2.6 Question

$yp := (x, y) \to \dfrac{\left(-16 \cdot x^3 + 81 \cdot x\right)}{16 \cdot x^2 \cdot y + 16 \cdot x \cdot y^3 + 8 \cdot y}$

$$yp := (x, y) \mapsto \frac{-16 \cdot x^3 + 81 \cdot x}{16 \cdot x^2 \cdot y + 16 \cdot x \cdot y^3 + 8 \cdot y} \tag{1.1}$$

$solve(yp(x, y) = 0)$

$$\left\{x = \frac{9}{4}, y = y\right\}, \left\{x = -\frac{9}{4}, y = y\right\}, \{x = 0, y = y\} \tag{1.2}$$

$eqn := 8 \cdot \left(x^2 + y^2\right)^2 = 81 \cdot \left(x^2 - y^2\right)$

$$eqn := 8 \left(x^2 + y^2\right)^2 = 81\, x^2 - 81\, y^2 \tag{1.3}$$

$myneweqn := implicitdiff(eqn, y, x)$

$$myneweqn := -\frac{x \left(16\, x^2 + 16\, y^2 - 81\right)}{y \left(16\, x^2 + 16\, y^2 + 81\right)} \tag{1.4}$$

$solve(myneweqn = 0)$

$$\{x = 0, y = y\}, \left\{x = \frac{\sqrt{-16\, y^2 + 81}}{4}, y = y\right\}, \left\{x = -\frac{\sqrt{-16\, y^2 + 81}}{4}, y = y\right\} \tag{1.5}$$

$subs(x = 0, eqn)$

$$8\, y^4 = -81\, y^2 \tag{1.6}$$

$solve(\%, y)$

$$0, 0, \frac{9\, I}{4} \sqrt{2}, -\frac{9\, I}{4} \sqrt{2} \tag{1.7}$$

$neweqn := subs\left(x = \frac{9}{4}, eqn\right)$

$$neweqn := 8 \left(y^2 + \frac{81}{16}\right)^2 = -81\, y^2 + \frac{6561}{16} \tag{1.8}$$

$solve(neweqn, y)$

$$\frac{9\, I}{4} \sqrt{2 + \sqrt{5}}, -\frac{9\, I}{4} \sqrt{2 + \sqrt{5}}, \frac{9 \sqrt{-2 + \sqrt{5}}}{4}, -\frac{9 \sqrt{-2 + \sqrt{5}}}{4} \tag{1.9}$$

$subs\left(y = \mathrm{sqrt}\left(\frac{81}{16} - x^2\right), eqn\right)$

$$\frac{6561}{32} = 162\, x^2 - \frac{6561}{16} \tag{1.10}$$

$solve(\%, x)$

$$-\frac{9 \sqrt{3}}{8}, \frac{9 \sqrt{3}}{8} \tag{1.11}$$

2.7 #1 Clobbered

$f := t \to \frac{1}{100} \cdot t^4 - \frac{6}{100} \cdot t^3$

$$f := t \mapsto \frac{1}{100} \cdot t^4 - \frac{3}{50} \cdot t^3 \quad \textbf{(2.1)}$$

$solve(f(t) = 0)$

$$6, 0, 0, 0 \quad \textbf{(2.2)}$$

$fp := \mathrm{D}(f)$

$$fp := t \mapsto \frac{1}{25} \cdot t^3 - \frac{9}{50} \cdot t^2 \quad \textbf{(2.3)}$$

