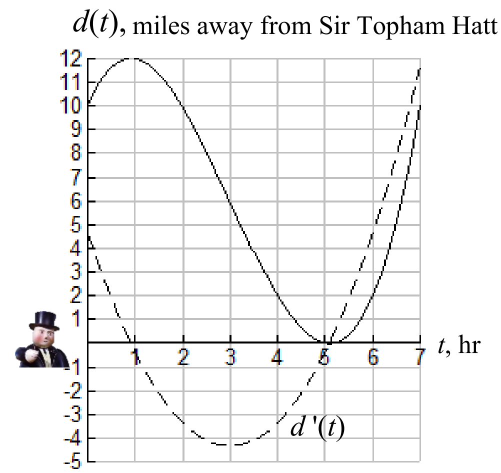
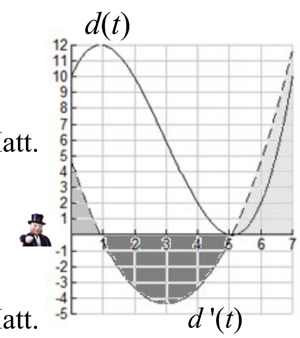
Thomas the Tank Engine Takes a Trip



Turn in the following by the beginning of the class Tuesday, Jan. 10
to receive +1 Rhino bonus participation point.

Thomas the Tank Engine is $d = f(t)$ miles from his boss Sir Topham Hatt, where t is given in hours. The graph of $d = f(t)$ is shown for $0 \le t \le 7$.
The derivative, $d'(t)$ is Thomas' instantaneous velocity $v(t)$ at time t.
Recall $d'(t)$ also gives Thomas' trajectory of movement.
See his trip animated at users.pfw.edu/lamaster/ma165/ThomasTrip.htm

1. Consider the net signed area under the dashed velocity curve $d'(t)$.
Report to the nearest integer.



a. Report $\int_0^1 d'(t)dt =$ ______ miles.

Interpret: On the interval $0 < t < 1$, Thomas' displacement is ____ miles __________ Topham Hatt. {away from, toward}
Over this interval Thomas is __________________. {speeding up, slowing down }

b. Report $\int_1^3 d'(t)dt =$ ______ miles.

Interpret: On the interval $1 < t < 3$, Thomas' displacement is ____ miles __________ Topham Hatt. {away from, toward}
Over this interval Thomas is __________________. {speeding up, slowing down }

c. Report $\int_3^5 d'(t)dt =$ ______ miles.

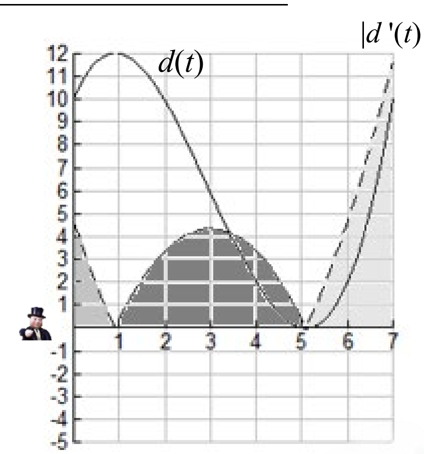
Interpret: On the interval $3 < t < 5$, Thomas' displacement is ____ miles __________ Topham Hatt. {away from, toward}
Over this interval Thomas is __________________. {speeding up, slowing down }

d. Report $\int_5^7 d'(t)dt =$ ______ miles

Interpret: On the interval $5 < t < 7$, Thomas' displacement is ____ miles __________ Topham Hatt. {away from, toward}
Over this interval Thomas is __________________. {speeding up, slowing down }

e. Report $\int_0^7 d'(t)dt =$ ______ miles

Interpret: On the interval $0 < t < 7$, ____



2. Consider the area under the dashed speed curve $|d'(t)|$. Report to the nearest integer.

a. Report $\int_0^1 |d'(t)|\,dt =$ ______ miles **b.** Report $\int_1^3 |d'(t)|\,dt =$ ______ miles

c. Report $\int_3^5 |d'(t)|\,dt =$ ______ miles **d.** Report $\int_5^7 |d'(t)|\,dt =$ ______ miles

e. Report $\int_0^7 |d'(t)|\,dt =$ ______ miles

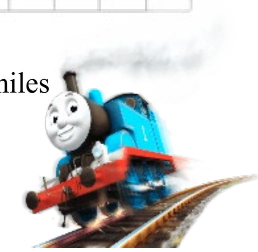
3. On the interval for $0 \le t \le 7$, consider each.
Assume at $t = 0$, his "trip odometer," which records miles traveled, is set to 0 miles.

a. Thomas traveling the fastest speed at $t =$ ____ hrs. He reaches mile marker _____.

b. He is the maximum distance of __________ miles from Topham Hatt
at what time(s)? $t =$ ___________

c. Report the total number of miles the odometer reads at the end of the trip, i.e., after 7 hours. ________ miles

d. Thomas speeds up when ________ is concave _______ and when _________ is ________________.
{ d, d', $|d'|$ } {up, down } { d, d', $|d'|$ } {increasing, decreasing}



e. Thomas slows down when ________ is concave _______ and when _________ is ________________.
{ d, d', $|d'|$ } {up, down } { d, d', $|d'|$ } {increasing, decreasing}