## Chapter 1 Problem 3:

Constrained expression:

In[1]:=
```
y[x_] := g[x] + 1/3 (-3 + x) (-1 + x) (g[1] - g[0]) +
  1/6 (-3 + 2 (-1 + x) x) (π - (D[g[τ], τ] /. τ → 2)) + 2 / 3 * (-1 - 1 / 2 * Integrate[g[τ], {τ, 0, 3}]);
y[x] // TraditionalForm
```

Out[2]//TraditionalForm=

$$\frac{1}{6}(2(x-1)x-3)(\pi-g'(2))+\frac{2}{3}\left(-\frac{1}{2}\int_0^3 g(\tau)\,d\tau-1\right)+\frac{1}{3}(g(1)-g(0))(x-3)(x-1)+g(x)$$

Check the constraints (note last is true after simplification):

In[3]:=
```
FullSimplify[y[1] - y[0] == 0]
FullSimplify[(D[y[x], x] /. x → 2) - π == 0]
FullSimplify[1 / 2 * Integrate[y[x], {x, 0, 3}] + 1 == 0]
```

Out[3]= True

Out[4]= True

Out[5]= $2+\int_0^3 \frac{1}{6}\left(2(-3+x)(-1+x)(-g[0]+g[1])+6\,g[x]-2\left(2+\int_0^3 g[\tau]\,d\tau\right)+(-3+2(-1+x)x)(\pi-g'[2])\right)dx == 0$

Check integral constraint with some g:

In[6]:=
```
g[x_] := x^2 Sin[x];
FullSimplify[N[FullSimplify[1 / 2 * Integrate[y[x], {x, 0, 3}] + 1]] == 0]
```

Out[7]= True