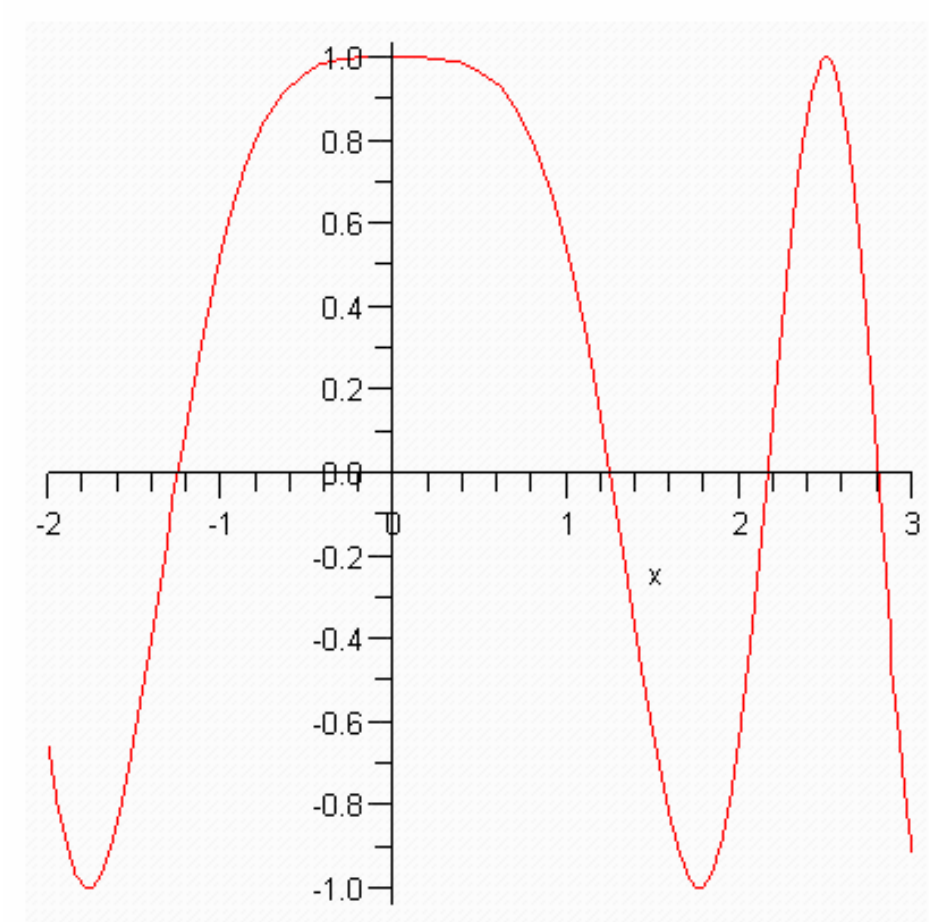
Differentiation demo

120, p. 202

> $f := x \to cos(x^2)$

$$f := x \to \cos(x^2)$$

