Approximants de Padé et TI 92

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1 Ecriture d'une procédure déterminant les coefficients d'un polynôme donné

Soit P un polynôme de la variable x de degré n. Si $P(x) = a_0 + a_1x + a_2x^2 + \cdots + a_nx^n$ alors pour tout entier k inférieur ou égal à n,

$$P^{(k)}(x) = k!a_k + (k+1)!a_{k+1}x + \cdots + \frac{n!}{(n-k)!}a_nx^{n-k}$$

on en déduit que

$$a_k = \frac{p^{(k)}(0)}{k!}$$

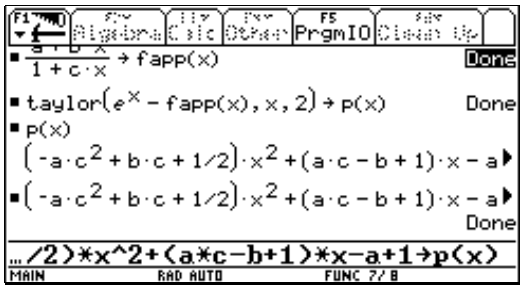
Algorithme	Programme
	`coefpoly(exp1,var,d)`
	`Func`
Déclarer les variables locales l1 et n	`local l1,n`
Initialiser n à 0 et l1 à liste vide	`{}→l1: 0 →n`
Tant que n est inférieur ou égal au degré	`While n≤ d`
Calculer a_n et le stocker dans l1[n+1]	`(exp1|var=0)/(n !)→l1[n+1]`
Augmenter n de 1	`n+1→n`
Calculer la dérivée (n+1)ème de exp1	`d(exp1, var) →exp1`
Fin du Tant Que	`Endwhile`
Sortir l1	`l1`
Fin de la fonction	`EndFunc`

2 Résolution du TD à l'aide de la TI-92

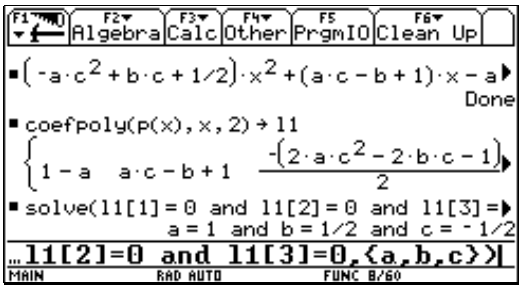
1) On définit $fapp(x)$.
2) On demande le développement de taylor de $e^x - fapp(x)$ à l'ordre 2.
3) Le résultat est stocké dans $p(x)$.
4) On met dans `l1` les coefficients de p.
5) On résout le système :

$$\begin{cases} \texttt{l1}[1] = 0 \\ \texttt{l1}[2] = 0 \\ \texttt{l1}[3] = 0 \end{cases}$$

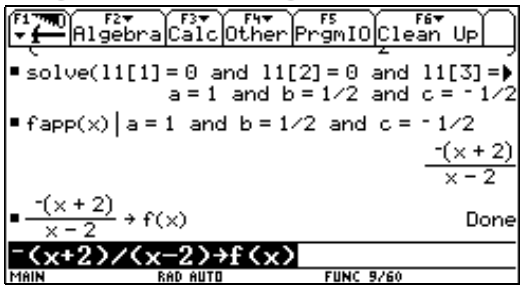
par rapport aux variables a, b et c.



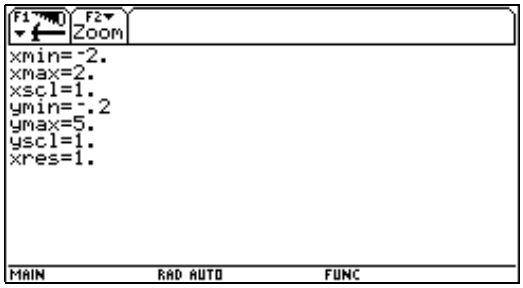
On définit alors la fonction $f = fapp$ en remplaçant a, b et c par les valeurs. trouvées

