SkalarproduktFunktionen

Buch:Höhere Mathematik sehen und verstehen, Haftendorn, Riebesehl, Dammer, Springer Spektrum, Feb. 2021

Datei fkt-skalar.nb zu Abschnitt 2.1.6.2 Seite 144, Abb. 2.7

In[•]:= `g[x_] := 1/2 + 1/2 (1 - x)^2`

In[•]:= `f[x_] = 1/2 + 1/8 (2 - x)^3 (*f[x_]:=3/2-1/2x*)`

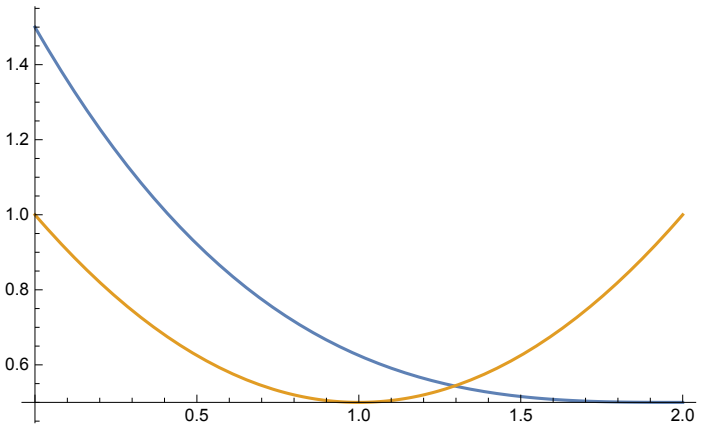
Out[•]= $\frac{1}{2} + \frac{1}{8}(2 - x)^3$

In[•]:= `{4 f[x], 4 g[x]} // Simplify`

Out[•]= $\left\{\frac{1}{2}\left(4 + (2 - x)^3\right), 2\left(2 - 2x + x^2\right)\right\}$

In[•]:= `Plot[{f[x], g[x]}, {x, 0, 2}]`

Out[•]=



In[•]:= `f[x]`

Out[•]= $\frac{1}{2} + \frac{1}{8}(2 - x)^3$

In[•]:= `f[x] /. x → 1`

Out[•]= $\frac{5}{8}$

In[•]:= `Table[f[x], {x, 0, 2, 1/2}]`

Out[•]= $\left\{\frac{3}{2}, \frac{59}{64}, \frac{5}{8}, \frac{33}{64}, \frac{1}{2}\right\}$

In[•]:=
```
fvdv = Table[4 f[x], {x, 0, 2, 1/2}]
```
Out[•]= $\left\{6, \frac{59}{16}, \frac{5}{2}, \frac{33}{16}, 2\right\}$

In[•]:=
```
gvdv = Table[4 g[x], {x, 0, 2, 1/2}]
```
Out[•]= $\left\{4, \frac{5}{2}, 2, \frac{5}{2}, 4\right\}$

In[•]:=
```
fvdv.gvdv
```
Out[•]= $\frac{411}{8}$

In[•]:=
```
% // N
```
Out[•]= 51.375

In[•]:=
```
1/2 fvdv.gvdv
% // N
```
Out[•]= $\frac{411}{16}$

Out[•]= 25.6875

In[•]:=
```
fv10dv = Table[4 f[x], {x, 0, 2, 1/5}]
```
Out[•]= $\left\{6, \frac{1229}{250}, \frac{506}{125}, \frac{843}{250}, \frac{358}{125}, \frac{5}{2}, \frac{282}{125}, \frac{527}{250}, \frac{254}{125}, \frac{501}{250}, 2\right\}$

In[•]:=
```
gv10dv = Table[4 g[x], {x, 0, 2, 1/5}]
```
Out[•]= $\left\{4, \frac{82}{25}, \frac{68}{25}, \frac{58}{25}, \frac{52}{25}, 2, \frac{52}{25}, \frac{58}{25}, \frac{68}{25}, \frac{82}{25}, 4\right\}$

