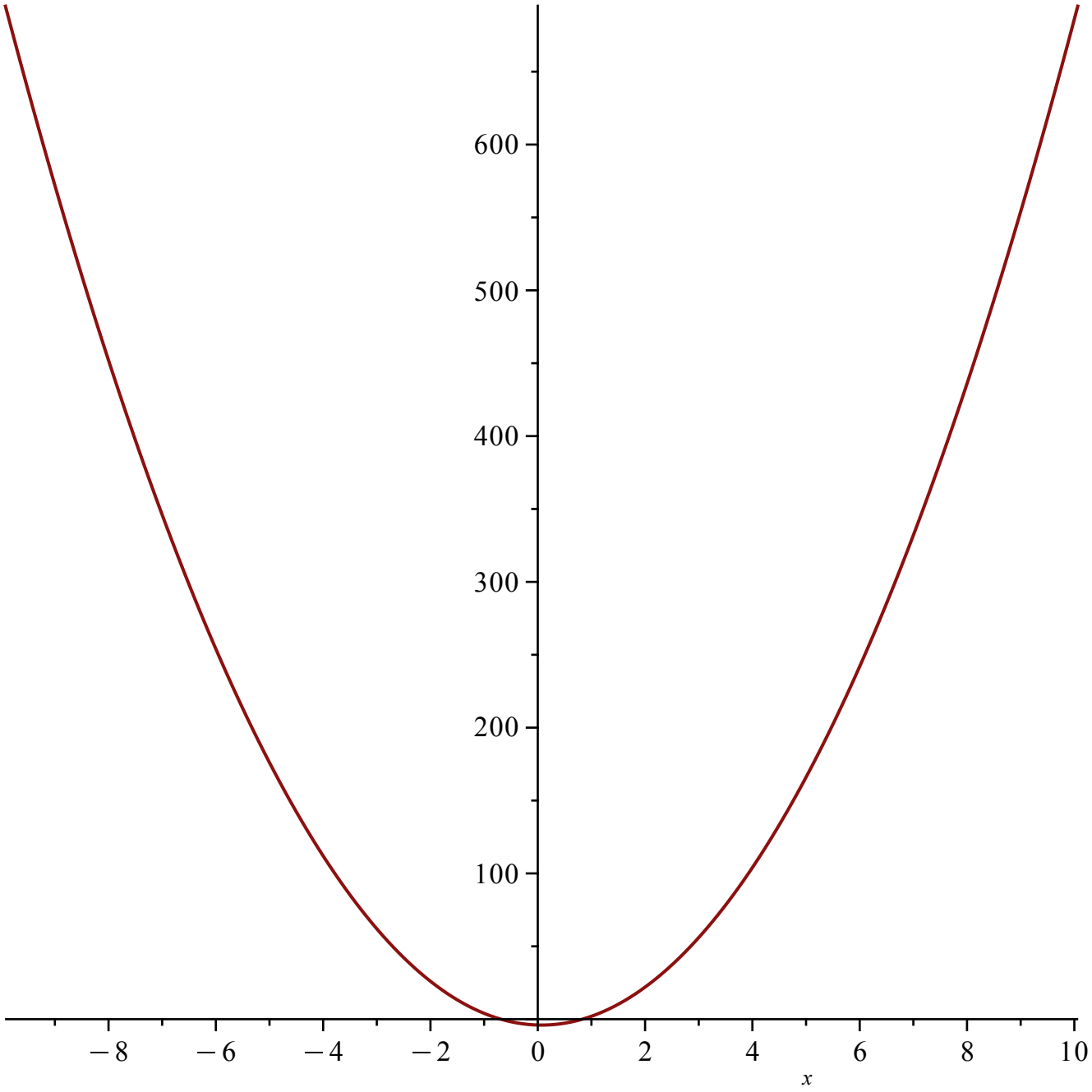
Sara Abdorab

Lab 6:

$$f := x \mapsto 7\,x^2 - x - 4$$

$$f := x \mapsto 7 \cdot x^2 - x - 4 \quad \textbf{(1)}$$

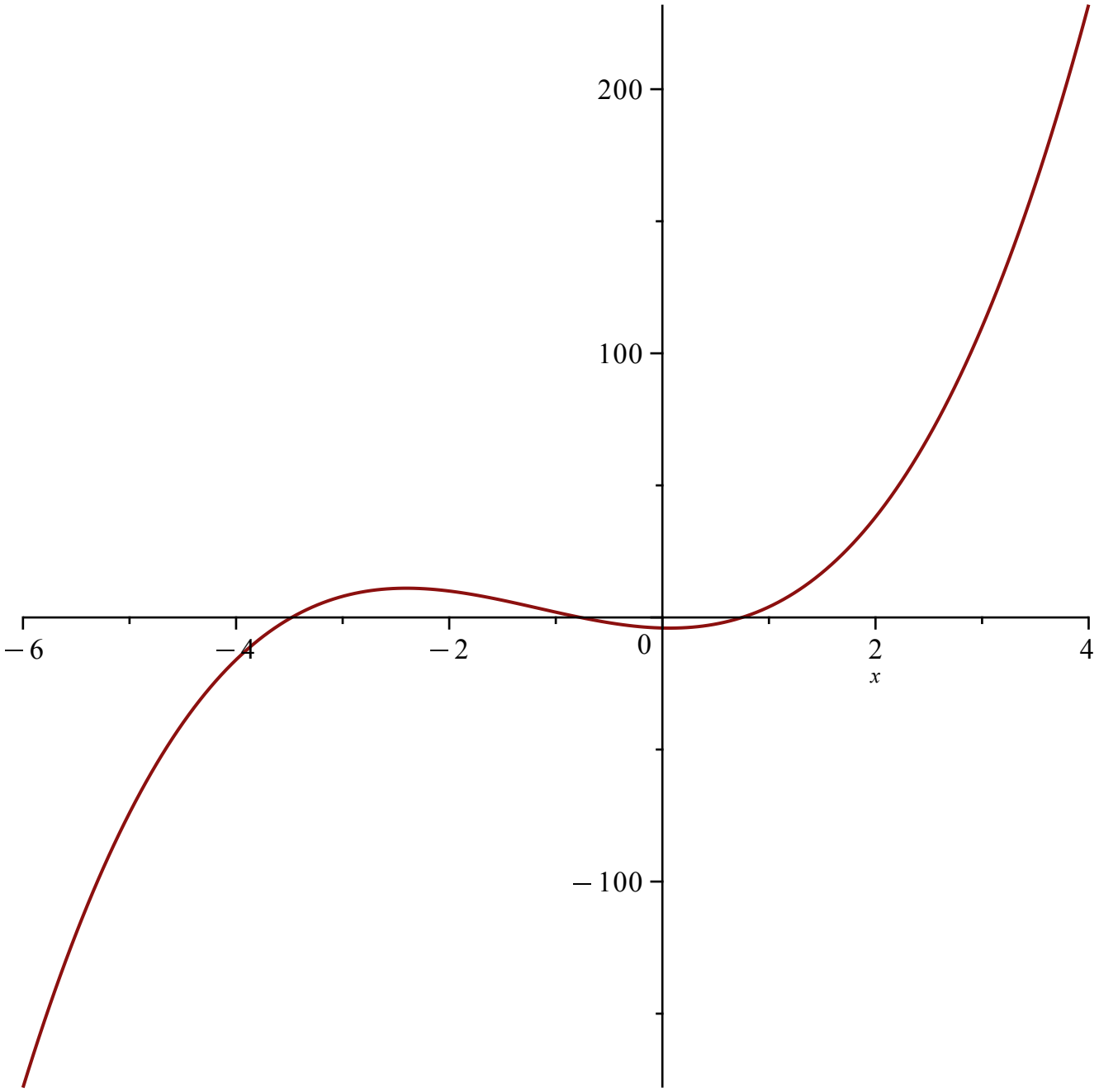
$$plot\left(7\,x^2 - x - 4\right)$$



$$f := x \mapsto 2 \cdot x^3 + 7 \cdot x^2 - x - 4;$$

$$f := x \mapsto 2 \cdot x^3 + 7 \cdot x^2 - x - 4 \quad \textbf{(2)}$$

$$plot(f(x), x = -6..4);$$



$\mathrm{D}(f)(x);$

$$6x^2 + 14x - 1 \quad \textbf{(3)}$$

$solve(\mathrm{D}(f)(x) > 0, x); evalf(\%);$

$$\left(-\infty, -\frac{7}{6} - \frac{\sqrt{55}}{6}\right), \left(-\frac{7}{6} + \frac{\sqrt{55}}{6}, \infty\right)$$

