
Lab 4 Reference Plots by Li-An Chen

Note: There are for reference. You do not need to do any of these plots for your assignment.

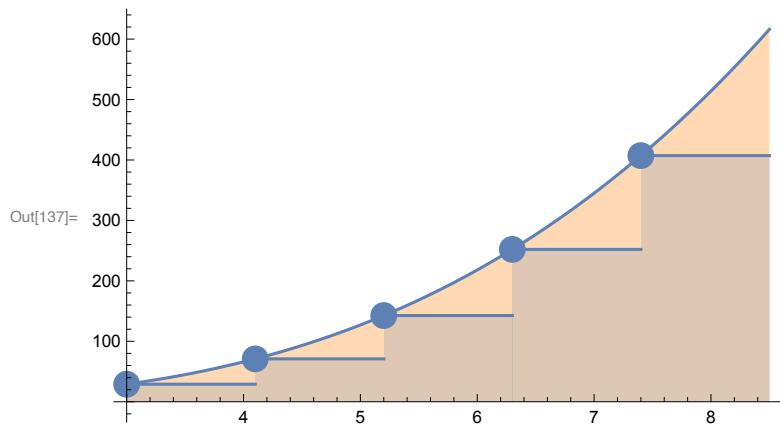
Example 1 - Left Rectangle Approximation

```
In[125]:= Clear[a, b, n, width]
a = 3;
b = 8.5;
n = 5;
width = (b - a) / n;

In[130]:= Clear[f]
f[x_] := x ^ 3 + 2
width * Sum[f[a + i * width], {i, 0, n - 1}]

Out[132]= 991.98

In[137]:= Show[Plot[f[x], {x, a, b}, Filling -> Axis,
  FillingStyle -> Directive[Opacity[0.3], Orange]], DiscretePlot[f[x],
  {x, a, b - width, width}, ExtentSize -> Right, PlotMarkers -> {"Point", Medium}]]
```

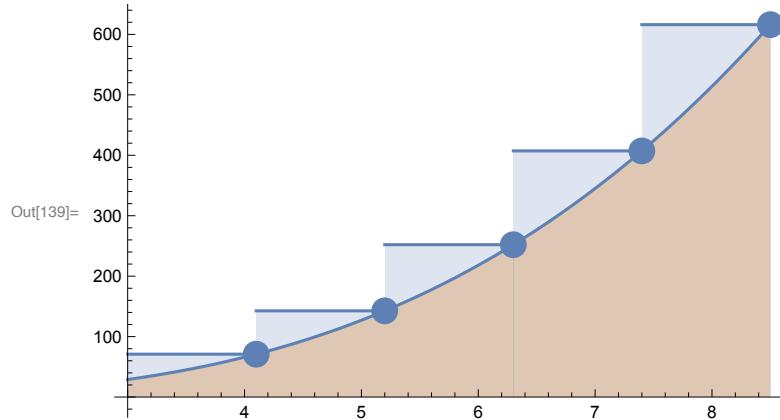


Example 2 - Right Rectangle Approximation

```
In[138]:= width * Sum[f[a + (i + 1) * width], {i, 0, n - 1}]

Out[138]= 1637.82
```

```
In[139]:= Show[Plot[f[x], {x, a, b}, Filling -> Axis,
  FillingStyle -> Directive[Opacity[0.3], Orange]],
 DiscretePlot[f[x], {x, a + width, b, width}, ExtentSize -> Left,
 PlotMarkers -> {"Point", Medium}, PlotRange -> {0, f[b]}]]
```

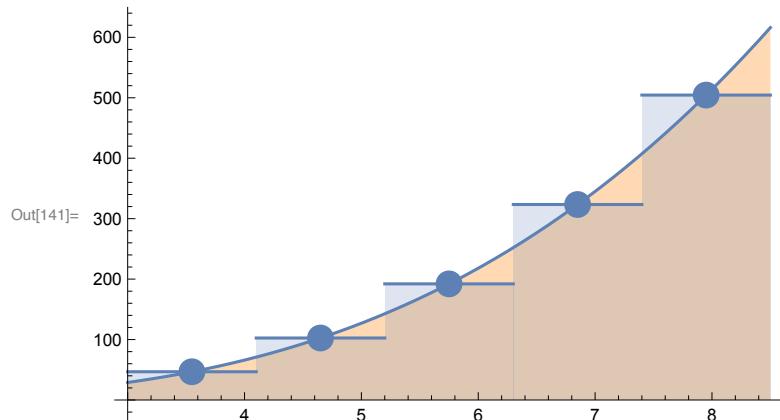


Example 3 - Midpoint Method

```
In[140]:= width * Sum[f[a + (i + 1/2) * width], {i, 0, n - 1}] // N
```

