(c) [Note: For AP exam, you are <u>not</u> allowed to find maxes and mins from the graph. You must find the critical points, if any, then compare their objective fcn. values with those at the endpoints. A common student error is to forget to check the endpoints.]

$$A'(x) = 2(150-1.5x)(-1.5) + 4x \overset{\text{set}}{=} 0$$
$$-450 + 4.5x + 4x = 0$$
$$8.5x = 450$$
$$x_{crit} \approx 52.941\ldots$$

$$A(x_{crit}) \approx 10588.235\ldots$$

endpts. $\begin{cases} A(20) = 15200 \\ A(93.\bar{3}) = 17522.\bar{2} \end{cases}$ ← max. value

Max. area is $\boxed{17{,}522.222\ ft^2}$ [3 decimal places required by AP standard].

2. [Looking ahead to (b), we see that $N$ = # of rooms is a <u>parameter</u> of the problem.]

(a) Let $x$ = length of wall containing a door, for one room
$y$ = " " common wall betw. any 2 rooms

Constraints: $xy = 350 \Rightarrow y = \frac{350}{x}$
$x > 0$
$y > 0$

Objective fcn.: Total wall length = $W(x,y) = (2N)(x) + (N+1)y$

[But wait! Our textbook deals only with fcns. of a single independent variable. Thus we must rewrite $W(x,y)$ as $W(x)$.]

$$W(x) = (2N)(x) + (N+1)\frac{350}{x}$$
$$= 2Nx + \frac{350N}{x} + \frac{350}{x}$$

<u>There are no endpts. to check.</u> [You must write this.]

∴ Min. for $W(x)$ must occur at a critical pt.

$$W'(x) = 2N - 350(N+1)x^{-2} \overset{\text{set}}{=} 0$$ [OK since $x>0$ is a constraint]
$$-\frac{350(N+1)}{x^2} = -2N$$