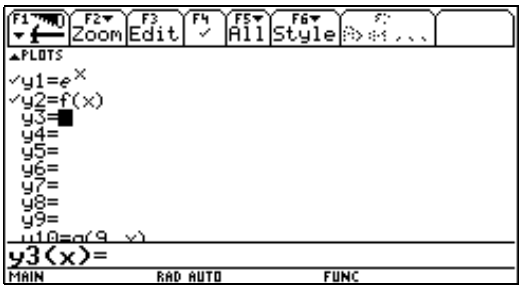


On entre les fonctions dans l'éditeur de fonctions

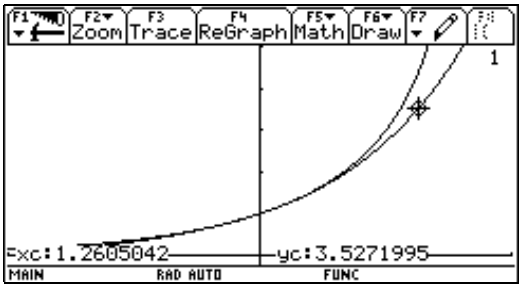


On entre la fenêtre désirée.

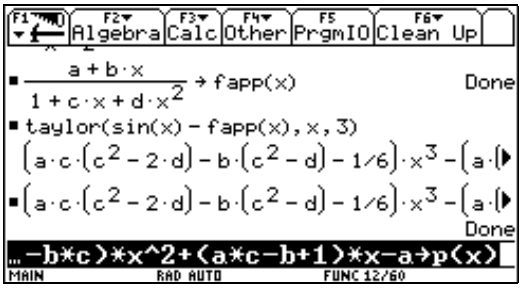


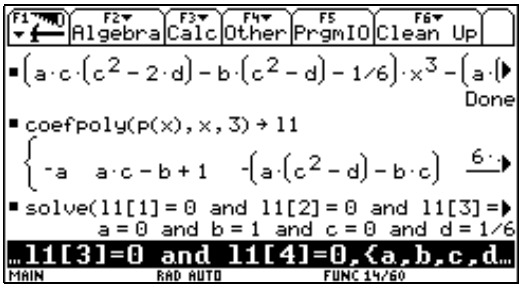


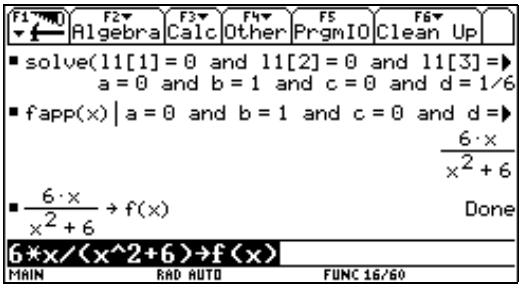
On trace les deux graphes.

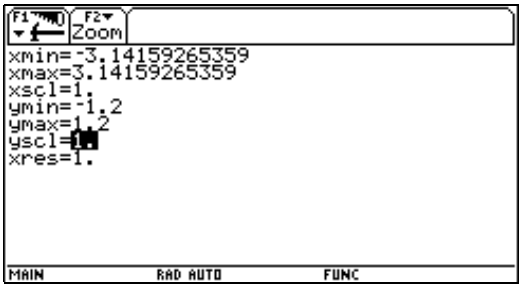


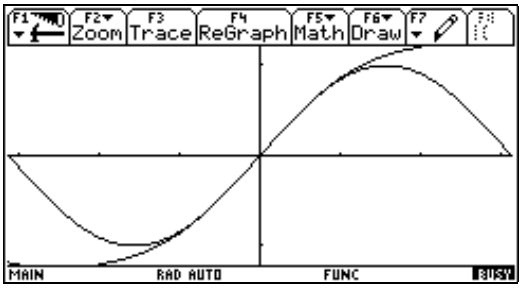
On recommence pour la fonction
$sin(x)$ avec $p = 1$ et $q = 2$