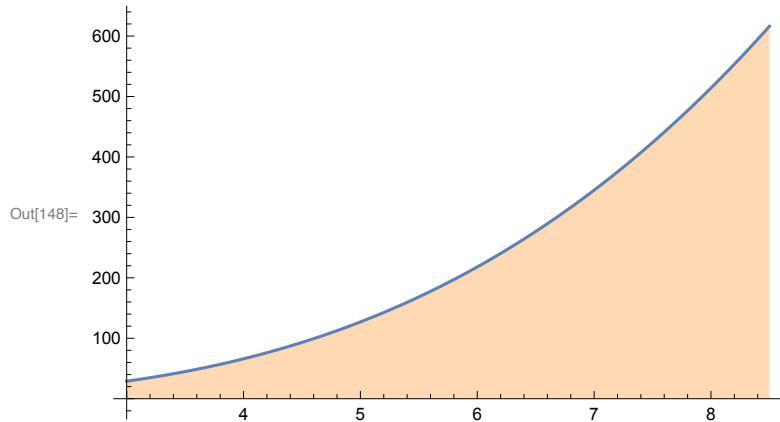
Out[140]= 1286.2

```
In[141]:= Show[Plot[f[x], {x, a, b}, Filling -> Axis,
  FillingStyle -> Directive[Opacity[0.3], Orange], PlotRange -> Automatic],
 DiscretePlot[f[x], {x, a + width/2, b - width/2, width}, ExtentSize -> Full,
 PlotMarkers -> {"Point", Medium}, PlotRange -> Automatic]]
```



Exact Solution

```
In[148]:= Plot[f[x], {x, a, b}, Filling -> Axis, FillingStyle -> Directive[Opacity[0.3], Orange]]
```

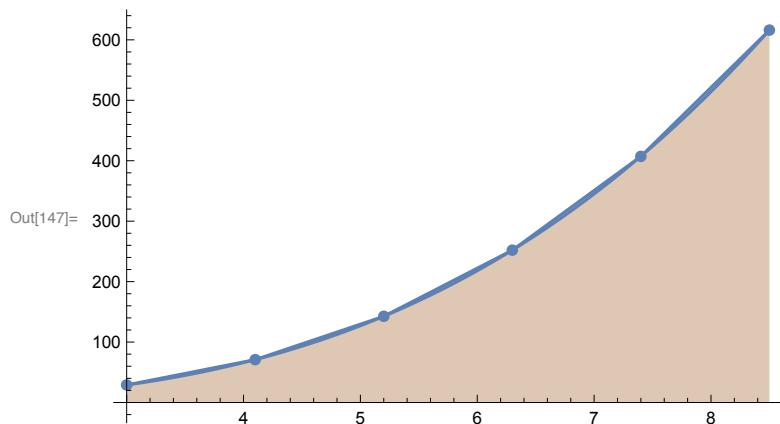


Example 4 - Trapezoidal

```
In[142]:= width * Sum[(f[a + i * width] + f[a + (i + 1) * width]) / 2, {i, 0, n - 1}] // N
```

Out[142]= 1314.9

```
In[147]:= Show[Plot[f[x], {x, a, b}, Filling -> Axis,
  FillingStyle -> Directive[Opacity[0.3], Orange], PlotRange -> Automatic],
  ListLinePlot[Table[{x, f[x]}, {x, a, b, width}],
  PlotMarkers -> Automatic, Filling -> Axis, PlotRange -> Automatic]]
```