$solve(fp(t) = 0)$

$$\frac{9}{2}, 0, 0 \quad \textbf{(2.4)}$$

$fpp := \mathrm{D}(fp)$

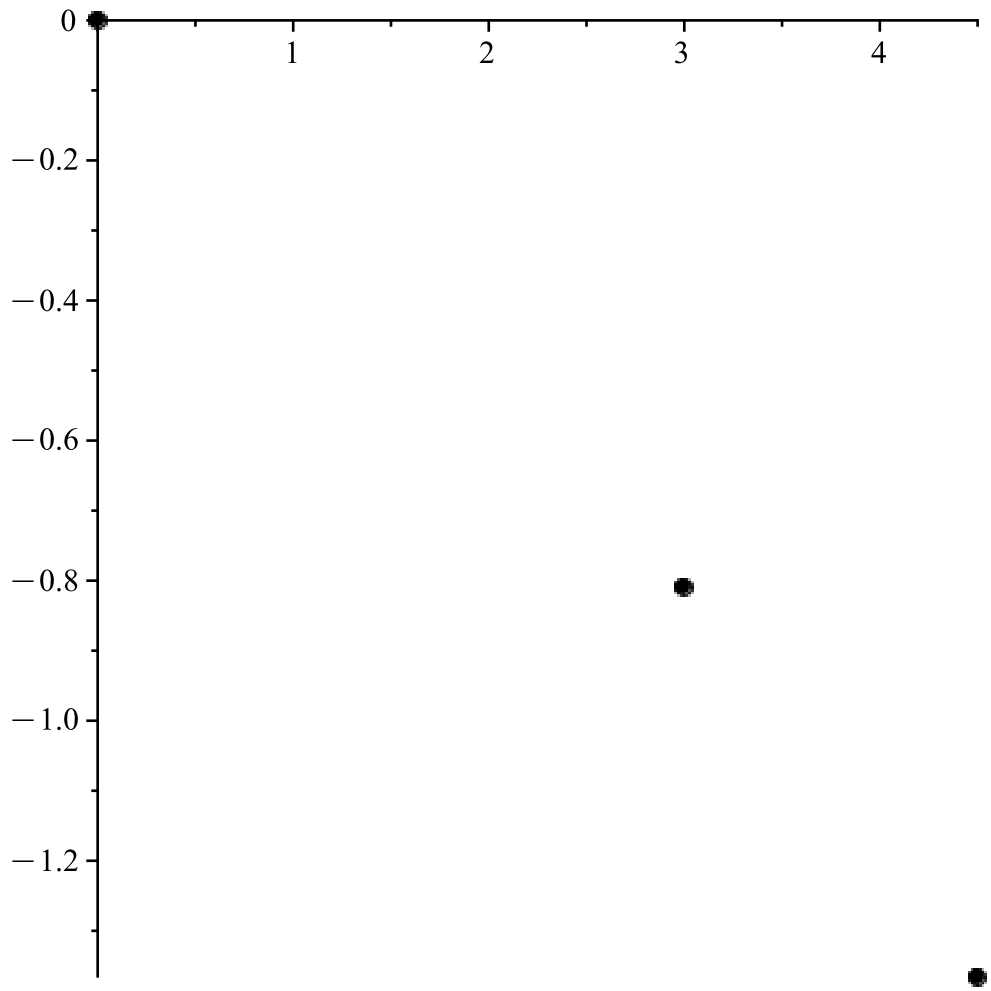
$$fpp := t \mapsto \frac{3}{25} \cdot t^2 - \frac{9}{25} \cdot t \quad \textbf{(2.5)}$$

