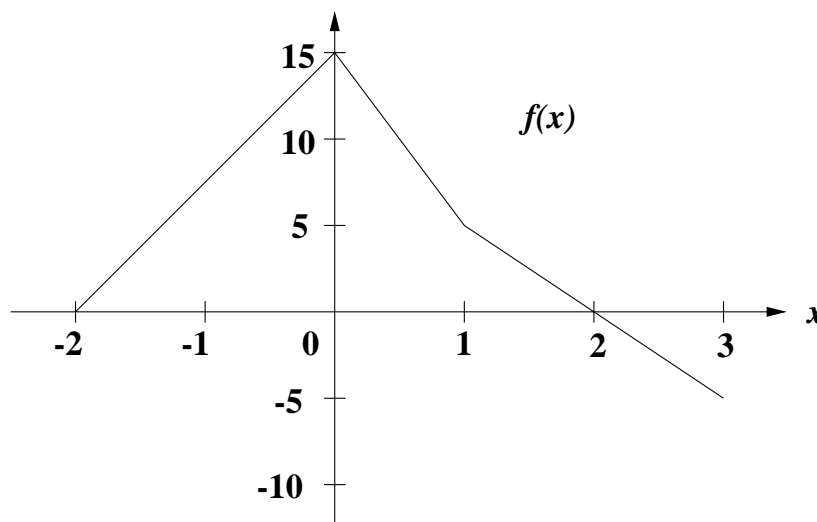


This quiz is due at the beginning of Monday's class. Do everything on a separate sheet of paper. Keep this sheet for study purposes.

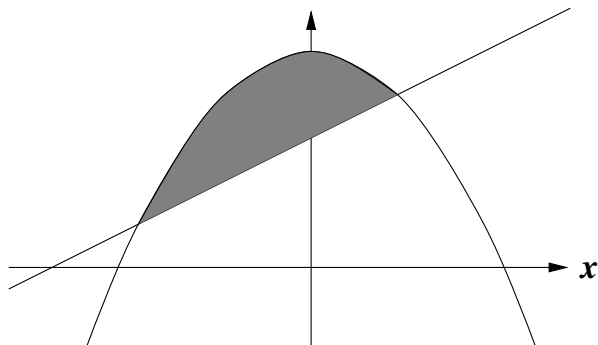
- Doug's bicycle has a speedometer attached. During yesterday's ride, he checked the speedometer at noon and every 15 minutes thereafter until 1:00 PM. At noon, his speed was 18.3 MPH; at 12:15 PM it was 22.4 MPH; at 12:30 PM it was 27.3 MPH; at 12:45 PM it was 33.4 MPH; and at 1:00 PM it was 40.8 MPH. Assume that Doug's speed was always increasing between noon and 1:00 PM.
  - Use the data given above in order to find the best possible **underestimate** for the total distance that Doug traveled between noon and 1:00 PM.
  - Use the data given above in order to find the best possible **overestimate** for the total distance that Doug traveled between noon and 1:00 PM.

- By using a left-hand sum with 2 rectangles, approximate the value of  $\int_6^{14} \frac{7}{1.1^t} dt$ . Sketch a graph of the integrand along with the two rectangles that you used.

- Using the graph of  $f(x)$  shown below, compute the exact value of  $\int_{-2}^3 f(x) dx$ .



4. (6 points) The graphs of  $f(x) = x + 3$  and  $g(x) = 5 - x^2$  are sketched below and the area between the two curves is shaded in.



- (a) Find the points of intersection of these two graphs.
- (b) Set up, but do not evaluate, the definite integral (or integrals) which represent the exact area between these two graphs.
- (c) Use the built-in features of your calculator to get a very good approximation of this area.
5. Deep in a Hundred Acre Wood where Christopher Robin plays, it has been raining at the rate of  $r(t)$  inches per hour since 8:00 AM. I've recorded these rates every 1.5 hours in the table below. The rain has continued to fall down harder and harder until my last recorded entry.

time ( $t$ )	rate ( $r(t)$ )
8:00 AM	0.5
9:30 AM	1.2
11:00 AM	1.7
12:30 AM	2.5

- (a) Use the information in the table to give the best possible underestimate for the total number of inches of rain which have fallen between 8:00 AM and 12:30 PM.

- (b) Use the information in the table to give the best possible overestimate for the total number of inches of rain which have fallen between 8:00 AM and 12:30 PM.
- (c) Piglet would really like a better estimate. Show how you can combine your answers above in an attempt to find a closer estimate to the total number of inches of rain which have fallen between 8:00 AM and 12:30 PM.
6. At noon, the number of bacteria in Gordon's sink was 500 and was growing very rapidly. In fact, the number of bacteria was growing at a rate of  $r(t) = 200(1.6)^t$  bacteria per hour, where  $t$  represents the number of hours since noon.
- (a) Set up, but do not evaluate, the definite integral needed to compute the total change in the bacteria population between noon and 3:00 PM.
- (b) Use the built-in integrator on your calculator to get a good approximation to the value of the definite integral used in part (a).
- (c) How many bacteria were there in Gordon's sink at 3:00 PM?