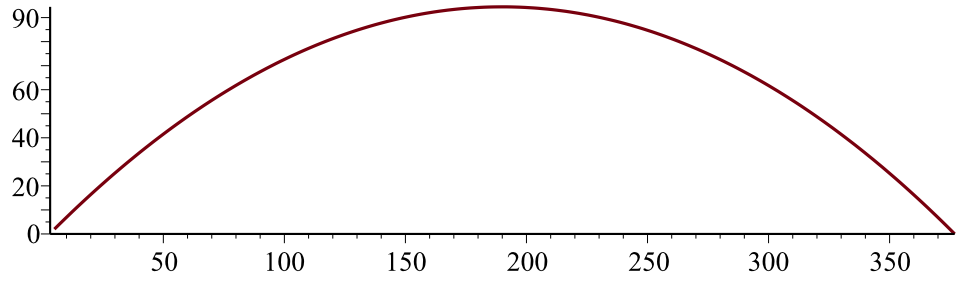
$$4.341 \quad \textbf{(20)}$$

> $AlturaMax := subs(t = TiempoAlturaMax, rhs(SolVert)); evalf(\%, 4)$

$$AlturaMax := \frac{118091}{1250}$$

$$94.47 \quad \textbf{(21)}$$

> $plot([rhs(SolHoriz), rhs(SolVert), t = 0..TiempoVuelo[2]], scaling = CONSTRAINED)$



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