1.

restart

$d := [5.998, 5.997, 5.996, 5.997, 5.996, 5.996, 5.997, 5.999, 5.995, 5.996]:$

$delta_{ins} := 0.004:$

$d_bar := \frac{1}{10} sum(d[i], i = 1 ..10) \ \# \ d的平均值 = $ 5.996700000

$u_a_d := \text{sqrt}\left(\frac{sum((d[i] - d_bar)^2, i = 1 ..10)}{10 - 1} \right) \ \# \qquad\qquad = $

0.001159501809

$u\_a := \text{sqrt}\left(\frac{sum((d[i] - d\_bar)^2, i = 1 ..10)}{10 \cdot (10 - 1)} \right) \ \# \qquad\qquad$ A

$\qquad = $ 0.0003666666666

$u\_b := \frac{delta_{ins}}{\text{sqrt}(3)} : \#B类标准不确定度$

$evalf(u_b) \ \# \ 求值 = $ 0.002309401077

$u_c := \text{sqrt}(u_a^2 + u_b^2) \ \# \qquad\qquad\qquad = $ 0.002338327987

2.

restart

$l := [4.8101, 8.0549, 11.3014, 14.5493, 17.7988, 21.0497]:$

$delta_l := \dfrac{\frac{1}{3}((l[4] - l[1]) + (l[5] - l[2]) + (l[6] - l[3]))}{3 \cdot 10} \ \# \ 逐差法= $

0.3247933333

3.

restart

$with(plots):$

$with(Statistics):$

$t\_v := [[12.0, 2.15], [20.0, 3.30], [25.5, 3.70], [37.1, 4.95], [49.4, 6.55],$
$\quad [60.0, 7.90], [77.8, 9.90]]: \# 时间—速度样本点$

$ft := LinearFit([t, 1], Vector([seq(t\_v[i][1], i = 1 .. nops(t\_v))]),$
$\quad Vector([seq(t\_v[i][2], i = 1 .. nops(t\_v))]), t): \# 最小二乘法$
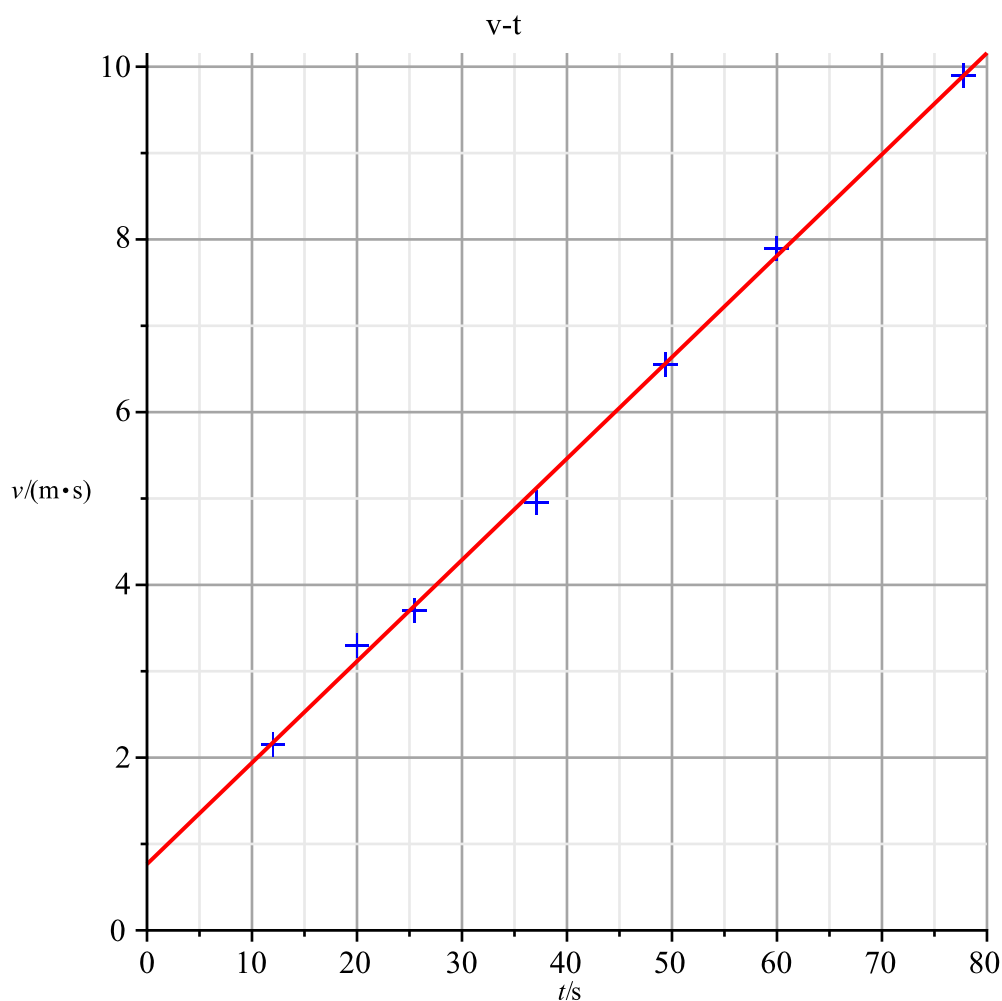
$v0 := coeffs(ft)[1] \ \# \ 初速度 = $ 0.766660899698654

$a := coeffs(ft)[2]$ # 加速度 = 0.117400190568167

$dots := pointplot(t\_v, style = point, symbol = cross, symbolsize = 16, color = blue,$

$\qquad labels = [typeset(t, "/", "s"), typeset(v, "/", "(m \cdot s)")],$
$\qquad title = "v-t", gridlines = true, view = [0..80, 0..10]) :$

$line := plot(ft, t = 0..80, color = red) :$

$display(dots, line)$ # 画图

4.

$restart$

$with(Statistics) :$

$n := 6 :$ # 样本容量

$d\_vals := [23.532, 22.840, 22.375, 21.912, 21.5565, 21.226] :$

$d\_prime\_vals := [26.679, 27.366, 27.865, 28.316, 28.674, 29.030] :$

$d\_vals := Vector(d\_prime\_vals) - Vector(d\_vals) :$

$[seq(d\_vals)]$ # 直径 =

$[3.14700000000000, 4.52600000000000, 5.49000000000000,$
$6.40400000000000, 7.11750000000000, 7.80400000000000]$

$lambda := 589.3 \cdot 10^{-3} : \# \dfrac{波长}{毫米}$

$sqrt\_m\_vals := Vector([seq(\text{sqrt}(5\,i), i = 1\,..\,n)]) :$

$ft := LinearFit([sqrt\_m, 1], sqrt\_m\_vals, d\_vals, sqrt\_m) : \# 最小二乘法$

$\text{rho} := \dfrac{coeffs(ft)[2]^2}{4\,lambda} \quad \# \text{ 曲率半径} = 0.872075103473402$

$s_a := \text{sqrt}\left(\dfrac{\dfrac{1}{Correlation(sqrt\_m\_vals,\, d\_vals)^2} - 1}{n - 2}\right) coeffs(ft)[2] :$

$\# \text{ 斜率不确定度}$

$u := \dfrac{\text{abs}(coeffs(ft)[2])}{2\,lambda} s_a \# \text{ 曲率半径不确定度} = 0.0126952639532919$