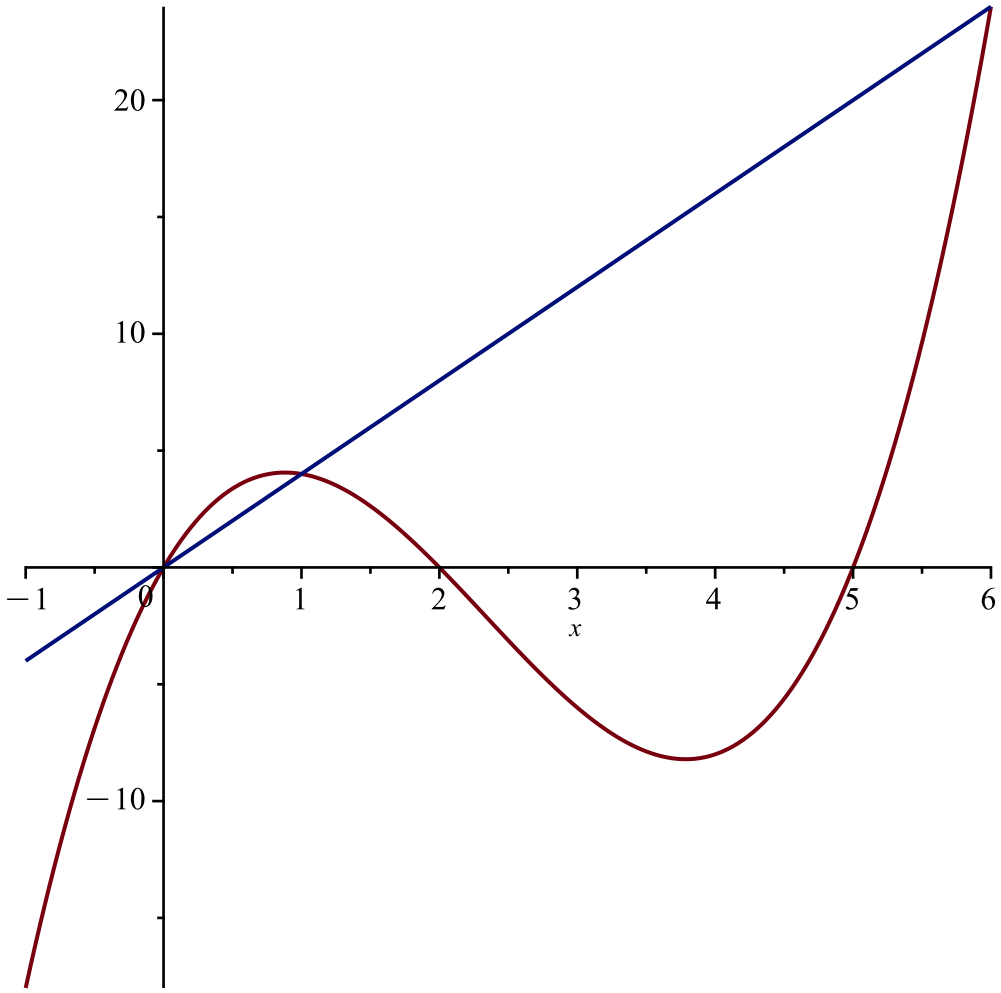
# Rolle's Theorem and Mean-Value Theorem (MVT) Demo.