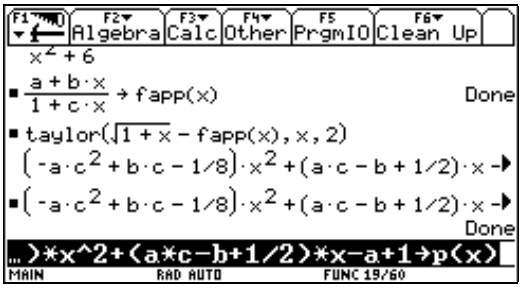


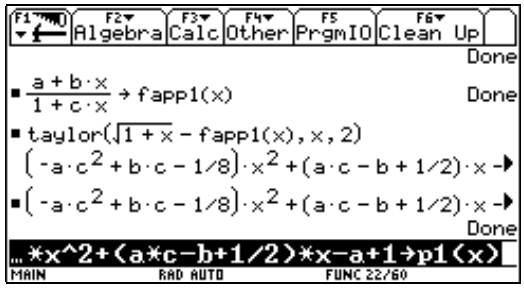


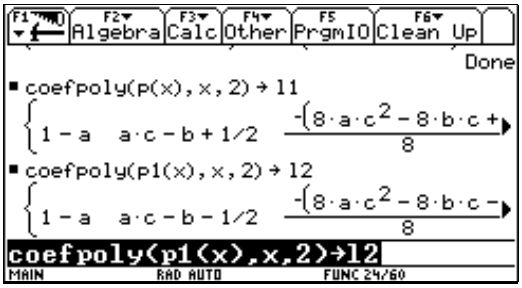


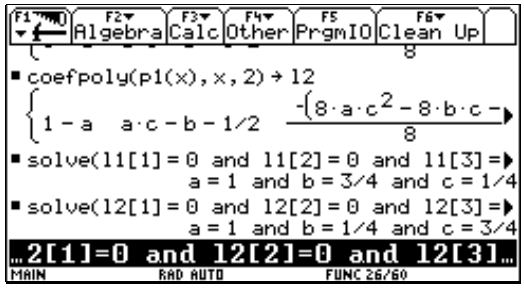


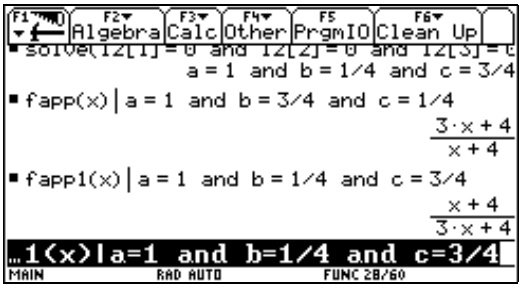
Comparaison des Padé [1/1] des fonctions $\sqrt{x+1}$ et $\dfrac{1}{\sqrt{x+1}}$



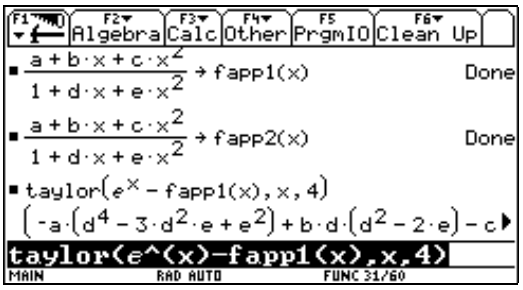


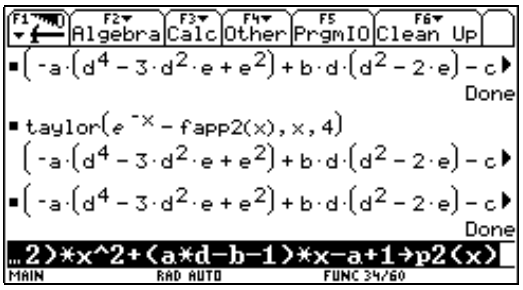


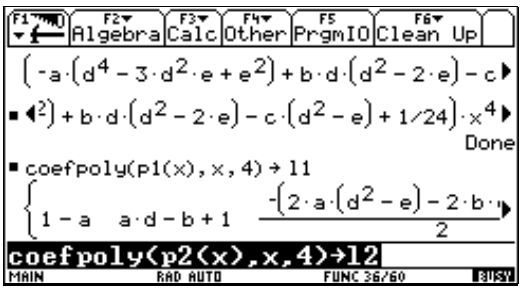


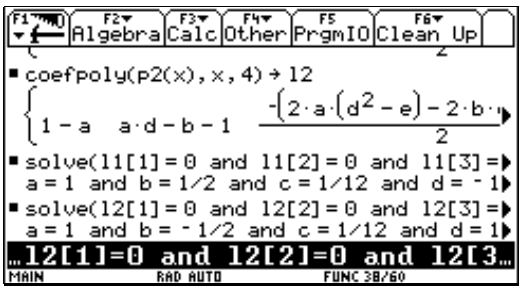


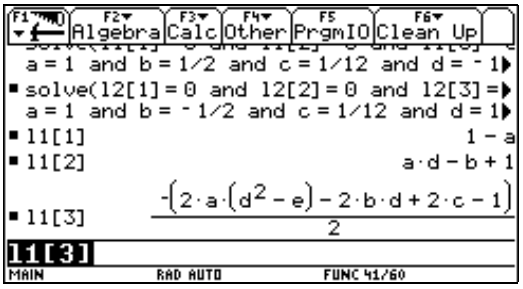
Comparaison des Padé [2/2] des fonctions e^x et e^{-x}.

