Riemann Sums - Unequal Widths

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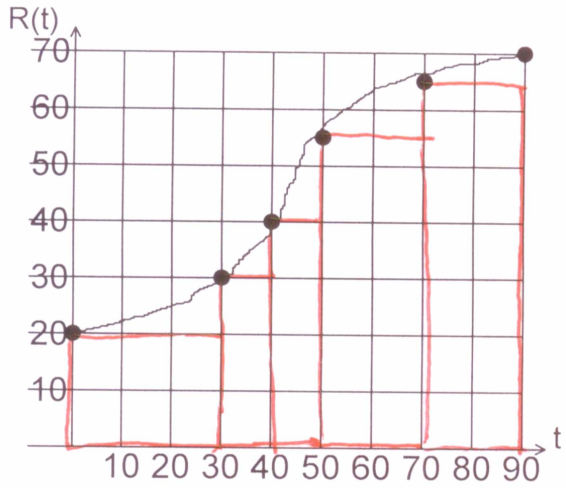
Let f be continuous and non-negative on the interval [a, b], then a Riemann Sum can be used to find an approximate area of f under the curve if the widths of the rectangles are unequal by:

1. Area = ___ + ___ + ___ + ___ + ... where n is # of blanks = # of rectangles
2. Each blank has (ht.)(Δx) of each rectangle where (Δx) is different for each rectangle.
3. The heights are determined by the problem situation (upper, midpt., etc.).

**calc.(FR) The rate of fuel consumption (in gallons per minute) recorded during a plane flight is given by a twice differentiable function R of time t, min.



t	R(t)
0	20
30	30
40	40
50	55
70	65
90	70

1. Approximate the value of the total fuel consumption, using a left Riemann sum with the 5 subintervals indicated in the table above.

$S_L = (30)(20) + (10)(30) + (10)(40) + (20)(55) + (20)(65) =$ ~~2500~~ 3700 gal.

2. Is this numerical approximation less than the value of the exact area? Explain your reasoning.

Since $R'(t) > 0$, the left Riemann sum is less than the exact value.