$solve(fpp(t) = 0)$

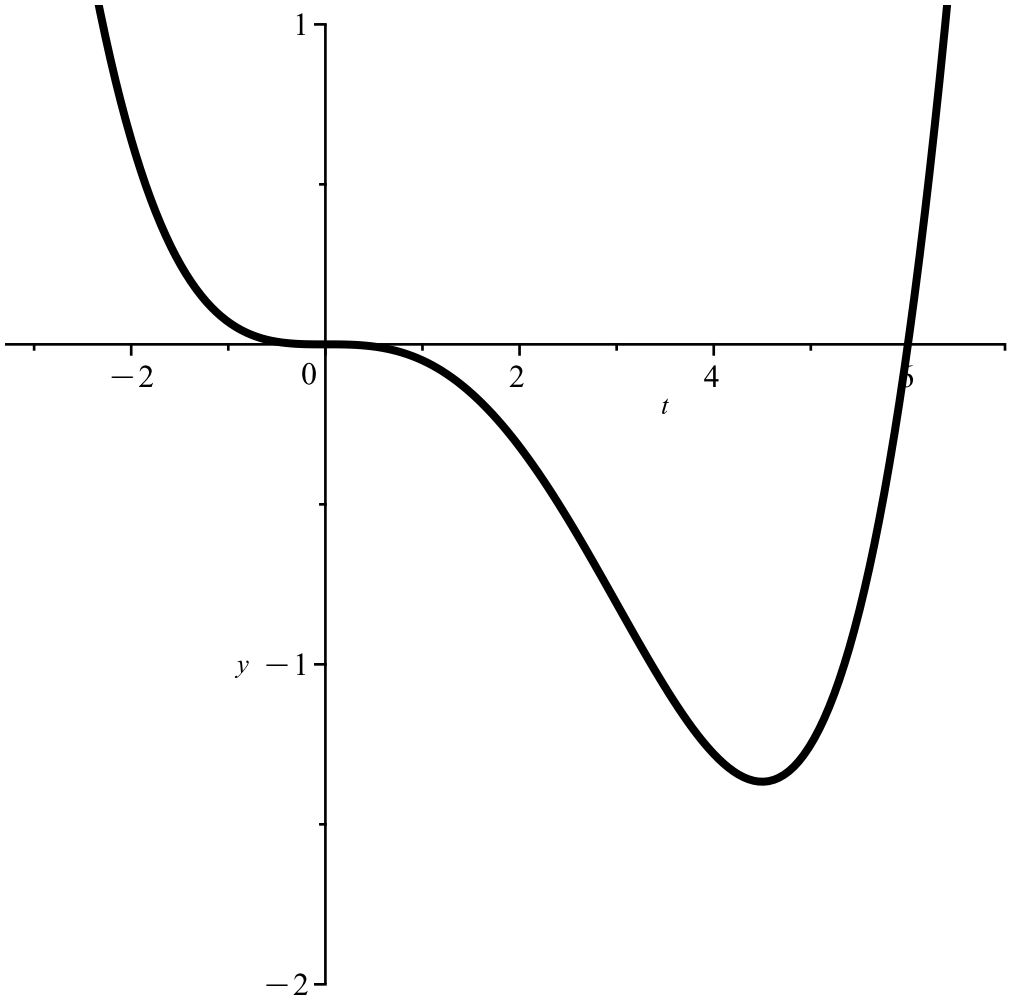
$$0, 3 \quad \textbf{(2.6)}$$

$with(plots) :$

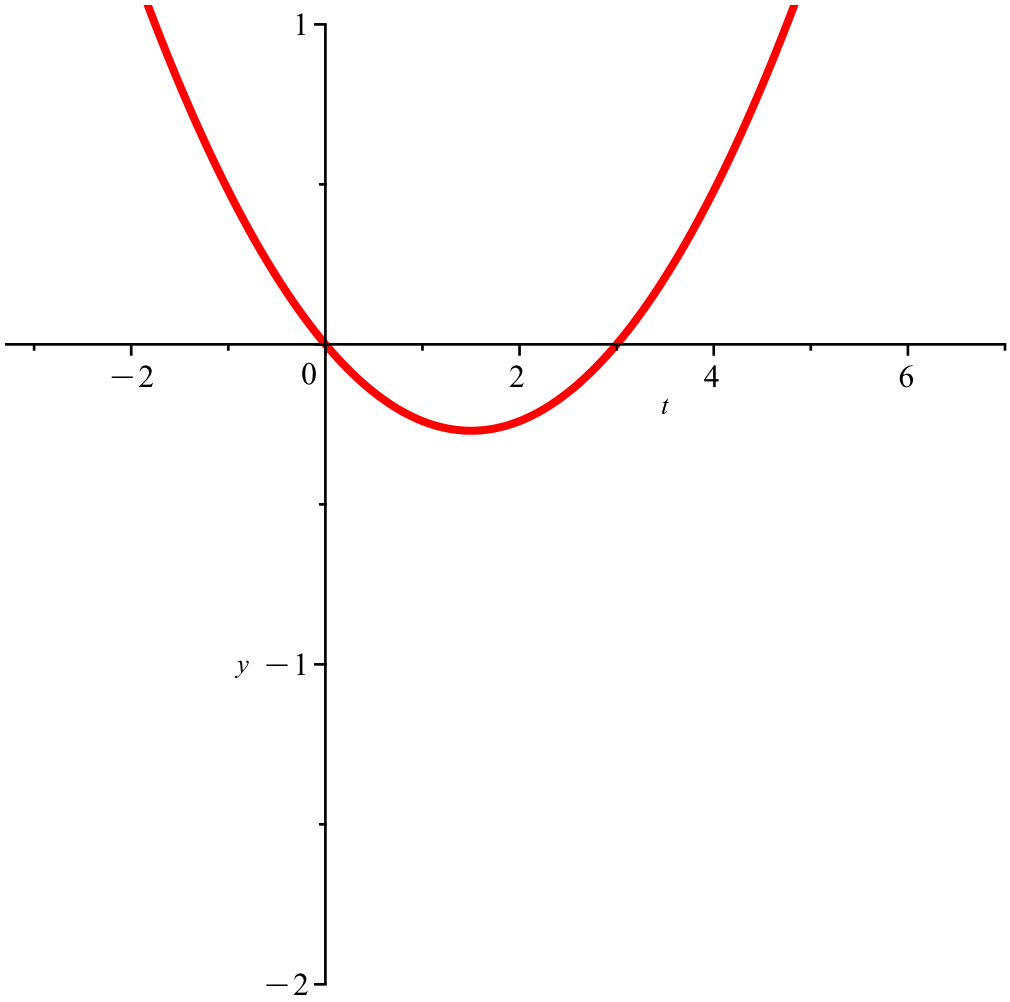
$myextremes := pointplot\left(\left[[0, f(0)], \left[\frac{9}{2}, f\left(\frac{9}{2}\right)\right], [3, f(3)]\right], symbol = solidcircle, symbolsize = 15\right)$