$$(-\infty, -2.402699748), (0.069366414, \infty) \quad \textbf{(4)}$$

$solve(\mathrm{D}(f)(x) = 0, x); evalf(\%);$

$$-\frac{7}{6}+\frac{\sqrt{55}}{6}, -\frac{7}{6}-\frac{\sqrt{55}}{6}$$

$$0.069366414, -2.402699748 \quad \textbf{(5)}$$

$CP := fsolve(\mathrm{D}(f)\ (x) = 0, x);$

$$CP := -2.402699748, 0.06936641452 \quad \textbf{(6)}$$

$CP[1];$

$$-2.402699748 \quad \textbf{(7)}$$

$CP[2];$

$$0.06936641452 \quad \textbf{(8)}$$

$(\mathrm{D@@2})(f)\ (x);$

$$12\,x + 14 \quad \textbf{(9)}$$

$(\mathrm{D@@2})(f)\ (CP[1]);$

$$-14.83239698 \quad \textbf{(10)}$$

$(\mathrm{D@@2})(f)\ (CP[2]);$

$$14.83239697 \quad \textbf{(11)}$$

$solve((\mathrm{D@@2})(f)\ (x) > 0, x);$

$$\left(-\frac{7}{6}, \infty\right) \quad \textbf{(12)}$$

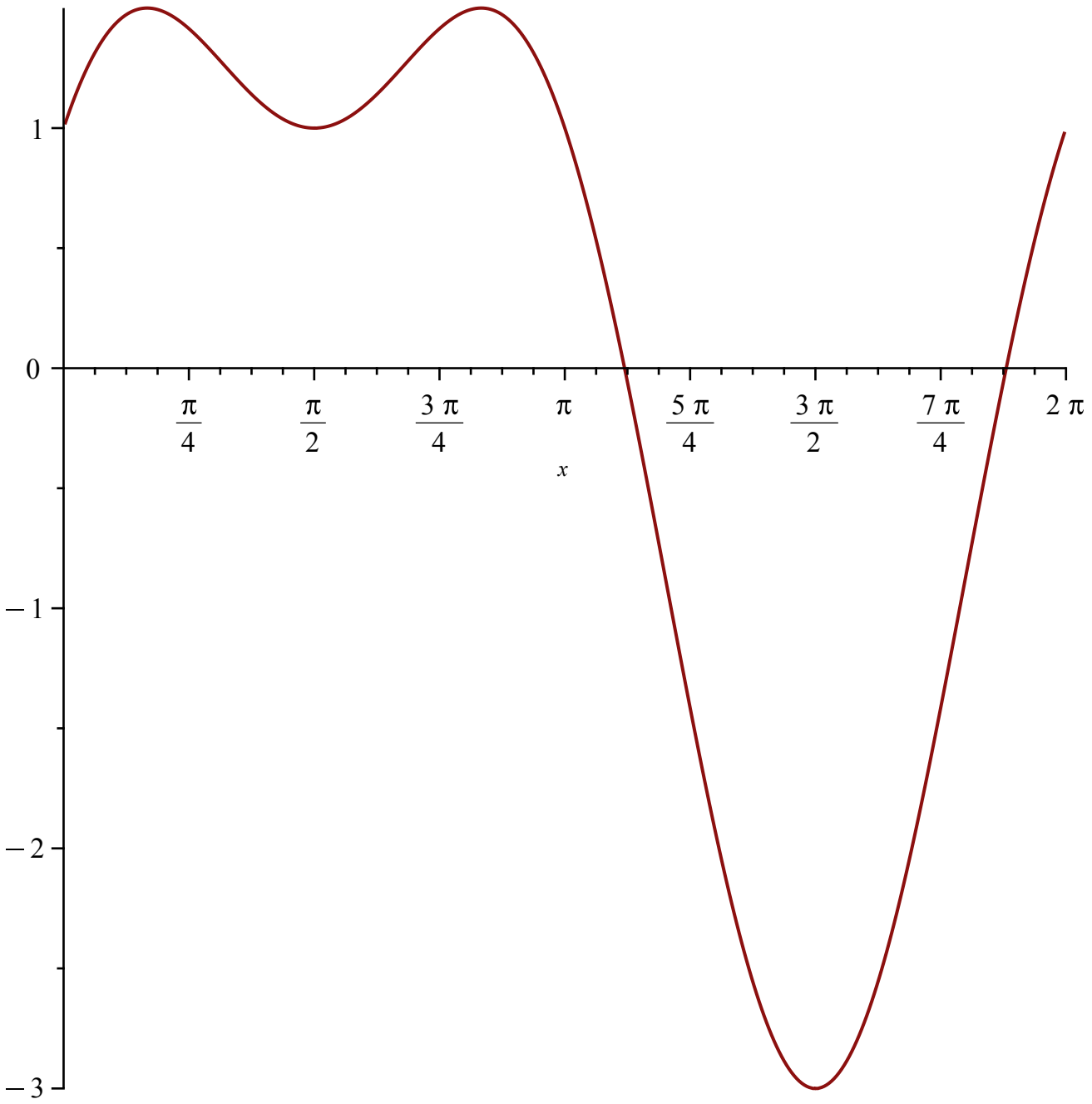