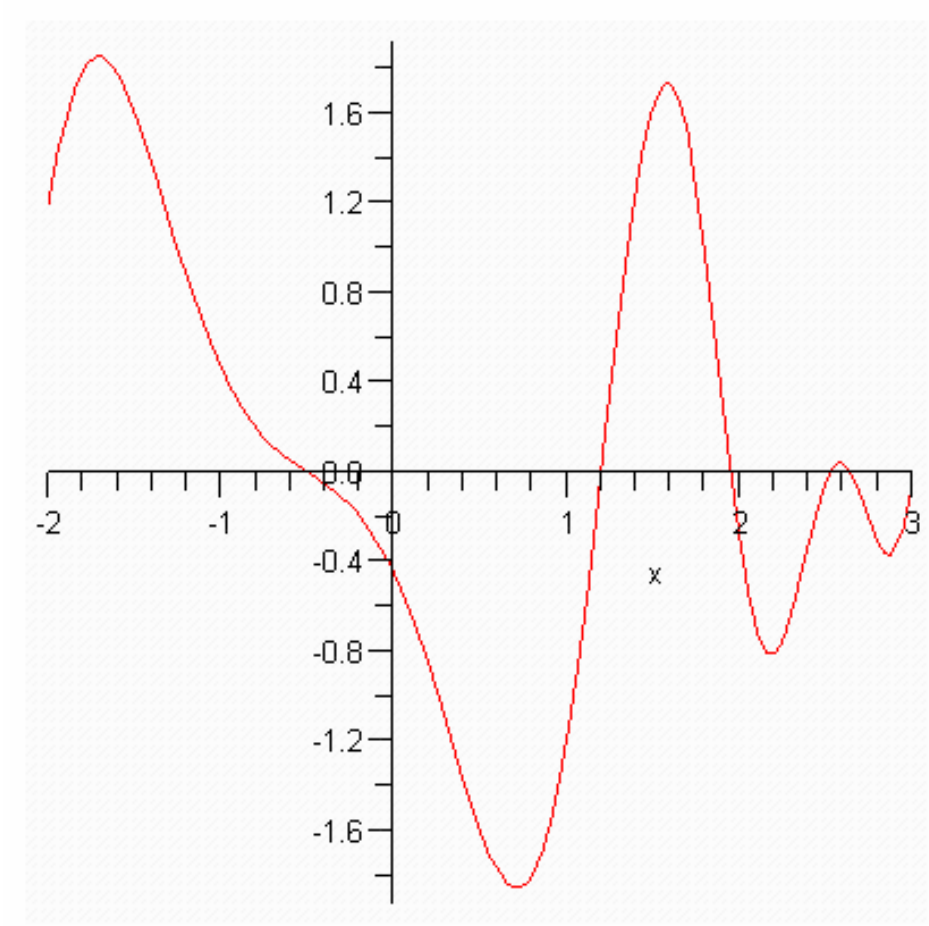
> $plot(f(x), x = -2..3)$



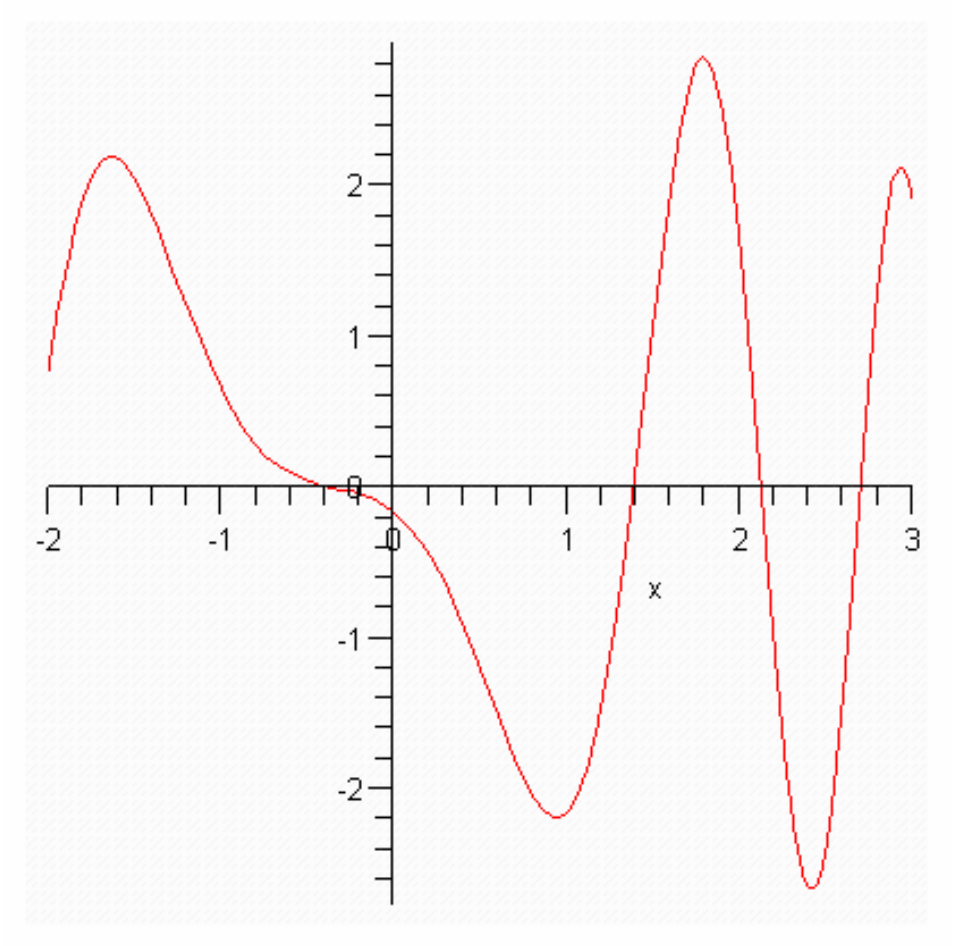
> $g := (x, h) \to \frac{(cos((x+h)^2) - cos(x^2))}{h}$