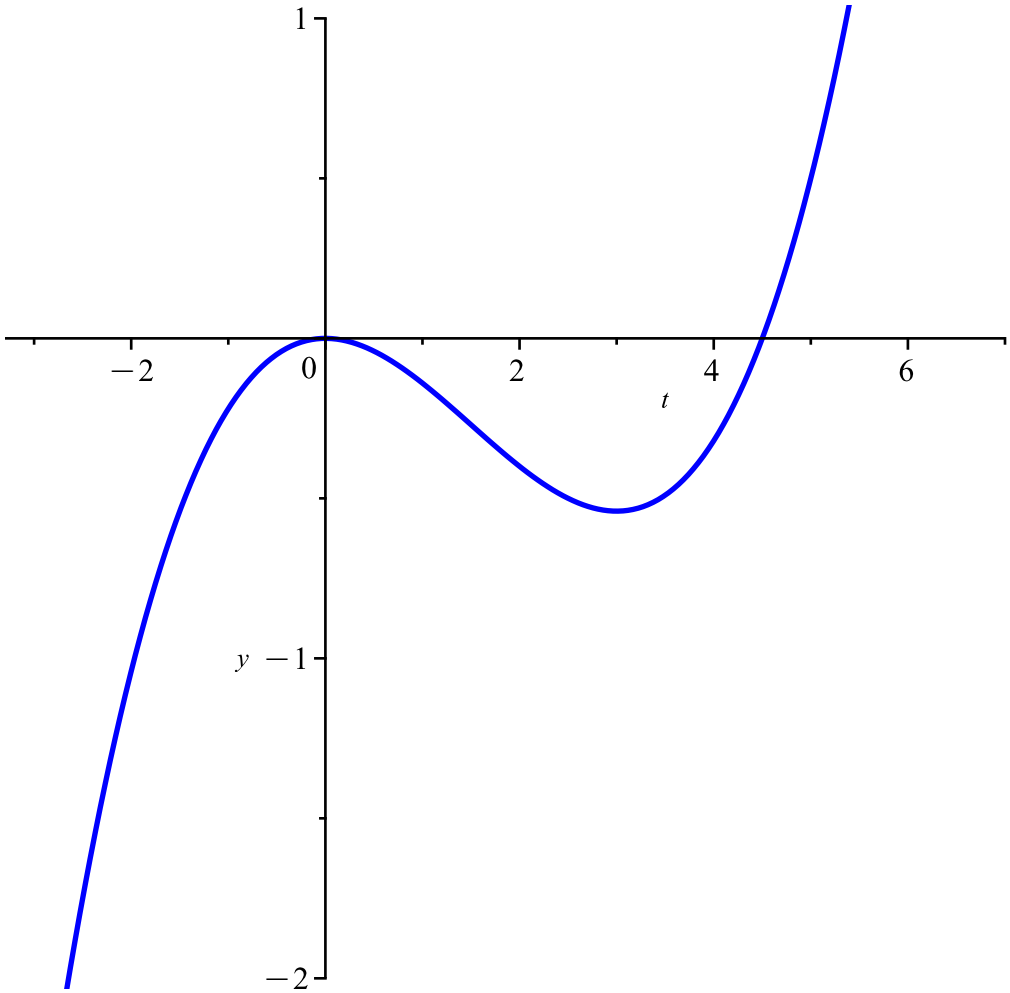
$$myfplot := plot(f(t), t = -3.3 \ldots 7, y = -2 \ldots 1, thickness = 3, color = black)$$