$solve((\mathrm{D@@2})(f)\ (x) = 0, x);$

$$-\frac{7}{6} \quad \textbf{(13)}$$

$f := x \mapsto 2 \cdot \sin(x) + \cos(2 \cdot x);$

$$f := x \mapsto 2 \cdot \sin(x) + \cos(2 \cdot x) \quad \textbf{(14)}$$

$plot(f(x), x = 0..2 \cdot \mathrm{Pi});$



$solve(\mathrm{D}(f)\,(x) > 0, x);$

$$\left(-\frac{9\,\pi}{2}, -\frac{23\,\pi}{6}\right), \left(-\frac{7\,\pi}{2}, -\frac{19\,\pi}{6}\right), \left(-\frac{5\,\pi}{2}, -\frac{11\,\pi}{6}\right), \left(-\frac{3\,\pi}{2}, -\frac{7\,\pi}{6}\right), \left(-\frac{\pi}{2}, \frac{\pi}{6}\right), \left(\frac{\pi}{2}, \frac{5\,\pi}{6}\right), \left(\frac{3\,\pi}{2}, \frac{13\,\pi}{6}\right), \left(\frac{5\,\pi}{2}, \frac{17\,\pi}{6}\right), \left(\frac{7\,\pi}{2}, \frac{25\,\pi}{6}\right), \left(\frac{9\,\pi}{2}, \frac{29\,\pi}{6}\right) \tag{15}$$