In[•]:=
```
1/5 fv10dv.gv10dv
% // N
```
Out[•]= $\frac{62\,249}{3125}$

Out[•]= 19.9197

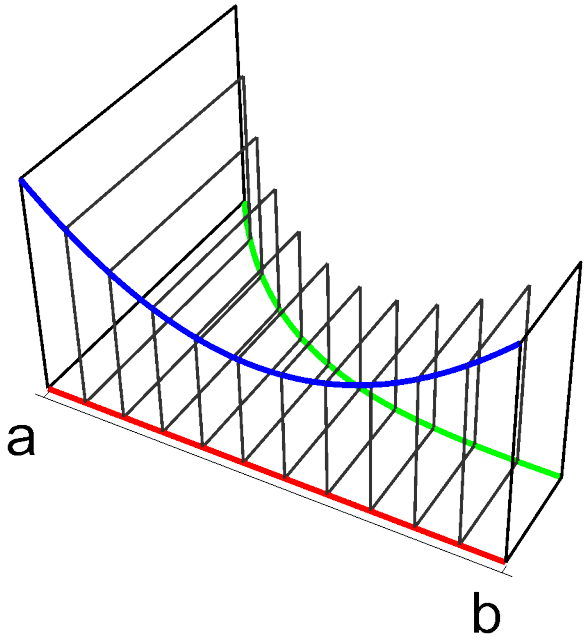
In[•]:=
```
∫_0^2 16 f[x] × g[x] 𝕕x
```
Out[•]= $\frac{248}{15}$

In[•]:=
```
% // N
```
Out[•]= 16.5333

```
In[•]:= rects = ParametricPlot3D[
          {{x, t f[x], 0}, {x, t f[x], g[x]}, {x, 0, t g[x]}, {x, f[x], t g[x]}}, {x, 0, 2},
          {t, 0, 1}, BaseStyle → {Opacity[1], Thickness[0.005], FontSize → 30}, PlotRange → All,
          Boxed → False, MeshFunctions -> {#1 &}, Mesh → 10, MeshShading → {Opacity[0.5]},
          Axes → {True, False, False}, Ticks → {{{0, "a"}, {2, "b"}}, None}];

In[•]:= rectsleer = ParametricPlot3D[
          {{x, t f[x], 0}, {x, t f[x], g[x]}, {x, 0, t g[x]}, {x, f[x], t g[x]}}, {x, 0, 2},
          {t, 0, 1}, BaseStyle → {Opacity[1], Thickness[0.005], FontSize → 30}, PlotRange → All,
          Boxed → False, MeshFunctions -> {#1 &}, Mesh → 10, MeshShading → {Opacity[0]},
          Axes → {True, False, False}, Ticks → {{{0, "a"}, {2, "b"}}, None}];

In[•]:= lines0 = ParametricPlot3D[{{x, 0, 0}, {x, 0, g[x]}, {x, f[x], 0}}, {x, 0, 2}, PlotStyle →
           {{Thickness[0.009], Red}, {Thickness[0.009], Blue}, {Thickness[0.009], Green}},
          BaseStyle → {Thickness[0.008]}, PlotRange → All, Boxed → False, Mesh → None];

In[•]:= lines =
         ParametricPlot3D[{{x, 0, 0}, {x, 0, g[x]}, {x, f[x], 0}, {x, f[x], g[x]}}, {x, 0, 2},
          PlotStyle → {{Thickness[0.011], Red}, {Thickness[0.009], Blue},
            {Thickness[0.009], Green}, {Thickness[0.009], RGBColor[0.8, 0, 1]}},
          BaseStyle → {Thickness[0.008]}, PlotRange → All, Boxed → False, Mesh → None];

In[•]:= extra =
         Graphics3D[{Line[{{0, 0, 0}, {0, f[0], 0}, {0, f[0], g[0]}, {0, 0, g[0]}, {0, 0, 0}}],
           Line[{{2, 0, 0}, {2, f[2], 0}, {2, f[2], g[2]}, {2, 0, g[2]}, {2, 0, 0}}]}];

In[•]:= allrects =
         Graphics3D[{EdgeForm[Thickness[0.007]], FaceForm[RGBColor[0, 1, 1]], Opacity[0.5],
           Table[Polygon[{{x, 0, 0}, {x, f[x], 0}, {x, f[x], g[x]}, {x, 0, g[x]}, {x, 0, 0}}],
            {x, 0, 2, 0.2}]}, Boxed → False];

In[•]:= allvects = Graphics3D[{Thickness[0.007], Table[{Arrow[{{x, 0, 0}, {x, f[x], 0}}],
            Arrow[{{x, 0, 0}, {x, 0, g[x]}}]}, {x, 0, 2, 0.2}]}, Boxed → False];

In[•]:= allboxes =
         Graphics3D[{EdgeForm[Thickness[0.003]], FaceForm[RGBColor[1, 1, 1]], Opacity[0.3],
           Table[Cuboid[{x, 0, 0}, {x + 0.2, f[x], g[x]}], {x, 0, 2, 0.2}]}, Boxed → False];
```

