

APPROXIMATE INTEGRATION INVESTIGATION

Aim: To estimate areas under the curve using the left endpoint estimate and the right endpoint estimate. Then to compare the estimates to the actual area under the curve and to conclude how the error of the approximation is affected by the shape of the curve and the number of intervals.

Use your CAS calculator to find the actual area in each case.

Open the file numerical integration.tns

Graph 1:

For the graph of the function $y = 2^x$, $x \in [0, 2]$, using 4 equal intervals, find:

Left endpoint estimate =

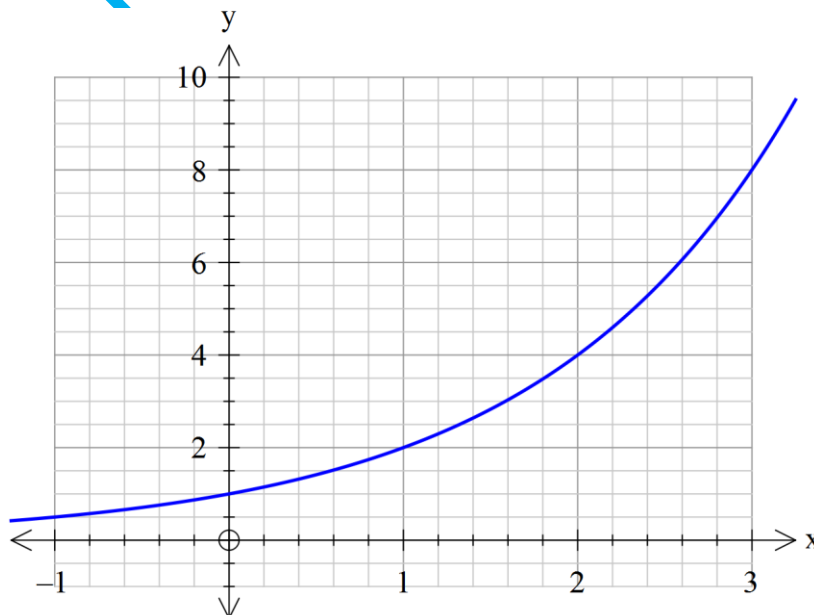
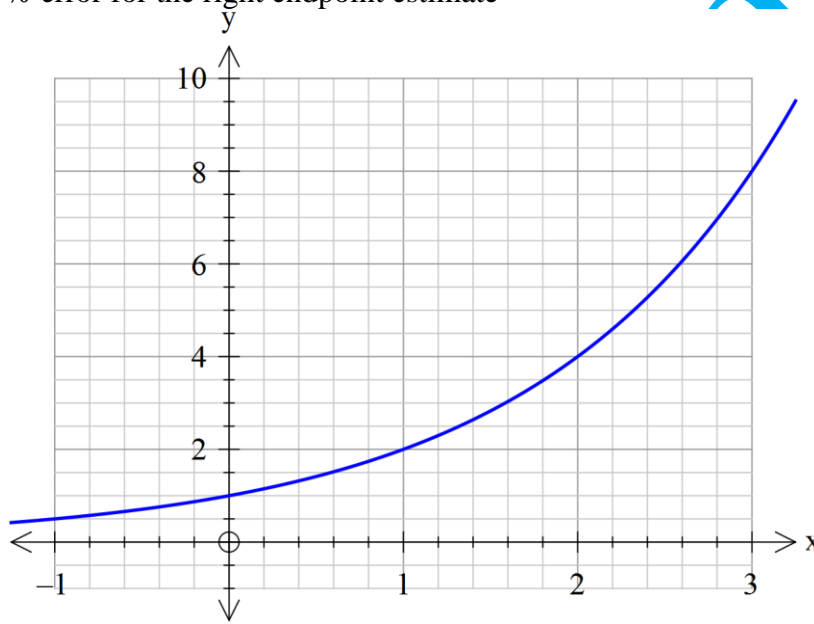
Right endpoint estimate =

Average of the two above =

Actual area =

% error for the left endpoint estimate =

% error for the right endpoint estimate =



Graph 2:

For the graph of the function $y = \sqrt{x}, x \in [0,1]$, using 5 equal intervals, find:

