AP Calculus
5.3 Worksheet

All work must be shown in this course for full credit. Unsupported answers may receive NO credit.

1. The graph of f shown below consists of line segments and a semicircle. Evaluate each definite integral.
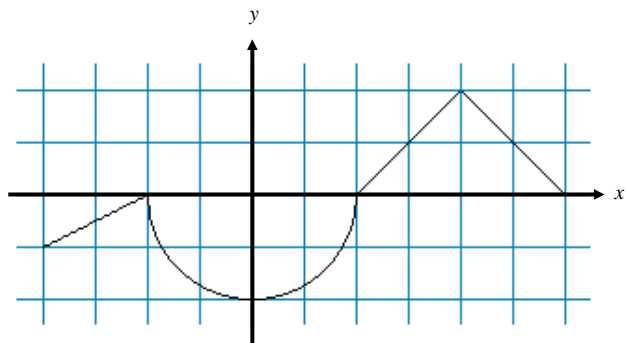
a) $\int_{0}^{2} f(x)\,dx$

b) $\int_{2}^{6} f(x)\,dx$

c) $\int_{-4}^{2} f(x)\,dx$

d) $\int_{-4}^{6} f(x)\,dx$

e) $\int_{-4}^{6} |f(x)|\,dx$

f) $\int_{-4}^{6} [f(x)+2]\,dx$

2. Part e above, gives a way to find the total Area between the x – axis and the function between $x = -4$ and $x = 6$. Without using absolute value signs, write two different expressions that can be used to find the total area between the x – axis and the function between $x = -4$ and $x = 6$.

3. [Calculator Required ... for now] What is the average value of $y = x^2 \sqrt{x^3 + 1}$ on [0, 2] ?

4. [Calculator Required] ... Traffic flow is defined as the rate at which cars pass through an intersection, measured in cars per minute. The traffic flow at a particular intersection is modeled by the function F defined by

$$F(t) = 82 + 4\sin\left(\frac{t}{2}\right) \quad \text{for } 0 \le t \le 30,$$

where $F(t)$ is measured in cars per minute and t is measured in minutes.

   a) Is traffic flow increasing or decreasing at $t = 7$? Give a reason for your answer.

   b) What is the average value of the traffic flow over the time interval $10 \le t \le 15$? Indicate units of measure.

   c) What is the average rate of change of the traffic flow over the time interval $10 \le t \le 15$? Indicate units of measure

5. [Calculator Required] At different altitudes in Earth's atmosphere, sound travels at different speeds. The speed of sound $s\,(x)$ (in meters per second) can be modeled by

$$s(x)=\begin{cases} -4x+341 & \text{if } 0\le x<11.5 \\ 295 & \text{if } 11.5\le x<22 \\ \frac{3}{4}x+278.5 & \text{if } 22\le x<32 \\ \frac{3}{2}x+254.5 & \text{if } 32\le x<50 \\ -\frac{3}{2}x+404.5 & \text{if } 50\le x\le 80 \end{cases}$$

where x is measured in kilometers. What is the average speed of sound over the interval [0. 80]?

6. A blood vessel is 360 millimeters (mm) long with circular cross sections of varying diameter. The table below gives the measurements of the diameter of the blook vessel at selected points along the length of the blood vessel, where x represents the distance from one end of the blood vessel, and $B\,(x)$ is a twice differentiable function that represents the diameter at that point.

Distance x (mm)	0	60	120	180	240	300	360
Diameter $B\,(x)$ (mm)	24	30	28	30	26	24	26

a) Write an integral expression in terms of $B\,(x)$ that represents the average radius, in mm, of the blood vessel between $x=0$ and $x=360$.

b) Approximate the value of your answer from part a using the data from the table and a midpoint Riemann Sum with three subintervals of equal length. Show the computations that lead to your answer.

c) Using correct units, explain the meaning of $\pi\displaystyle\int_{125}^{275}\left(\dfrac{B(x)}{2}\right)^2\,dx$ in terms of the blood vessel.

7. Complete the following questions from the textbook:
    pages 290 – 292 #1, 4, 5, 11 – 16, 40, 41, 47, 48, 49 … AND … p293 #1, 2
    (for #11 – 14 … NINT means to use your calculator to integrate)