$solve(\mathrm{D}(f)\,(x) < 0, x);$

$$\left(-\frac{23\,\pi}{6}, -\frac{7\,\pi}{2}\right), \left(-\frac{19\,\pi}{6}, -\frac{5\,\pi}{2}\right), \left(-\frac{11\,\pi}{6}, -\frac{3\,\pi}{2}\right), \left(-\frac{7\,\pi}{6}, -\frac{\pi}{2}\right), \left(\frac{\pi}{6}, \frac{\pi}{2}\right), \left(\frac{5\,\pi}{6}, \frac{3\,\pi}{2}\right), \left(\frac{13\,\pi}{6}, \frac{5\,\pi}{2}\right), \left(\frac{17\,\pi}{6}, \frac{7\,\pi}{2}\right), \left(\frac{25\,\pi}{6}, \frac{9\,\pi}{2}\right) \tag{16}$$

$$solve(\mathrm{D}(f)\ (x) = 0, x);$$

$$\frac{\pi}{2}, -\frac{\pi}{2}, \frac{\pi}{6}, \frac{5\,\pi}{6} \tag{17}$$

$$(\mathrm{D@@2})(f)\left(\frac{\mathrm{Pi}}{2}\right); (\mathrm{D@@2})(f)\left(\frac{3\cdot \mathrm{Pi}}{2}\right);$$

$$2$$

$$6 \tag{18}$$

$$(\mathrm{D@@2})(f)\left(\frac{\mathrm{Pi}}{6}\right); (\mathrm{D@@2})(f)\left(\frac{5\cdot \mathrm{Pi}}{6}\right);$$

