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 $\boxed{A(t) = 45\sin(0.03t - 0.7) + 71}$. in

The function $\boxed{L(t) = 42\sin(0.034t - 1.52) + 42}$ 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.

out

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

$$\int_0^{180} A(t)\,dt = 13{,}945.846$$

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

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

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

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

people/min

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

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$$= 37.984 \text{ people/min}$$

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

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

$t = 180$ min
because there are no critical values and the max occurs at an endpoint.

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

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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.

$A(t) - L(t)$

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

t	$A(t) - L(t)$
0	41.956
* 32.255	58.155
180	25.738