Left endpoint estimate =

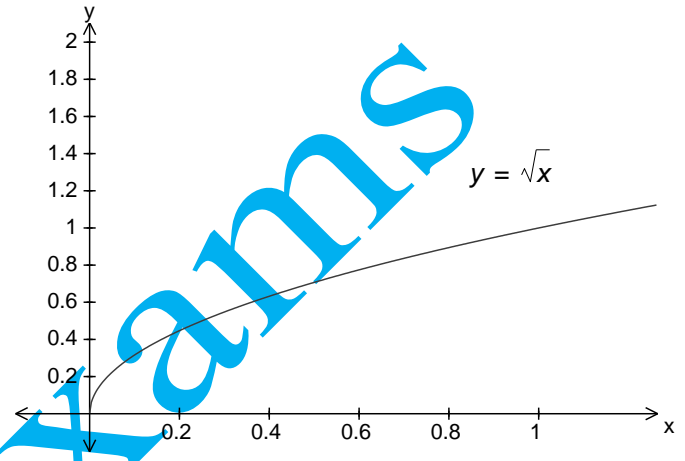
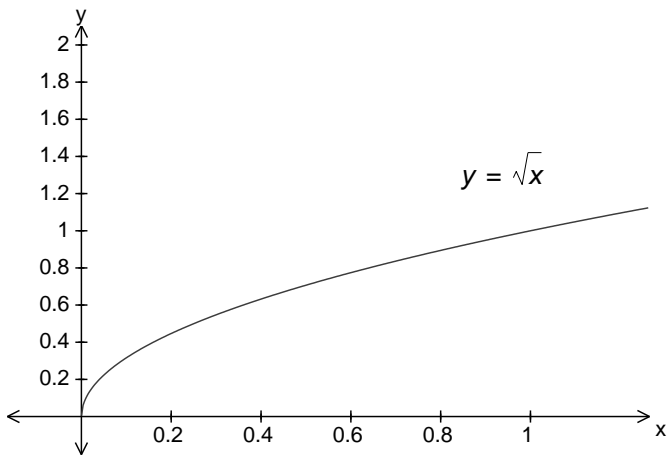
Right endpoint estimate =

Average of the two above =

Actual area =

% error for the left endpoint estimate =

% error for the right endpoint estimate =



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Graph 3

For the graph of the function $y = 3 - \sqrt{x}$, $x \in [0, 4]$, using 4 equal intervals, find:

Left endpoint estimate =

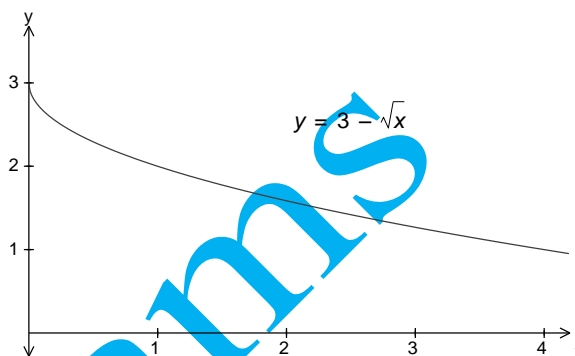
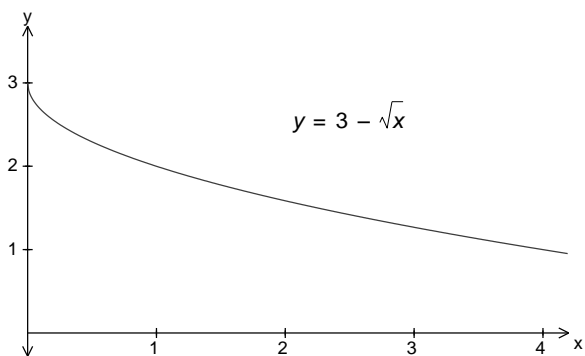
Right endpoint estimate =