$f := x \to x \cdot (x-2) \cdot (x-5)$

$$f := x \mapsto x \cdot (x-2) \cdot (x-5) \tag{1.1}$$

$with(plots):$
$plot([f(x), L(x)], x = -1..6)$




$a := 0; b := 6$

$$a := 0$$

$$b := 6 \tag{1.2}$$

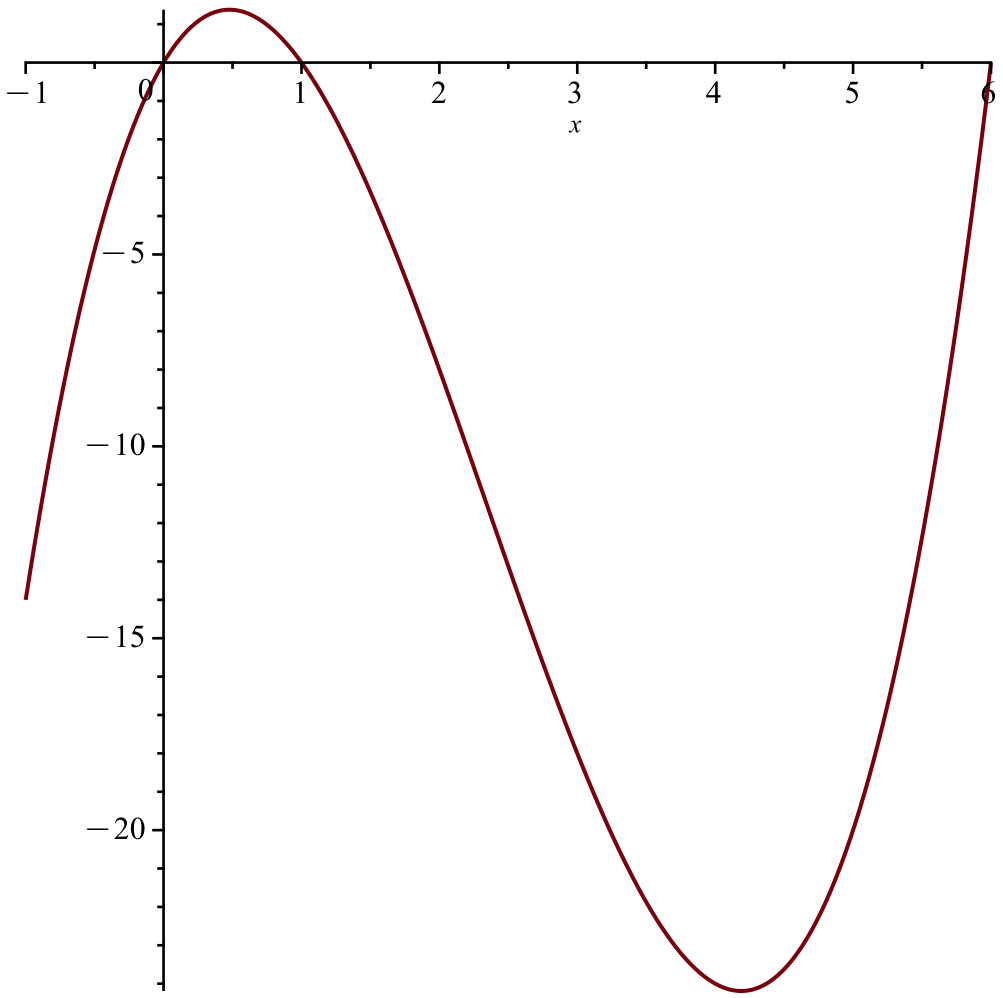
$L := x \to \frac{(f(b) - f(a))}{b-a} \cdot (x-a) + f(a)$

$$L := x \mapsto \frac{(f(b) - f(a)) \cdot (x-a)}{b-a} + f(a) \tag{1.3}$$

$h := x \to f(x) - L(x)$

$$h := x \mapsto f(x) - L(x) \tag{1.4}$$

$plot(h(x), x = -1..6)$




$hp := \mathrm{D}(h)$

$$hp := x \mapsto (x-2)\cdot(x-5) + x\cdot(x-5) + x\cdot(x-2) - 4 \quad \textbf{(1.5)}$$

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

$$fp := x \mapsto (x-2)\cdot(x-5) + x\cdot(x-5) + x\cdot(x-2) \quad \textbf{(1.6)}$$

$solve(hp(x) = 0)$

$$\frac{7}{3} + \frac{\sqrt{31}}{3}, \frac{7}{3} - \frac{\sqrt{31}}{3} \quad \textbf{(1.7)}$$

$c1 := \frac{7}{3} + \frac{\sqrt{31}}{3}$

$$c1 := \frac{7}{3} + \frac{\sqrt{31}}{3} \quad \textbf{(1.8)}$$

$c2 := \frac{7}{3} - \frac{\sqrt{31}}{3}$

$$c2 := \frac{7}{3} - \frac{\sqrt{31}}{3} \quad \textbf{(1.9)}$$

$mavg := \frac{(f(b) - f(a))}{b - a}$

$$mavg := 4 \tag{1.10}$$

$fp(c1)$

$$\left(\frac{1}{3}+\frac{\sqrt{31}}{3}\right)\left(-\frac{8}{3}+\frac{\sqrt{31}}{3}\right)+\left(\frac{7}{3}+\frac{\sqrt{31}}{3}\right)\left(-\frac{8}{3}+\frac{\sqrt{31}}{3}\right)+\left(\frac{7}{3}+\frac{\sqrt{31}}{3}\right)\left(\frac{1}{3}+\frac{\sqrt{31}}{3}\right) \tag{1.11}$$

$simplify(\%)$

$$4 \tag{1.12}$$

$fp(c2)$

$$\left(\frac{1}{3}-\frac{\sqrt{31}}{3}\right)\left(-\frac{8}{3}-\frac{\sqrt{31}}{3}\right)+\left(\frac{7}{3}-\frac{\sqrt{31}}{3}\right)\left(-\frac{8}{3}-\frac{\sqrt{31}}{3}\right)+\left(\frac{7}{3}-\frac{\sqrt{31}}{3}\right)\left(\frac{1}{3}-\frac{\sqrt{31}}{3}\right) \tag{1.13}$$

$simplify(\%)$

$$4 \tag{1.14}$$

$f(x)$

$$x\,(x-2)\,(x-5) \tag{1}$$

$diff(f(x), z)$

$$0 \tag{2}$$