Chapter 1 Problem 1:

1.

Constrained expression

In[1]:=
```
y1[x_] := g[x] + (y0 - g[x0]) + (x - x0) (yx0 - (D[g[x], x] /. x → x0));
y1[x] // TraditionalForm
```

Out[2]//TraditionalForm=

$$(x - \text{x0})\,(\text{yx0} - g'(\text{x0})) + g(x) - g(\text{x0}) + \text{y0}$$

Check the constraints

In[3]:=
```
y1[x0] - y0 == 0
(D[y1[x], x] /. x → x0) - yx0 == 0
```

Out[3]= True

Out[4]= True

2.

Constrained expression

In[5]:=
```
y2[x_] := g[x] + (yf - g[xf]) + (x - xf) (yx0 - (D[g[x], x] /. x → x0));
y2[x] // TraditionalForm
```

Out[6]//TraditionalForm=

$$(x - \text{xf})\,(\text{yx0} - g'(\text{x0})) + g(x) - g(\text{xf}) + \text{yf}$$

Check the constraints

In[7]:=
```
(D[y2[x], x] /. x → x0) - yx0 == 0
y2[xf] - yf == 0
```

Out[7]= True

Out[8]= True

3.

Constrained expression

In[9]:=
```
y3[x_] := g[x] + (y0 - g[x0]) + (x - x0) (yxf - (D[g[x], x] /. x → xf));
y3[x] // TraditionalForm
```

Out[10]//TraditionalForm=

$$(x - \text{x0})\,(\text{yxf} - g'(\text{xf})) + g(x) - g(\text{x0}) + \text{y0}$$

Check the constraints

In[11]:=
```
y3[x0] - y0 == 0
(D[y3[x], x] /. x → xf) - yxf == 0
```

Out[11]= True

Out[12]= True

4.

Constrained expression

In[13]:=
```
y4[x_] := g[x] + (x - xf)^2 (-2 x + 3 x0 - xf) / (x0 - xf)^3 (y0 - g[x0]) + (x - x0) (x - xf)^2 / (x0 - xf)^2 (yx0 - (D[g[x], x] /. x → x0)) +
  (x - x0)^2 (2 x + x0 - 3 xf) / (x0 - xf)^3 (yf - g[xf]) + (x - x0)^2 (x - xf) / (x0 - xf)^2 (yxf - (D[g[x], x] /. x → xf));
y4[x] // TraditionalForm
```

Out[14]//TraditionalForm=

$$\frac{(x-\text{x0})\,(x-\text{xf})^2\,(\text{yx0}-g'(\text{x0}))}{(\text{x0}-\text{xf})^2}+\frac{(x-\text{x0})^2\,(x-\text{xf})\,(\text{yxf}-g'(\text{xf}))}{(\text{x0}-\text{xf})^2}+\frac{(x-\text{xf})^2\,(\text{y0}-g(\text{x0}))\,(-2\,x+3\,\text{x0}-\text{xf})}{(\text{x0}-\text{xf})^3}+\frac{(x-\text{x0})^2\,(\text{yf}-g(\text{xf}))\,(2\,x+\text{x0}-3\,\text{xf})}{(\text{x0}-\text{xf})^3}+g(x)$$

Check the constraints

In[15]:=
```
y4[x0] - y0 == 0
(D[y4[x], x] /. x → x0) - yx0 == 0
FullSimplify[y4[xf] - yf == 0]
FullSimplify[(D[y4[x], x] /. x → xf) - yxf == 0]
```

Out[15]= True

Out[16]= True

Out[17]= True

Out[18]= True