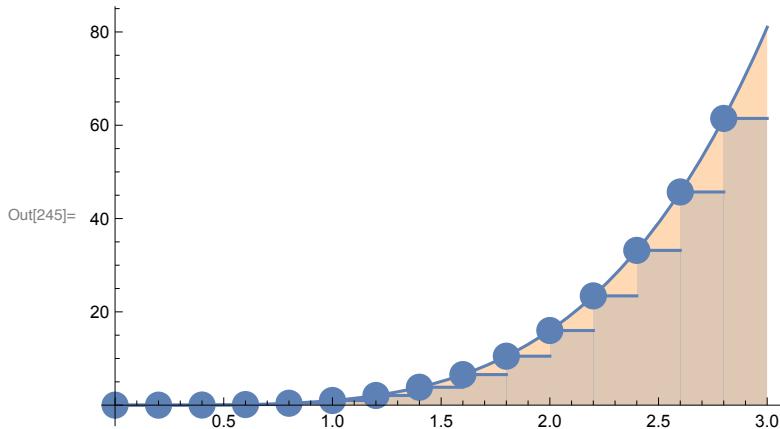


Reference Plots for Assignment Questions

Reference Plot for Q1a - Left Rectangle

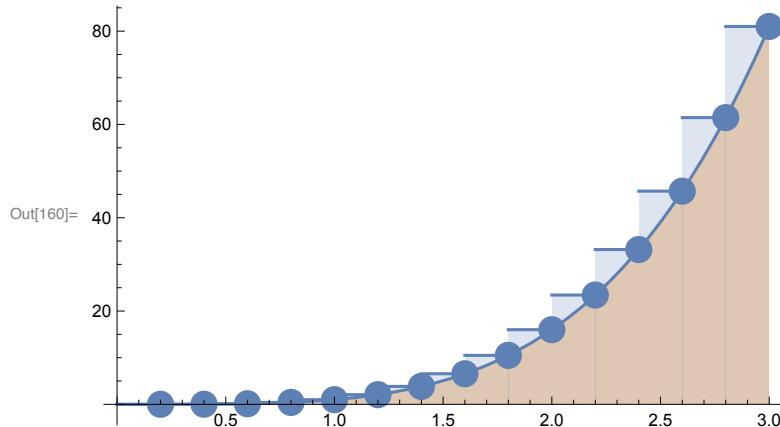
```
In[238]:= Clear[a, b, n, width]
a = 0;
b = 3;
n = 15;
width = (b - a) / n;
Clear[f]
f[x_] := x ^ 4

In[245]:= Show[Plot[f[x], {x, a, b}, Filling -> Axis,
  FillingStyle -> Directive[Opacity[0.3], Orange]], DiscretePlot[f[x],
  {x, a, b - width, width}, ExtentSize -> Right, PlotMarkers -> {"Point", Medium}]]
```



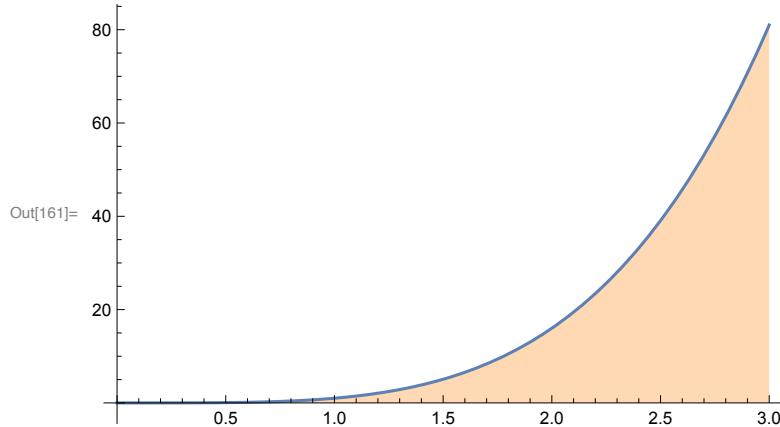
Reference Plot for Q1b - Right Rectangle

```
In[160]:= Show[Plot[f[x], {x, a, b}, Filling -> Axis,
  FillingStyle -> Directive[Opacity[0.3], Orange]],
 DiscretePlot[f[x], {x, a + width, b, width}, ExtentSize -> Left,
  PlotMarkers -> {"Point", Medium}, PlotRange -> {0, f[b]}]]
```



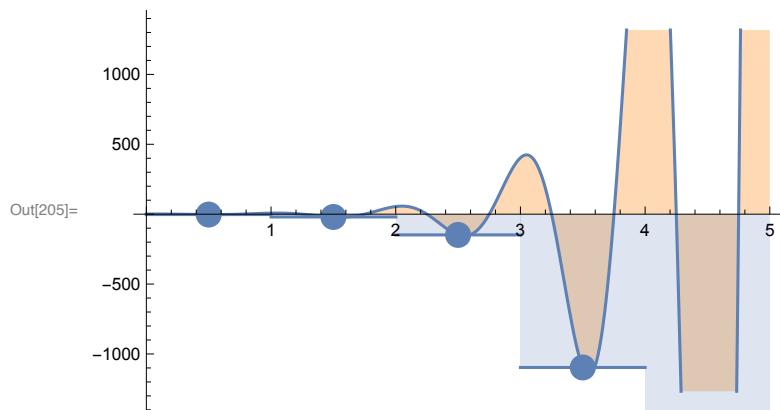
Reference Plot for Q1c - Exact Solution

```
In[161]:= Plot[f[x], {x, a, b}, Filling -> Axis, FillingStyle -> Directive[Opacity[0.3], Orange]]
```



Reference Plot for Q2ab - Midpoint Method “predominantly negative areas” for small n

```
In[200]:= Clear[a, b, width, f, nList];
f[x_] := Exp[2 x] * Cos[2 Pi x];
a = 0;
b = 5;
n = 5; (* Try different n *)
width = (b - a) / n;
Show[Plot[f[x], {x, a, b}, Filling -> Axis,
  FillingStyle -> Directive[Opacity[0.3], Orange], PlotRange -> Automatic],
 DiscretePlot[f[x], {x, a + width/2, b - width/2, width}, ExtentSize -> Full,
  PlotMarkers -> {"Point", Medium}, PlotRange -> Automatic]]
```



Reference Plot for Q3 - Trapezoid method

```
In[225]:= Clear[a, b, width, f, nList];
f[x_] := Exp[2 x] * Cos[2 Pi x];
a = 0;
b = 5;
n = 5; (* Try different n *)
width = (b - a) / n;
Show[Plot[f[x], {x, a, b}, Filling -> Axis,
  FillingStyle -> Directive[Opacity[0.3], Orange], PlotRange -> Automatic],
  ListLinePlot[Table[{x, f[x]}, {x, a, b, width}],
  PlotMarkers -> Automatic, Filling -> Axis, PlotRange -> Automatic]]
```

