Rate in/Rate out

A large flea market is held at the local fairgrounds on the first Saturday of each month. The rates at which people enter and leave the fairgrounds are recorded for a 3-hour period beginning when the market is open to the public. The rate at which people arrive is modeled by the function $A(t) = 45\sin(0.03t - 0.7) + 71$. The function $L(t) = 42\sin(0.034t - 1.52) + 42$ models the rate at which people leave. Both $A(t)$ and $L(t)$ are measured in people per minute and t is measured for $[0, 180]$ minutes. When the count begins at $t = 0$, there are already 1572 people in the flea market area of the fairgrounds.

a. How many additional people arrive for the flea market during the 3-hour period after it opens to the public?

$$\int_0^{180} A(t)\,dt = 13945.846$$

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b. Write an expression for P(t), the total number of people at the flea market at time t.

$$P(t) = 1572 + \int_0^t \left(A(x) - L(x)\right)dx$$

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c. Find the value of P'(75) and explain its meaning.

At time t = 75, the rate of change of the people at the flea market is 37.984 people/min.

$$P'(t) = 0 + A(t) - L(t)$$

$$P'(75) = A(75) - L(75) = 37.984$$

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d. For [0, 180], at what time is the number of people at the flea market at a maximum? Justify.

$\Rightarrow t = 180$ minutes

x	y
0	1572
180	$1572 + \int_0^{180} (A(t) - L(t))\,dt = 7756.583$

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$\rightarrow t = 32.255 \text{ min.}$

e. For [0, 180], at what time is the rate of change of people at the flea market at a maximum? What is the maximum rate of change? Justify.

x	
0	$A(0) - L(0) = 41.956$
32.255	$A(32.255) - L(32.255) = 58.155$
180	$A(180) - L(180) = 25.738$

checking endpoints and relative max

c.) $H'(t) = E(t) - L(t)$

$H'(17) = E(17) - L(17)$

graph: $E(t) - L(t)$

d.)

t	
9	
23 $\cancel{17}$	