7. [12 points] Maria has a toy car that drives around her flat backyard. She describes the path of the car by typing a pair of parametric equations into a computer navigation system. The computer controller uses $x$- and $y$-coordinates, where the units of the axes are meters, the point where Maria will be standing corresponds to the origin $(x, y) = (0, 0)$, the positive $y$-axis points north, and the positive $x$-axis points east. The car’s battery will only last 60 minutes, so Maria sets the domain of each of her parametric equations to be $0 \leq t \leq 60$, where $t$ is measured in minutes. Maria enters the parametric equations $x = f(t)$ and $y = g(t)$ where $f$ and $g$ are the functions shown in the graphs below.

- **a.** [3 points] The tangent line to the graph of $y = g(t)$ at the point $t = 40$ has equation $y - 10 = -2(t - 40)$. (This is the dashed line shown in the $ty$-plane above.) Use this information to compute the instantaneous speed of Maria’s car at time $t = 40$. Be sure to show your work clearly.

- **b.** [2 points] At time $t = 0$, the car starts at Maria’s location. Approximately how many meters away from Maria will the car be at time $t = 60$ (when it will run out of power)? Circle the one best estimate from among the choices below.
  
  0 m 150 m 300 m 450 m 600 m 750 m

- **c.** [3 points] At which of the times listed below is the slope of Maria car’s path in the $xy$-plane the least (most negative)? Circle the one best answer from among the choices below.
  
  $t = 15$  $t = 20$  $t = 28$  $t = 32$  $t = 38$

- **d.** [4 points] Maria’s friend William programs his car to move according to the parametric equations
  
  $$x = \int_0^t f(s) \, ds \quad \text{and} \quad y = \int_0^t g(s) \, ds$$
  
  where $f$ and $g$ are the functions shown in the graphs above. Compute the instantaneous speed of William’s car at time $t = 20$. Be sure to show your work clearly.