$$-3$$

$$-3 \tag{19}$$

$$fsolve(\ (\mathrm{D@@2})(f)\ (x) = 0, x = 0\ ..2\cdot\pi);$$

$$1.002966954 \tag{20}$$

$$fsolve(\ (\mathrm{D@@2})(f)\ (x) = 0, x = 2\ ..3);$$

$$2.138625700 \tag{21}$$

$$fsolve(\ (\mathrm{D@@2})(f)\ (x) = 0, x = 3\ ..4);$$

$$3.776459525 \tag{22}$$

$$fsolve(\ (\mathrm{D@@2})(f)\ (x) = 0, x = 5\ ..2\cdot\ \pi);$$

$$5.648318436 \tag{23}$$

$$f := x \mapsto \frac{(4\cdot x + 3)}{2\cdot x - 1};$$

$$f := x \mapsto \frac{4\cdot x + 3}{2\cdot x - 1} \tag{24}$$

$$Limit(f(x), x = \infty) = limit(f(x), x = \infty)$$

$$\lim_{x \to \infty} \frac{4\,x + 3}{2\,x - 1} = 2 \tag{25}$$

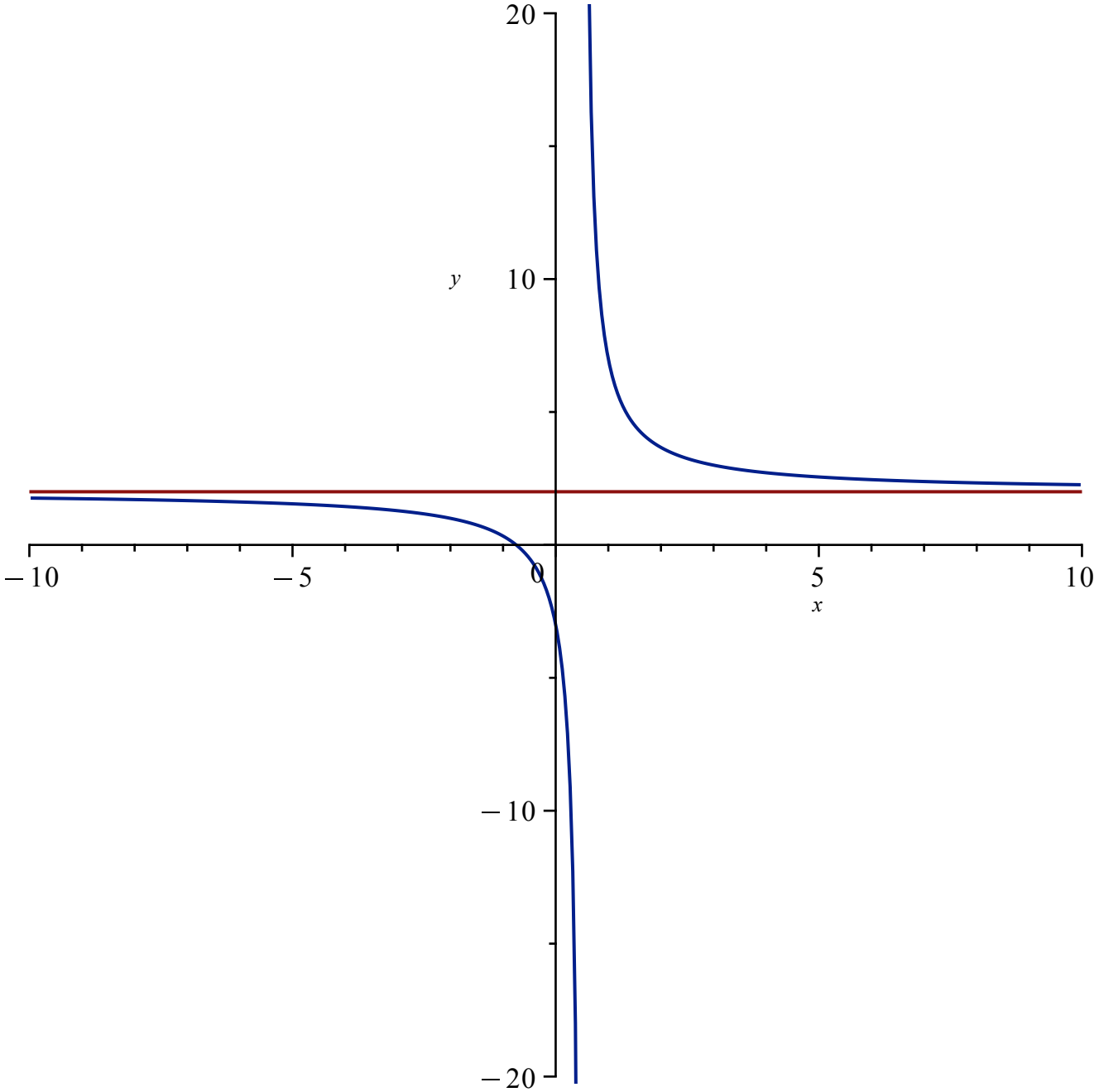
$$Limit(f(x), x = -\infty) = limit(f(x), x = -\infty)$$

