10. [10 points] The following parts are unrelated.

   a. [3 points] Consider the region in the first quadrant bounded by $y = -(x-2)(x-7)$ and the x-axis. Which of the following expressions represents the **perimeter** of the region? Circle **one** option below.

       i. $\displaystyle\int_2^7 -(x-2)(x-7)\ dx$ iv. $\displaystyle\int_2^7 \sqrt{1 + (9-2x)^2}\ dx$

       ii. $\displaystyle 5 + \int \sqrt{1 + (-(x-2)(x-7))^2}\ dx$ v. $\displaystyle \frac{1}{5}\int_2^7 -(x-2)(x-7)\ dx$

       iii. $\boxed{\displaystyle 5 + \int_2^7 \sqrt{1 + (9-2x)^2}\ dx}$ vi. NONE OF THESE

   b. [4 points] Suppose that $f(x)$ is a differentiable function with a second derivative which is always positive. Suppose that $\text{LEFT}(40), \text{RIGHT}(40), \text{TRAP}(40),$ and $\text{MID}(40)$ are estimates of the integral $\displaystyle\int_0^{10} f(x)\ dx$. Which of the following **could** be true? Circle **all** options which apply.

       i. $\boxed{\displaystyle \text{LEFT}(40) < \int_0^{10} f(x)\ dx < \text{TRAP}(40)}$

       ii. $\displaystyle \text{TRAP}(40) < \int_0^{10} f(x)\ dx < \text{RIGHT}(40)$

       iii. $\displaystyle \int_0^{10} f(x)\ dx < \text{TRAP}(40) < \text{LEFT}(40) < \text{RIGHT}(40)$

       iv. $\boxed{\displaystyle \text{MID}(40) < \int_0^{10} f(x)\ dx < \text{LEFT}(40) = \text{RIGHT}(40)}$

       v. $\text{TRAP}(40) = 180$ and the average value of $f(x)$ on the interval $[0, 10]$ is 20.

       vi. $\boxed{\text{TRAP}(40) = 220 \text{ and the average value of } f(x) \text{ on the interval } [0, 10] \text{ is } 20.}$

       vii. NONE OF THESE

   c. [3 points] Birds gather in a large area centered around Marcy's bird bath. The population density of birds, measured in birds per square kilometer, at a radial distance r kilometers from the center of Marcy's bird bath is given by the function $p(r)$.
      Which of the following expressions must represent the total number of birds found within 5 kilometers of the center of the bird bath? Circle **one** option below.

       i. $25\pi p(r)$ iii. $\displaystyle\int_0^5 p(r)\ dr$ v. $\boxed{\displaystyle\int_0^5 2\pi r p(r)\ dr}$ vii. $\displaystyle\int_0^5 \pi (p(r))^2\ dr$

       ii. $\displaystyle 25\pi \int_0^5 p(r)\ dr$ iv. $\displaystyle\int_{-5}^5 p(r)\ dr$ vi. $\displaystyle\int_{-5}^5 2\pi r p(r)\ dr$ viii. NONE OF THESE