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/*
wxMaxima 0.7.4 http://wxmaxima.sourceforge.net
Maxima 5.14.0 http://maxima.sourceforge.net
Using Lisp GNU Common Lisp (GCL) GCL 2.6.8 (aka GCL)
Distributed under the GNU Public License. See the file COPYING.
Dedicated to the memory of William Schelter.
The function bug_report() provides bug reporting information.

(%i1) w(x):=1 /* define the weight */;
(%o1) w(x) := 1

(%i2)
nn(f1,f2):=integrate(f1(x)*f2(x)*w(x),x,0,T) /*define inner product */;
(%o2) nn(f1 , f2) := integrate(f1(x)f2(x)w(x), x , 0 , T)

(%i3) p0(x):=1 /*define first element of basis */;
(%o3) p0(x) := 1

(%i4) p1(x):=x /* define second element */;
(%o4) p1(x) := x

(%i5)
p0n(x):=p0(x)/sqrt(nn(p0,p0)) /* define normalised first basis poly */;
(%o5) p0n(x) := 
$$\frac{p_0(x)}{\sqrt{\text{nn}(p_0, p_0)}}$$


(%i6) p0n(x);
(%o6) 
$$\frac{1}{\sqrt{T}}$$


(%i7)
p1w(x):=p1(x)-nn(p1,p0n)*p0n(x) /* define second orthogonal but un-norm
poly */;
(%o7) p1w(x) := p1(x) - nn(p1 , p0n) p0n(x)

(%i8) p1w(x);
(%o8) 
$$x - \frac{T}{2}$$


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(%i9)

p1n(x) := p1w(x) / sqrt(nn(p1w, p1w)) /*normalise second basis poly */;

(%o9)
$$p1n(x) := \frac{p1w(x)}{\sqrt{nn(p1w, p1w)}}$$

(%i10) ff(x) := exp(a*x);

(%o10) ff(x) := exp(a x)

(%i11) b() := nn(ff, p0n) /*p0n coefficient */;

(%o11) b() := nn(ff, p0n)

(%i12) b();

(%o12)
$$\frac{\frac{e^{aT} - 1}{a} - \frac{1}{a}}{\sqrt{T}}$$

(%i13) assume(T>0);

(%o13) [T > 0]

(%i14) a() := nn(ff, p1n) /*p1n coefficient */;

(%o14) a() := nn(ff, p1n)

(%i15) a();

(%o15)
$$\frac{2\sqrt{3} \left(\frac{(aT - 2)e^{aT}}{2a^2} + \frac{aT + 2}{2a^2} \right)}{T^{3/2}}$$

(%i16) pp(x) := b() * p0n(x) + a() * p1n(x);

(%o16) pp(x) := b() p0n(x) + a() p1n(x)

(%i17) pp(x);

(%o17)
$$\frac{12 \left(x - \frac{T}{2} \right) \left(\frac{(aT - 2)e^{aT}}{2a^2} + \frac{aT + 2}{2a^2} \right)}{T^3} + \frac{\frac{e^{aT} - 1}{a} - \frac{1}{a}}{T}$$

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(%i18) subst(1, T, %);
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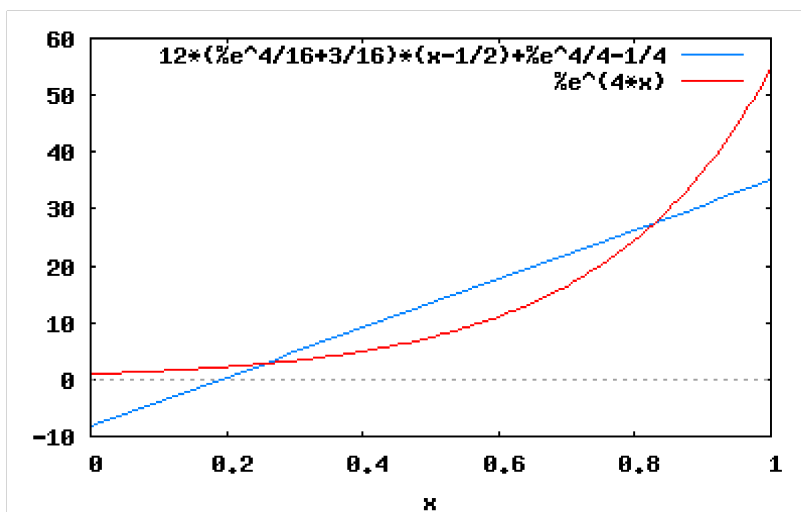
$$12 \left(\frac{(a-2)e^a}{2a^2} + \frac{a+2}{2a^2} \right) \left(x - \frac{1}{2} \right) + \frac{e^a}{a} - \frac{1}{a}$$

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(%i19) subst(4, a, %);
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$$12 \left(\frac{e^4}{16} + \frac{3}{16} \right) \left(x - \frac{1}{2} \right) + \frac{e^4}{4} - \frac{1}{4}$$

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(%i20) wxplot2d([%,exp(4*x)], [x,0,1])$
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(%t20)
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(%i21) float(%), numer;
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(%o21)
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(%i22) float(%o19), numer;
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(%o22) 43.19861252485818 (x - 0.5) + 13.39953750828606
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(%i23) expand(%);
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(%o23) 43.19861252485818 x - 8.19976875414303
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(%i24)
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