$$\lim_{x \to -\infty} \frac{4\,x + 3}{2\,x - 1} = 2 \tag{26}$$

$$solve(2\cdot x - 1 = 0, x);$$

$$\frac{1}{2} \tag{27}$$

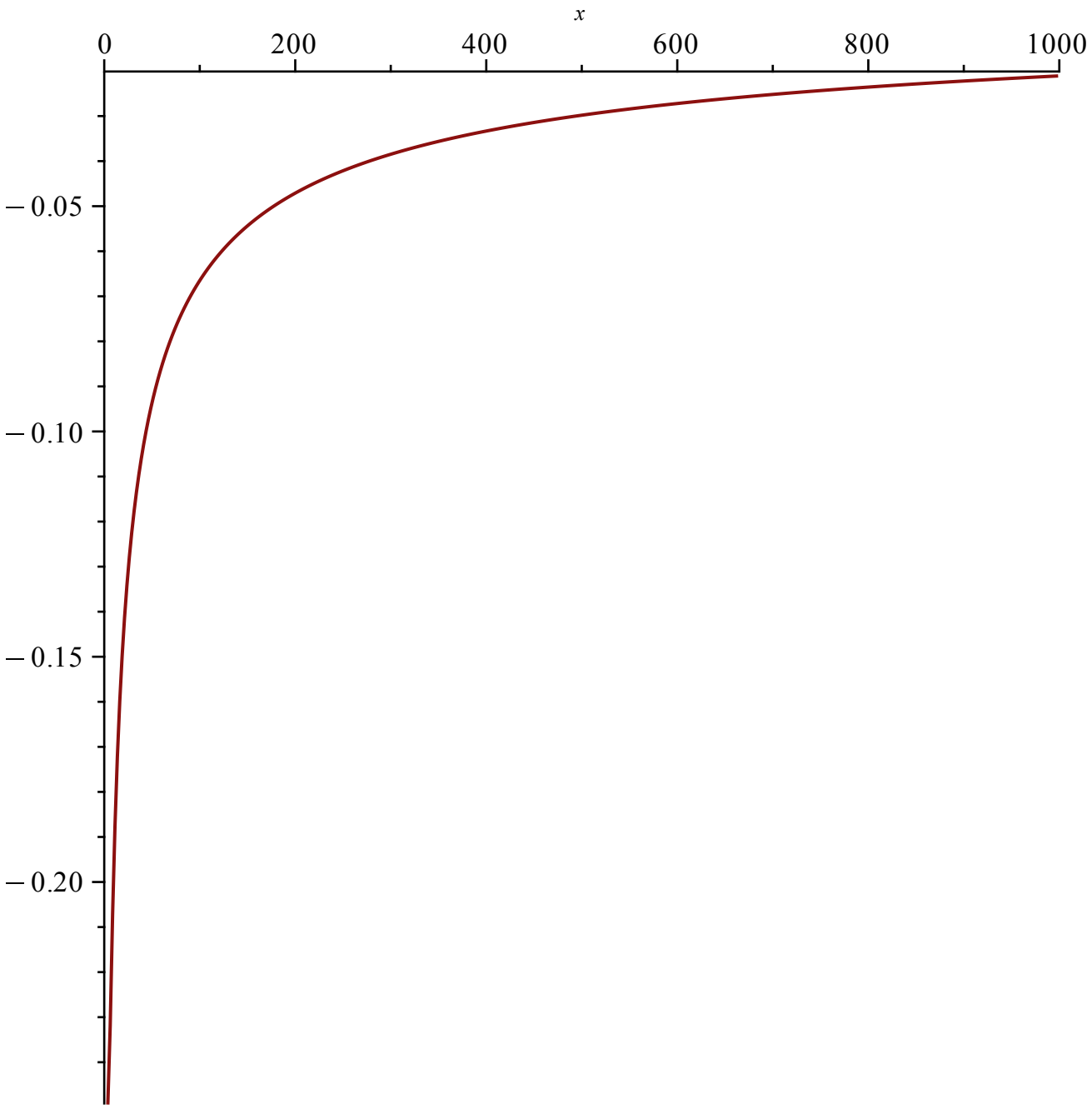
$$plot(\{f(x), 2\}, x = -10\ ..10, y = -20\ ..20);$$



$$f := x \mapsto \frac{\left(5 - 2 \cdot x^{\frac{3}{2}}\right)}{3 \cdot x^2 - 4};$$

$$f := x \mapsto \frac{5 - 2 \cdot x^{3/2}}{3 \cdot x^2 - 4} \quad \textbf{(28)}$$

$plot(f(x), x = 0..1000);$



$$fsolve\left(3\cdot x^2-4=0, x=0..11\right); solve\left(3\cdot x^2-4=0, x\right);$$

$$1.154700538$$

$$\frac{2\sqrt{3}}{3}, -\frac{2\sqrt{3}}{3} \qquad \textbf{(29)}$$

$$Limit(f(x), x=\infty) = limit(f(x), x=\infty)$$

$$\lim_{x\to\infty} \frac{5-2x^{3\,|\,2}}{3x^2-4} = 0 \qquad \textbf{(30)}$$