$$g := (x, h) \rightarrow \frac{\cos((x+h)^2) - \cos(x^2)}{h}$$

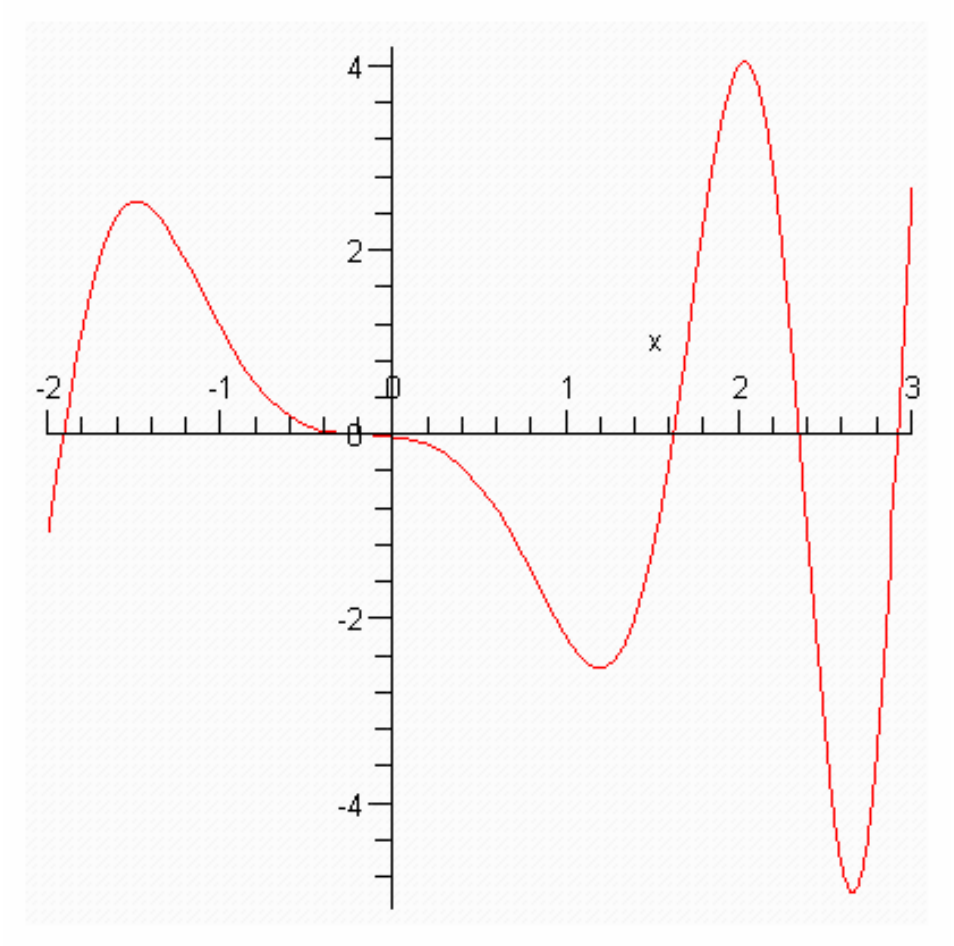
> $plot(g(x, 1), x = -2..3)$



> $plot(g(x,.7), x = -2..3)$



> $plot(g(x,.3), x = -2..3)$



> $help(diff)$

> $diff(f(x), x)$

$$-2\sin(x^2)\,x$$

> $h := diff(f(x), x)$