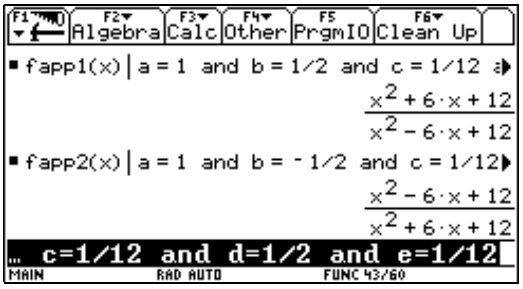




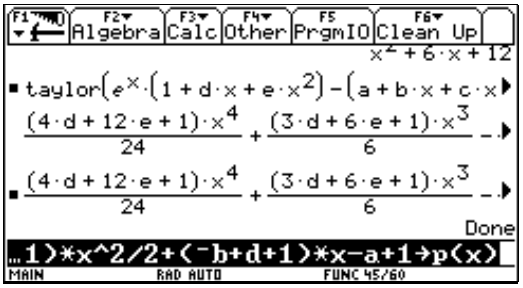


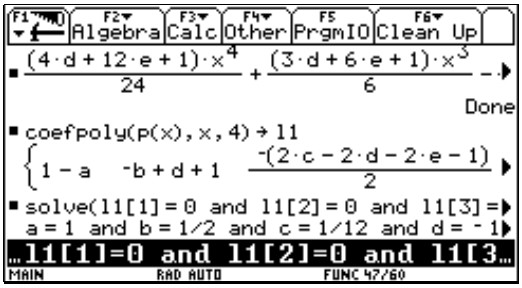


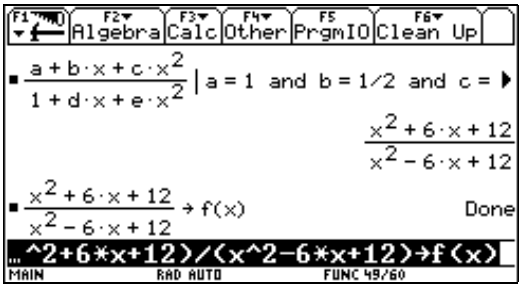


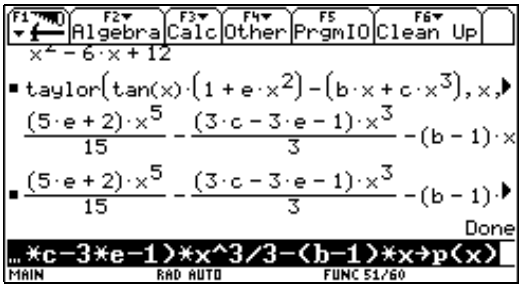


Les calculs deviennent si l'on procède par l'intermédiaire du produit :

