3) The annual yield per fruit tree is fairly constant at 150 pounds per tree when the number of trees per acre is 35 or fewer. For each additional tree over 35, the annual yield per tree for all trees on the acre decreases by 2 pounds due to overcrowding.

a) What would be the yield ***for one tree*** if 35 trees were planted? if 36 trees were planted? if 37 trees were planted?

n	t (lbs)
35	150
36	148
37	146

$\frac{\Delta t}{\Delta n} = -2 \text{ lbs/tree}$

$t - 150 = -2(n-35)$

$t = -2n + 70 + 150$

$t = -2n + 220$

OR

b) What would be the ***total yield per acre*** if 35 trees were planted? if 36 trees were planted? if 37 trees were planted? Organize your results in a table.

n	t	Y ← total yield (lbs)
35	150	(35)(150) = 5250
36	148	(36)(148) = 5328
37	146	(37)(146) = 5402
n trees	t pounds/tree	n trees · t pounds/tree = Y lbs

total yield increases because even though each tree makes less, there are more trees in one acre.

$t = 150 - 2(n-35)$

tree yield is 150 lb/tree less 2 lb for every tree over 35 lbs

d) *If x represents the number of trees per acre*, express the total yield per acre as a function of x. Use that function to determine the number of trees that should be planted per acre to maximize total yield.

x	t	f(x)
x	220 − 2x (from part a)	x(220 − 2x) = 220x − 2x²
37	146	5402

$f(37) = 220(37) - 2(37)^2$

$= 7400 - 2738$

$= 5402$ lbs ✓

$x = -\frac{b}{2a}$

$x = \frac{-(220)}{2(-2)}$

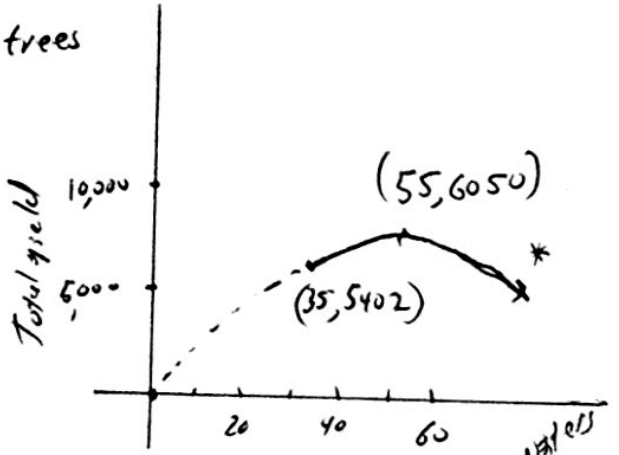
$= \frac{220}{4}$

$= 55$ trees

$f(55) = 220(55) - 2(55)^2$

$= 6050$ lbs/acre

Plant 55 trees to maximize yield



* Total yield decreases after 55 trees because the loss in yield per tree outweighs the gain in trees.