$$h := -2\sin(x^2)\,x$$

> $h(3.0)$

$$-2\,(\sin(x^2))\,(3.0)\,x\,(3.0)$$

> $help(D)$

> $D(f)$

$$x \rightarrow -2\sin(x^2)\,x$$

> $D(f)(3.0)$

$$2.472710912$$

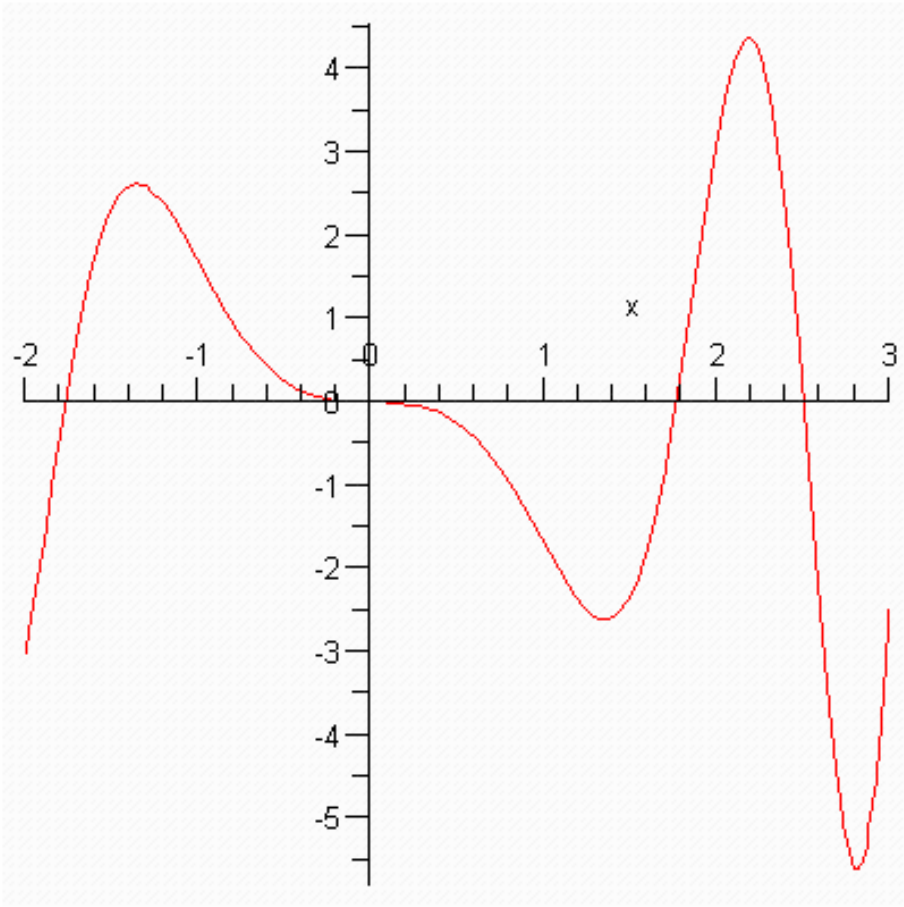
> $h := x \to D(f)(x)$

$$h := x \to (\mathrm{D}(f))(x)$$

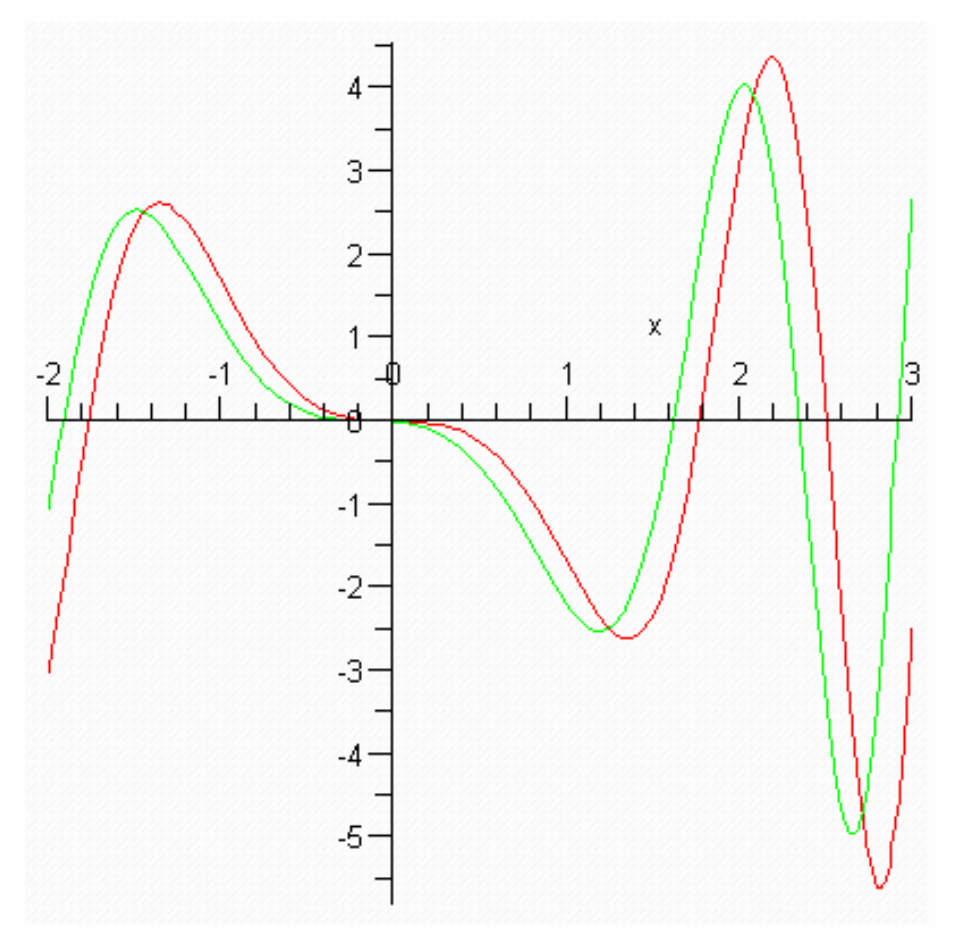