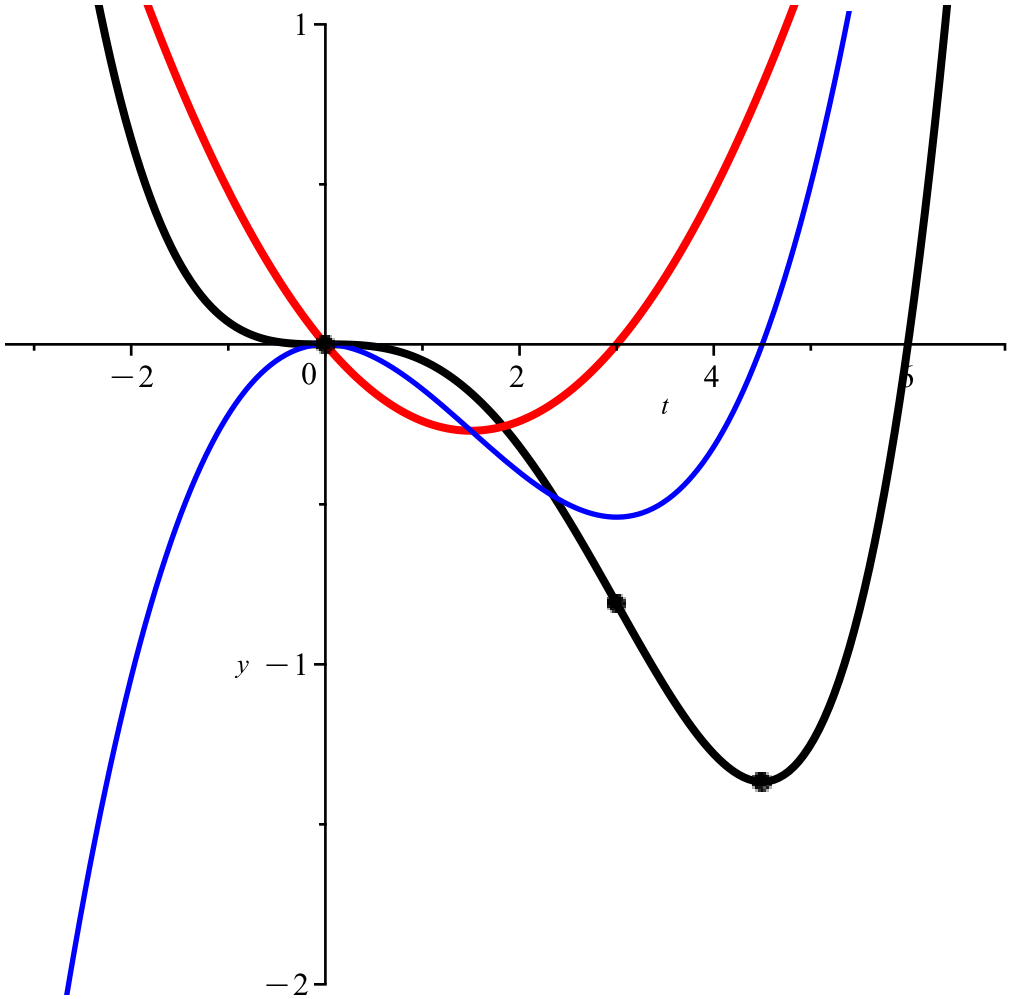
$myfpppplot := plot(fpp(t), t = -3.3..7, y = -2..1, thickness = 3, color = red)$



$myfpplot := plot(fp(t), t = -3.3..7, y = -2..1, thickness = 2, color = blue)$



display([*myfplot*, *myfppplot*, *myfpplot*, *myextremes*])


1
−2
0
2
4
t
y
−1
−2