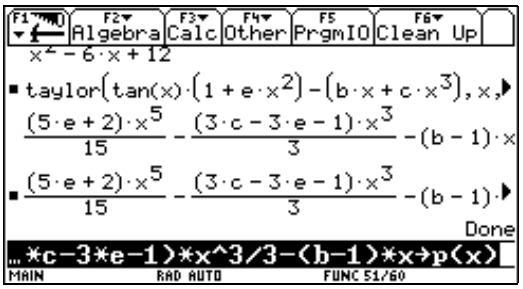


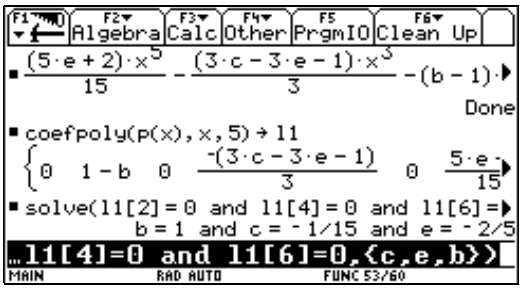




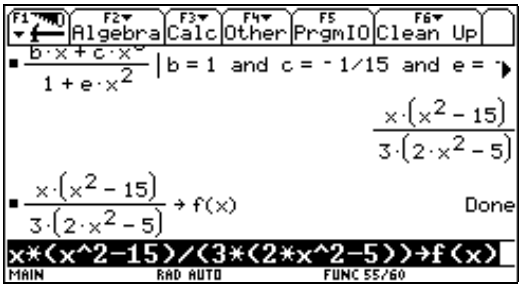


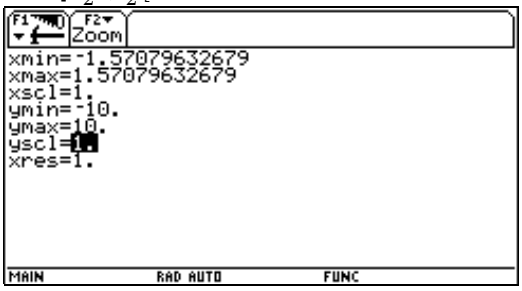
Recherche du Pade $[3/3]$ de $\tan(x)$:



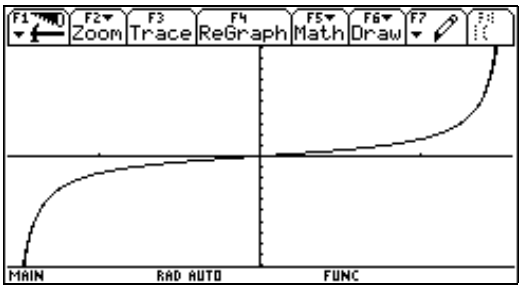


Sur $]\frac{-\pi}{2};\frac{\pi}{2}[$,

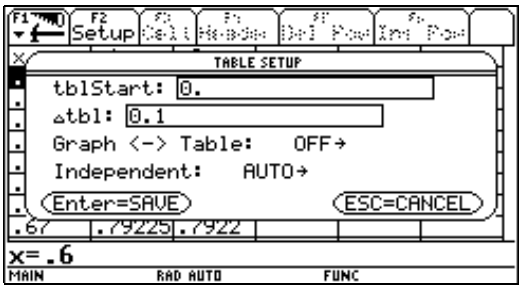


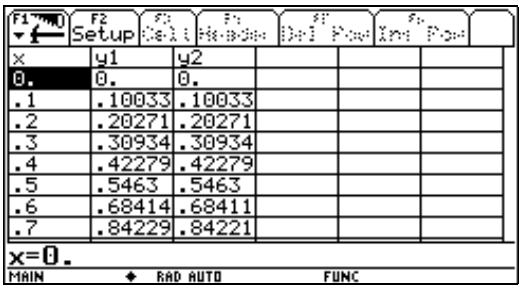


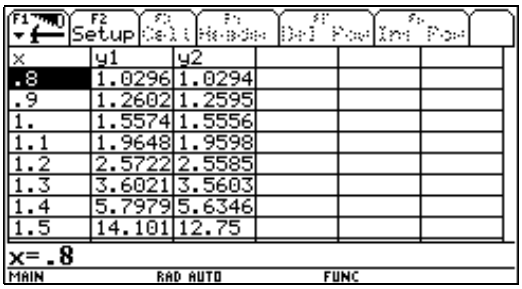
On peut comparer les graphes

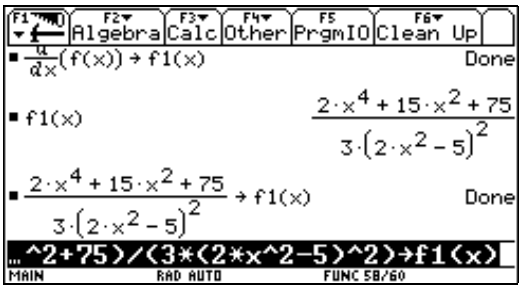


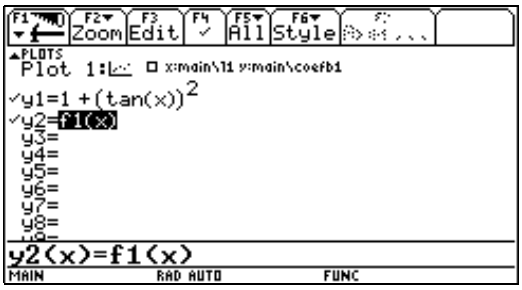
et les valeurs des deux fonctions.











De même pour les dérivées.