> $h(3.0)$

$$2.472710912$$

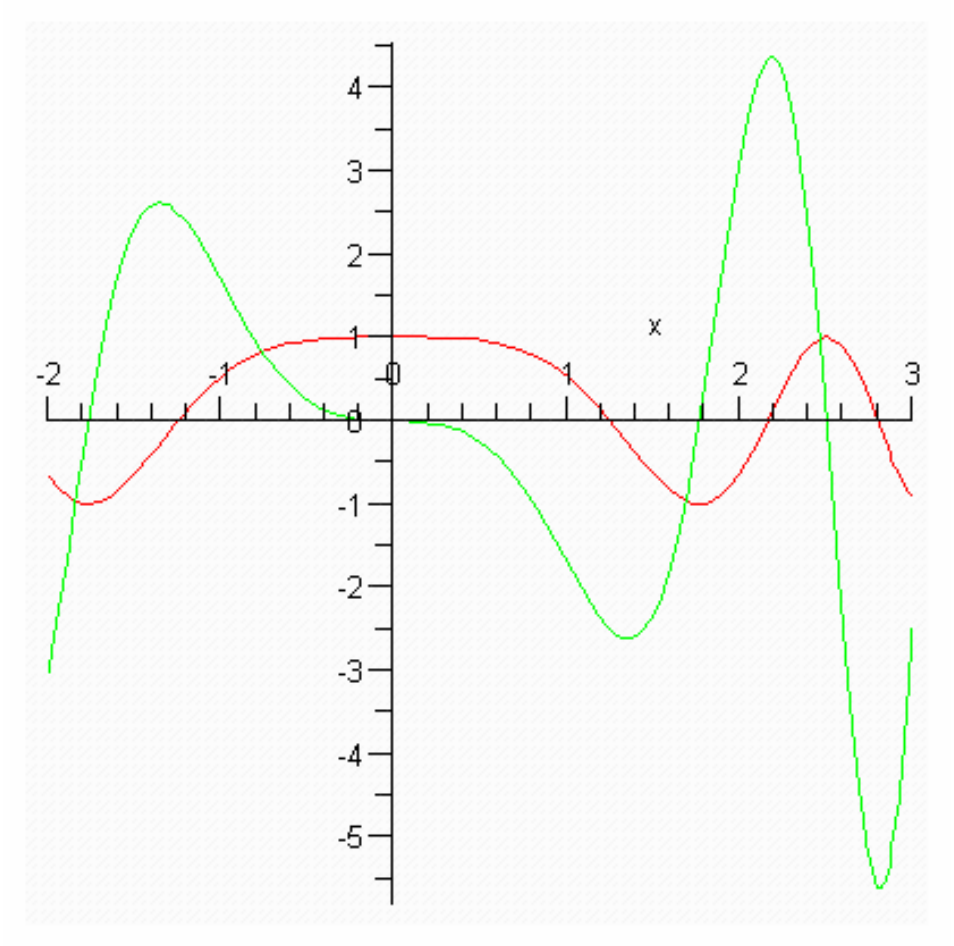
> $plot(h(x), x = -2..3)$



> $plot([h(x), g(x,.3)], x = -2..3)$



> $plot([f(x), h(x)], x = -2..3)$



>

Example of motion problem.

Position function s(t), velocity v(t), acceleration a(t).

