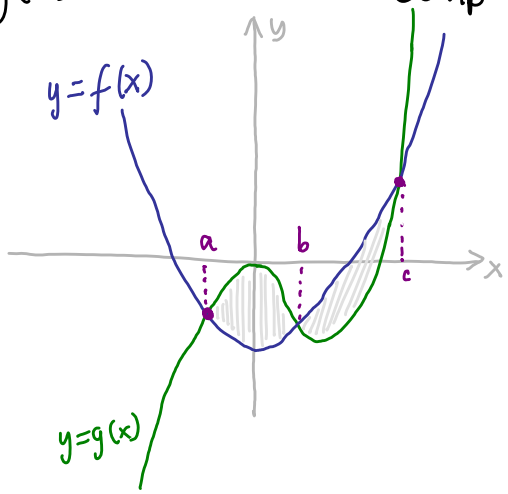
Math 124 Sec 2 Quiz 7 Solutions Oct 29, 2007

(1) Carefully sketch the region bounded by $f(x) = x^2 - 5$ and $g(x) = x^3 - 3x^2$ and compute its area



$Y_1 = X^2 - 5$
$Y_2 = X\wedge 3 - 3X^2$

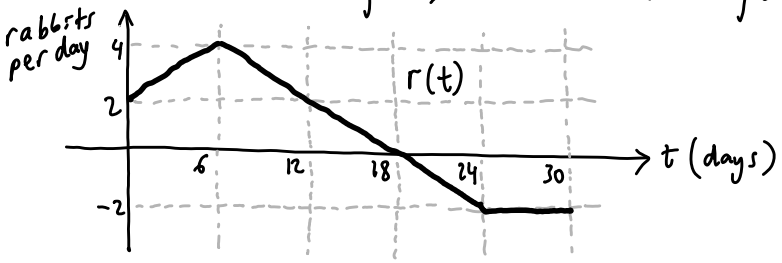
2nd Trace → 5: intersect

$a = -1$
$b = 1.3819$
$c = 3.618$

$$\text{Area} = \int_{-1}^{1.3819} \underbrace{(x^3-3x^2)}_{\text{above}} - \underbrace{(x^2-5)}_{\text{below}}\, dx + \int_{1.3819}^{3.618} \underbrace{(x^2-5)}_{\text{above}} - \underbrace{(x^3-3x)}_{\text{below}}\, dx$$

$$= 7.7192 + 6.5218 = 14.241$$

(2) The rate of change in a rabbit population is given by the function $r(t)$ in the graph below, where t is days since January 1st. If initially there are 200 rabbits at the farm, answer the following.



(a) During which time interval is the rabbit population increasing?

during days 0 – 18, since rate of change is positive

(b) What was the most number of rabbits present during these 30 days?

after day 18 the population decreases, so population at day 18 is the largest.

$$\int_0^{18} r(t)\,dt = \underbrace{3.5}_{\text{4 boxes}} \times \underbrace{12}_{\text{area of one box}} = 42 = \Delta \text{ population}$$

initially 200 rabbits, hence largest population: $200 + 42 = 242$

(c) How many rabbits are there at the end of January?

$$\Delta \text{population} = \int_0^{30} r(t)\,dt = 3.5 \times 12 - 1.5 \times 12 = 24$$

Final population = 200 + Δpopulation = 224 rabbits