Simple Task 10

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```
(*The function displays the given function with the given number of
  rectangles in the given range between the function and the x-axis.*)

rectanglesToFun[fun_, {lower_, upper_}, p_] :=
 Module[{i, rectList = {}, step, low = lower, up = upper, ylow, yup},
  If[IntegerQ[p] && p > 0 && low < up ,

    (*The step is set to the interval divided by the number of rectangles
     needed. Nothing is done unless p is a positive integer and the range is valid.*)

    step = Abs[ (up - low) / p ];

    (*Adds to the graphics list information
     to make the rectangles clear and edged with thick red.*)

    AppendTo[rectList, FaceForm[{Opacity[0]}]];
    AppendTo[rectList, EdgeForm[{Thick, Red}]];

    (*The loop goes through every rectangle in the range
     using an incrementer starting at low and each time increasing by
     step until it reaches up. Adds the rectangle graphic to the list. *)

    For[i = low, i < up, i = i + step,

     (*If the function is positive,
     the y value of the second point of the rectangle will be the y value of the right x-
      value of the rectangle. If the function is below the x-axis then it will be the y-
      value of the left x-value of the rectangle. This is to ensure that
       the rectangles are always completely between the function and the x-
      axis--would be an underestimation of the area.*)

     If[fun[i] > 0, AppendTo[rectList, Rectangle[{i, 0}, {i + step, fun[i]}]],
      AppendTo[rectList, Rectangle[{i, 0}, {i + step, fun[i + step]}]]]
    ];

    (*Plots the function and the list*)

    Show[
     Plot[fun[x], {x, low - 2 step, up + 2 step}, AxesOrigin → {0, 0}], Graphics[rectList]],

    (*ELSE: Prints the error message if the user enters unacceptable values.*)

    Print["Invalid p or range"]
   ]
  ]
```
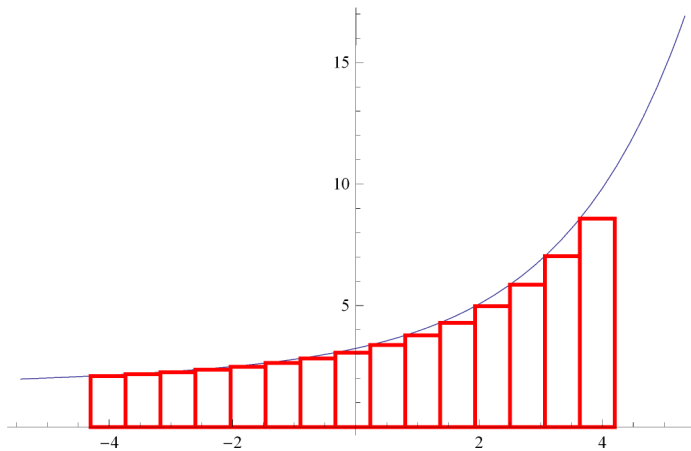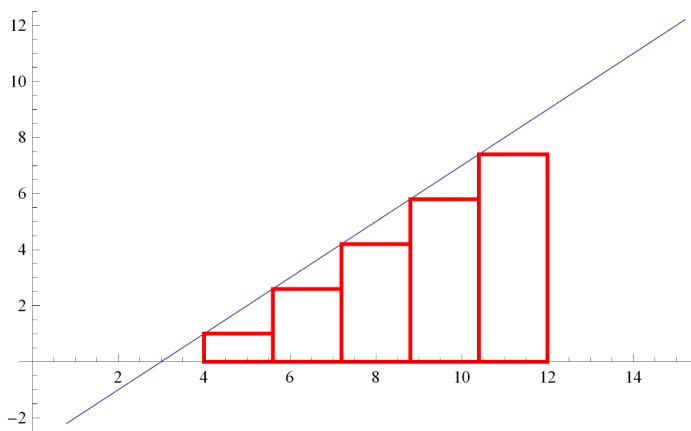
In[48]:= `testFun[x_] := E`$^{0.5\,x}$` + .5 (20 + x) ^ (1 / 2)`
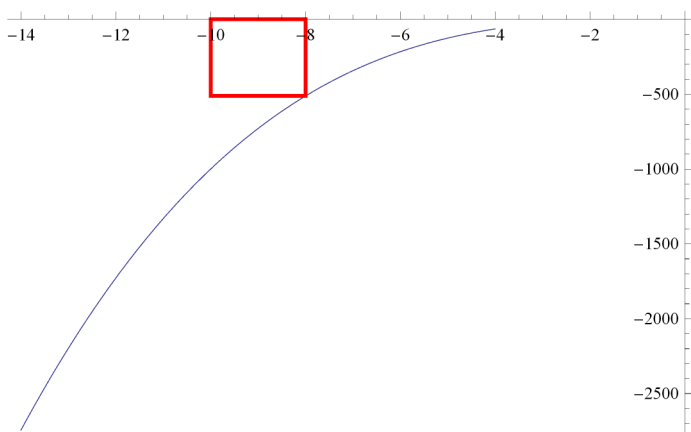`rectanglesToFun[testFun, {-4.3, 4.2}, 15]`

Out[49]=

In[38]:= `f[x_] := x - 3`
`rectanglesToFun[f, {4, 12}, 5]`

Out[39]=

In[64]:= `fun[x_] := x`^{3}
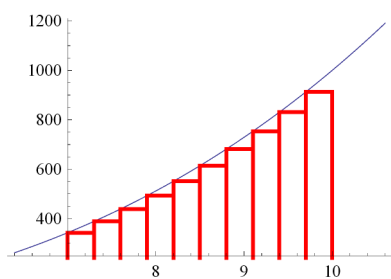`rectanglesToFun[fun, {-10, -8}, 1]`

Out[65]=

Other: Calculus Fun!

Code not provided for brevity.

rectanglesIntegral[fun, {7, 10}, 10]

Integral: $\dfrac{7599}{4}$

Area of Rectangle Estimation: $\dfrac{799\,779}{400}$
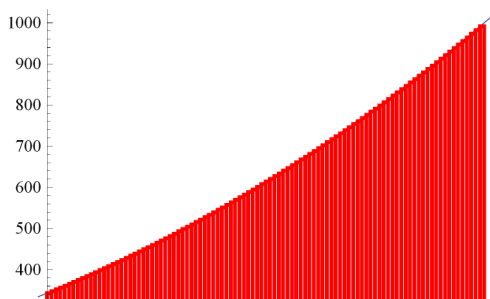
|Difference between the Methods|: 99.6975

rectanglesIntegral[fun, {7, 10}, 100]

Integral: $\dfrac{7599}{4}$

Area of Rectangle Estimation: $\dfrac{76\,384\,659}{40\,000}$

|Difference between the Methods|: 9.86648

rectanglesIntegral[fun, {7, 10}, 10 000]

Integral: $\dfrac{7599}{4}$

Area of Rectangle Estimation: $\dfrac{759\,939\,420\,459}{400\,000\,000}$

|Difference between the Methods|: 0.0985511