> $s := t \to t^3 - 12 \cdot t^2 + 36 \cdot t$

$$s := t \to t^3 - 12\,t^2 + 36\,t$$

> $v := t \to D(s)(t)$

$$v := t \to (\mathrm{D}(s))(t)$$

> $eval(v(t))$

$$3\,t^2 - 24\,t + 36$$

> $a := t \to D(D(s))(t)$

$$a := t \rightarrow (\mathrm{D}(\mathrm{D}(s)))(t)$$

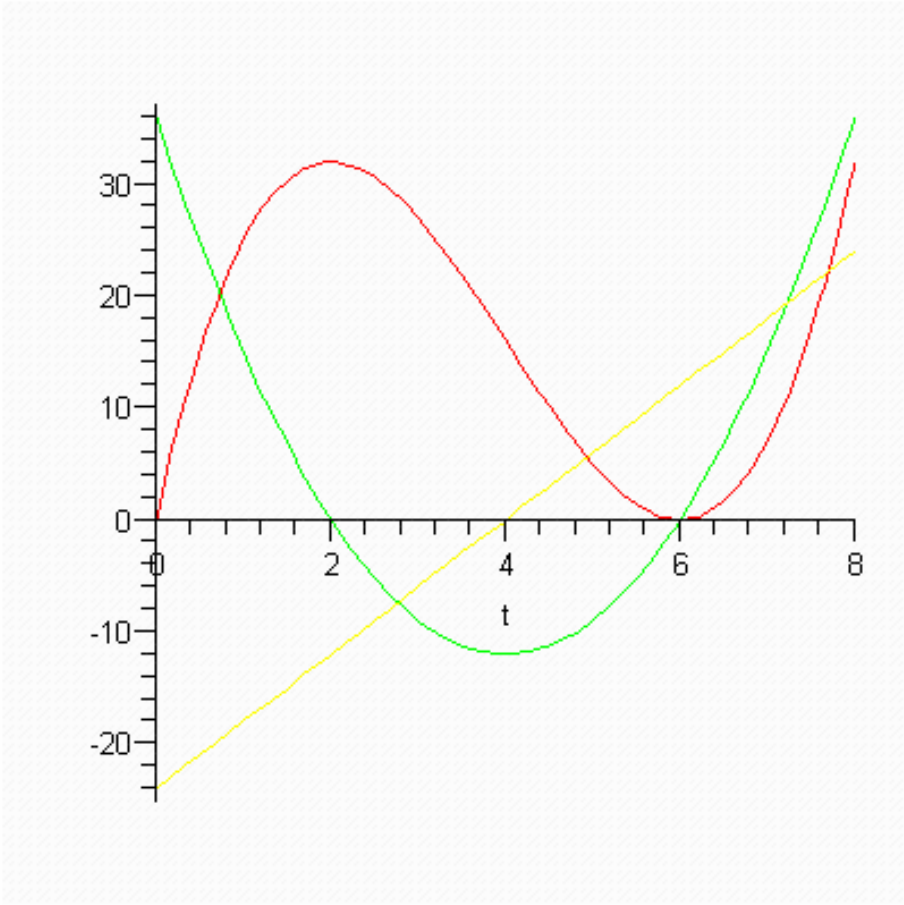
> $eval(a(t))$

$$6\,t - 24$$

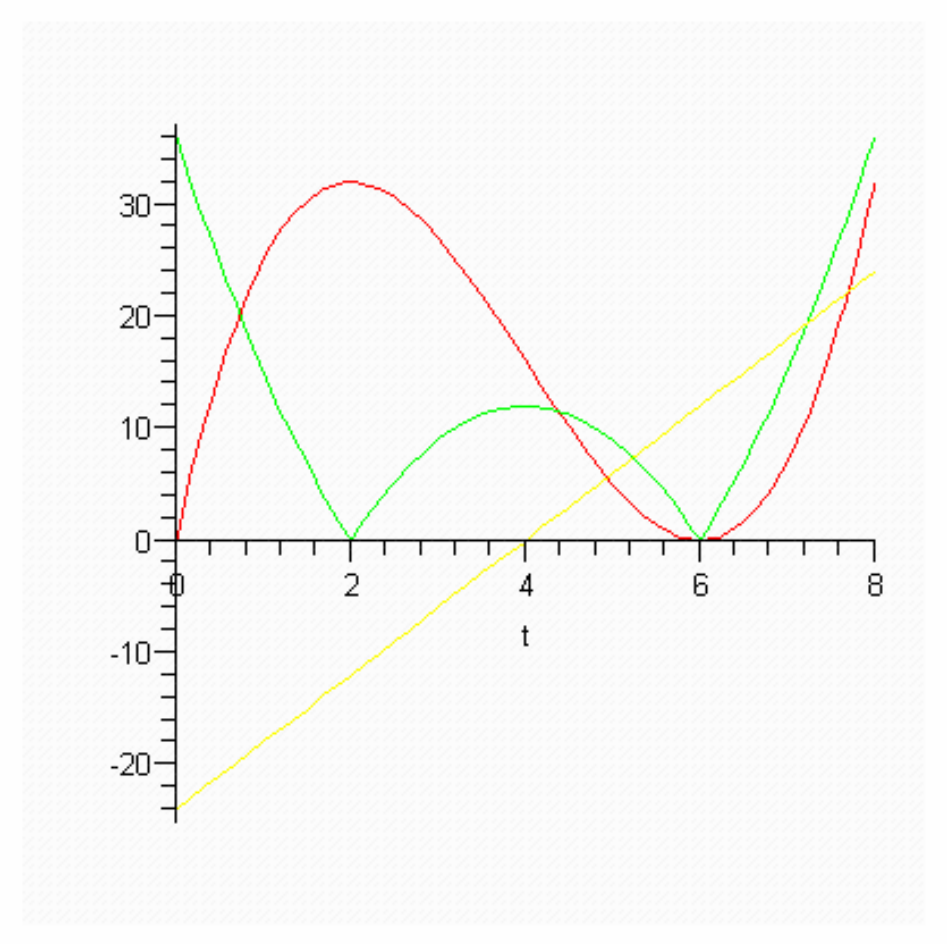
> $a := (D@@2)(s)(t)$

$$a := 6\,t - 24$$

> $plot([s(t), v(t), a(t)], t = 0..8)$



> $plot([s(t), abs(v(t)), a(t)], t = 0..8)$


30
20
10
0
-10
-20
0
2
4
6
8
t

>