In[ ]:=
```
Show[rectsleer, extra, lines0]
```

Out[ ]=

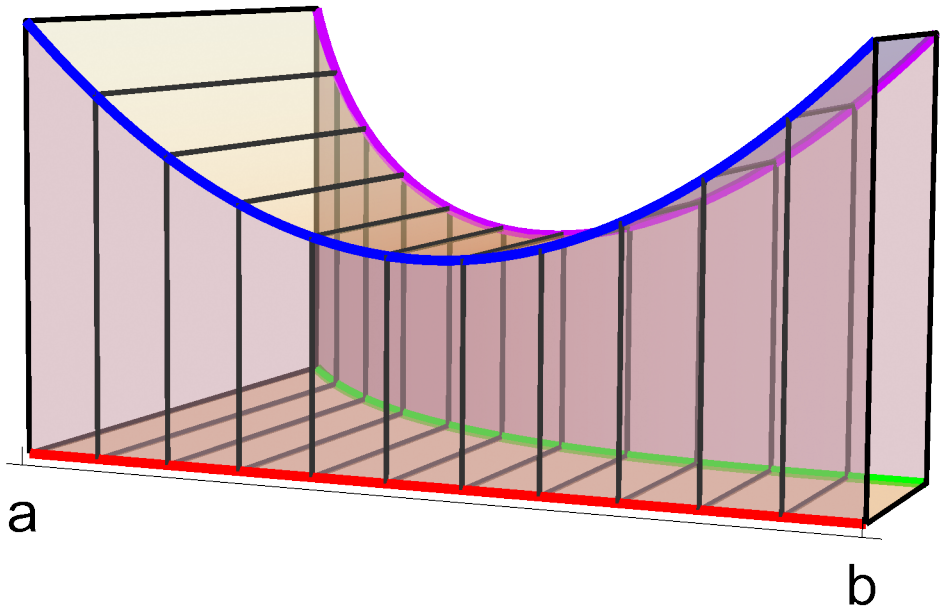


In[ ]:=
```
.1
```

Out[ ]=
```
0.1
```

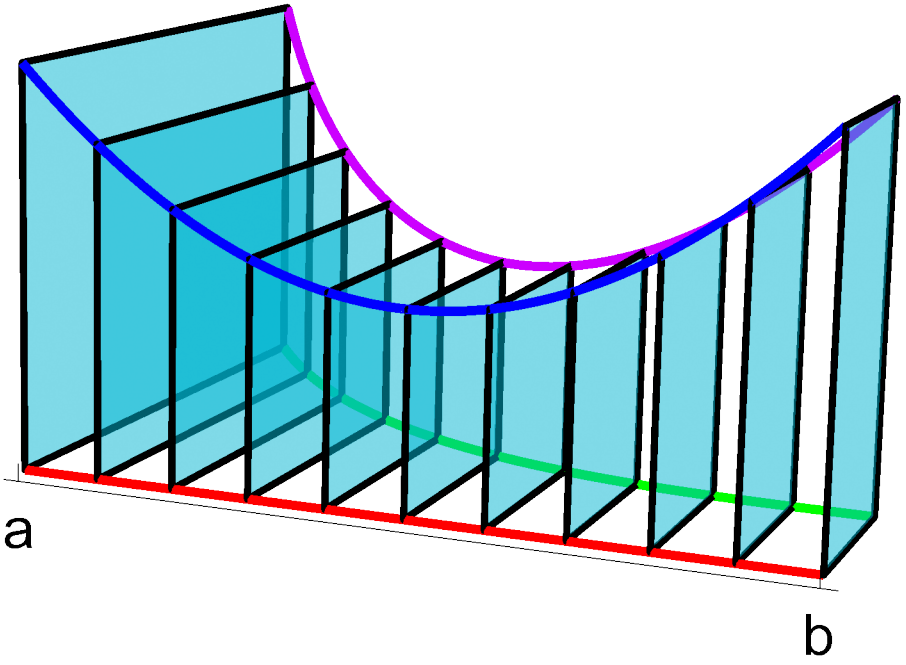
In[ ]:=
```
Show[rects, lines, extra]
```

Out[ ]=



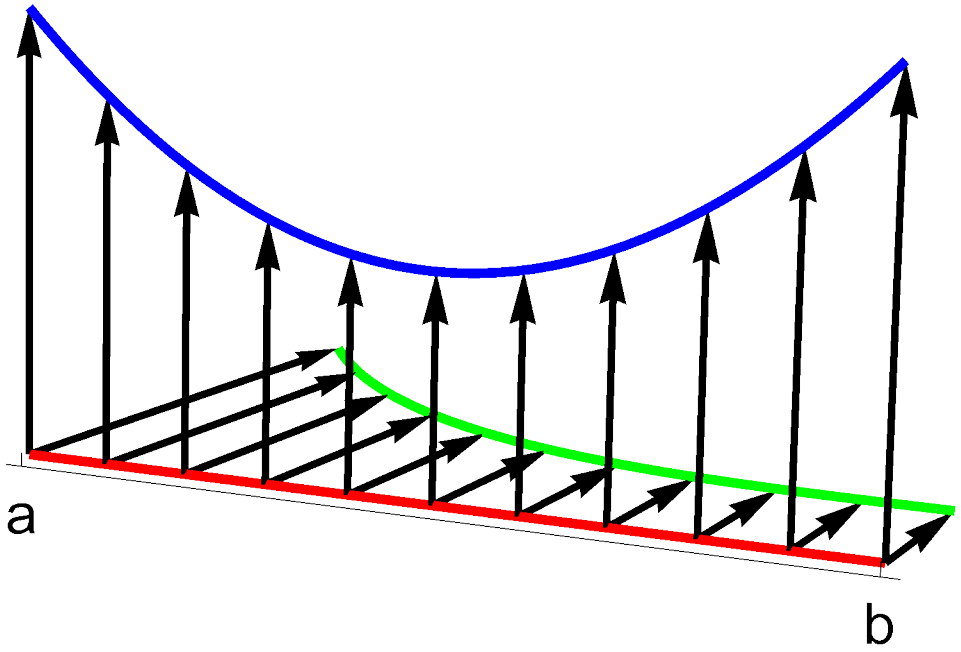
In[ ]:=
```
Show[allrects, lines, Axes → {True, False, False},
 BaseStyle → {FontSize → 30, Thickness[0.007]},
 Ticks → {{{0, "a"}, {2, "b"}}, None}, PlotRange → All]
```

Out[ ]=



In[•]:=
```
Show[allvects, lines0, Axes → {True, False, False},
 BaseStyle → {FontSize → 30, Thickness[0.007]},
 Ticks → {{{0, "a"}, {2, "b"}}, None}, PlotRange → All]
```

Out[•]=



In[•]:=
```
Show[allboxes, lines, lines, Axes → {True, False, False},
 BaseStyle → {FontSize → 30, Thickness[0.007]}, Ticks → {{{0, "a"}, {2, "b"}}, None}]
```

Out[•]=