Average of the two above =

Actual area =

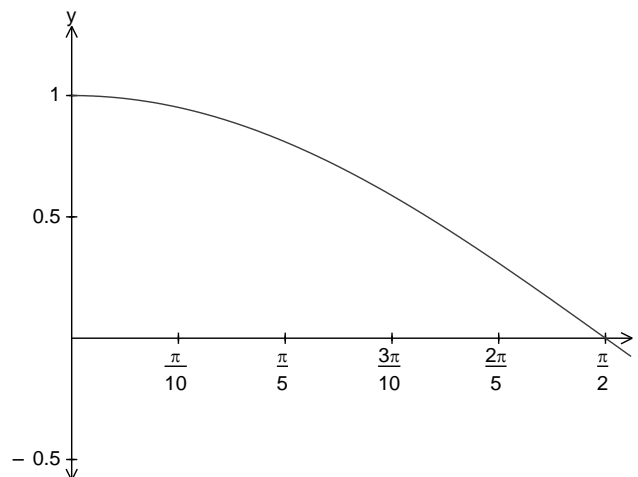
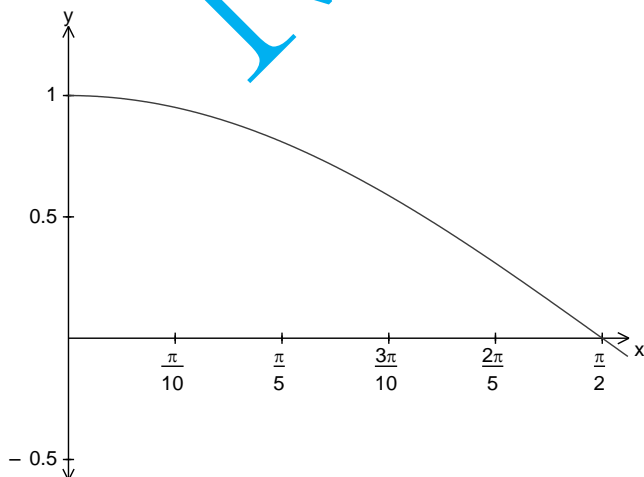
% error for the left endpoint estimate =

% error for the right endpoint estimate =



Graph 4

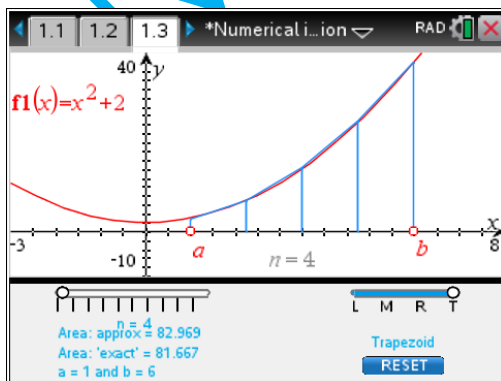
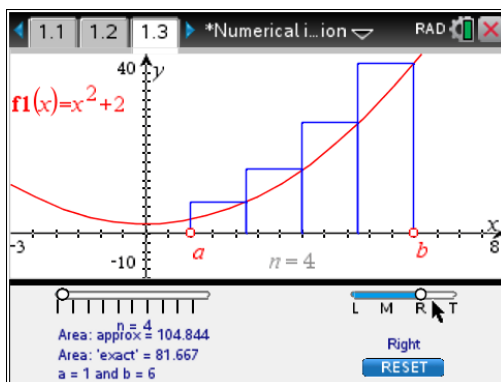
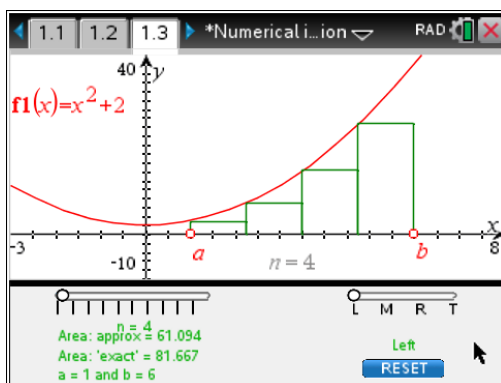
Repeat the above for the function $y = \cos(x)$, $x \in [0, \frac{\pi}{2}]$, using 5 equal intervals.



For each function above increase the number of intervals to 10 and repeat the calculations.

CONCLUSION:

Conclude your observations by comparing the left endpoint estimate and the right endpoint estimate to actual area in each case. Generalise your findings by stating when the left endpoint estimate overestimates and when it underestimates the area under the curve. In your conclusion you need to refer to the shape of the graph (concave up or down) and also comment on the increasing or decreasing property of a function over the given interval. Does the number of subdivisions affect the accuracy of estimation?



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