

Assignment 10

To be done on a **separate** piece of paper! Please **do not** cram all of your answers onto this worksheet!

Due **Wednesday 11/26/14** in class.

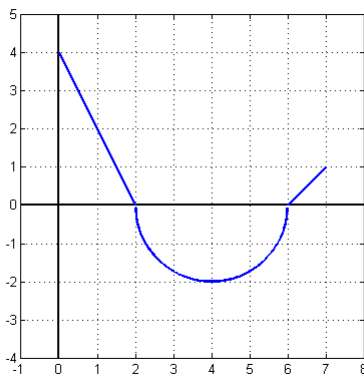
1. When we estimate distance from velocity data it is sometimes necessary to use times t_0, t_1, t_2, \dots that are not equally spaced. We can still estimate distances using the time periods $\Delta t_i = t_i - t_{i-1}$. For example, on May 7, 1992 the space shuttle *Endeavour* was launched on a mission to upgrade communications satellites. The table below, courtesy of NASA, gives the velocity data for the shuttle between liftoff and jettisoning of the solid rocket boosters.

Event	Time (s)	Velocity (ft/s)
Launch	0	0
Begin roll maneuver	10	185
End roll maneuver	15	319
Throttle to 89%	20	447
Throttle to 67%	32	742
Throttle to 104%	59	1325
Maximum dynamic pressure	62	1445
Solid rocket booster separation	125	4151

Use the data to estimate the height above Earth's surface of the space shuttle *Endeavour* 62 seconds after liftoff.

2. (a) Estimate the area under the graph of $f(x) = x^2$ from $x = 0$ to $x = 1$ using five approximating rectangles and left endpoints. Sketch the graph and the rectangles. Is your estimate an underestimate or an overestimate?
(b) Write an expression for the right-hand Riemann sum of $f(x) = x^2$ from $x = 0$ to $x = 1$ using n rectangles. Calculate Δx , x_i and $f(x_i)$ in terms of n and i .
(c) Use the formula $\sum_{i=1}^n i^2 = \frac{n(n+1)(2n+1)}{6}$ to evaluate the limit as n tends to infinity of your expression in (b).
(d) Use your result from (c) to evaluate $\int_0^1 x^2 dx$.

3. The graph of g shown below consists of two straight lines and semicircle. Use it to evaluate each integral.



(a) $\int_0^2 g(x)dx$

(b) $\int_2^6 g(x)dx$

(c) $\int_0^7 g(x)dx$

4. (a) If oil leaks from a tank at a rate of $r(t)$ gallons per minute at time t , what does $\int_0^{120} r(t)dt$ represent?
- (b) If $w(t)$ represents the growth rate of a child in pounds per year, what does $\int_5^{10} w(t)dt = 30$ mean?
5. (a) If $f(x)$ is the slope of a hiking trail, in feet per mile, at a distance x miles from the trailhead, write an expression that gives the total change in elevation, in feet, when hiking from $x = 3$ miles to $x = 5$ miles.
- (b) A honeybee populations starts with 100 bees and increases at a rate of $n(t)$ bees per week. Write an expression for the total number of honeybees after 3 weeks.
6. A population of Capybara is changing at a rate of $200 + 50t$ Capybara per year, where t is measured in years. By how much does the population change between the fourth and tenth year?

7. Find the average value of the function $f(x) = e^x$ on the interval $[0,5]$.

8. Find the area between $y = \cos(t)$ and $y = \sin(t)$ for $0 \leq t \leq \pi$.

9. Show that $2 \leq \int_0^2 \sqrt{1+x^3} dx \leq 6$.

10. True or false: on the interval $[a,b]$, the average value of $f(x) + g(x)$ is the average value of $f(x)$ plus the average value of $g(x)$.