

Thomas the Tank Engine's Maximum Speed

Turn in the following by the beginning of the class Thursday, Jan. 12 to receive +2 Rhino bonus participation points. 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 $0 \leq t \leq 7$. See his trip animated at users.pfw.edu/lamaster/mal65/ThomasTrip.htm

You may assume only the following

$d'(t)$ is quadratic with axis of symmetry at $t = 3$.

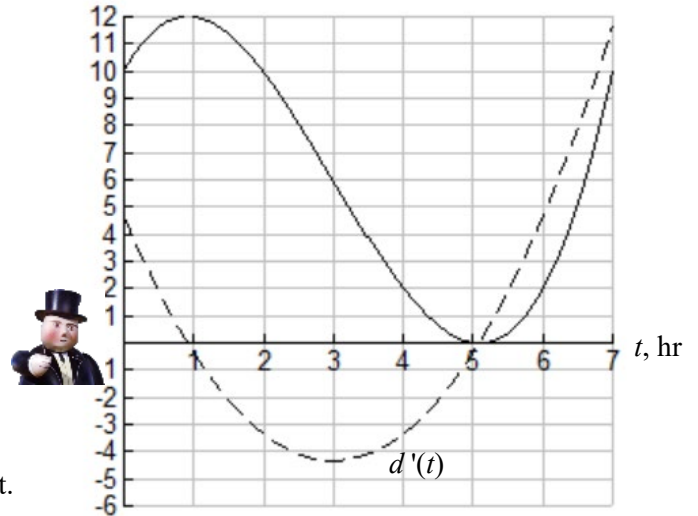
Note: $d'(1) \neq 0$ and $d'(5) \neq 0$.

Below is a table of values for $d(t)$.

NORMAL FLOAT AUTO REAL RADIAN MP				
PRESS + FOR Δ Tb1				
X	Y1			
0	10			
1	12			
2	10			
3	6			
4	2			
5	0			
6	2			
7	10			
8	26			
9	52			
10	90			

X=3

$d(t)$, miles away from Sir Topham Hatt



- Find a formula for $d(t)$ using the FTC. Show work for credit.

We have $\int_0^t d'(x)dx = d(t) - d(0)$ so, by subtraction,

$$d(t) = \int_0^t d'(x)dx + d(0), \text{ where } d'(x) = a(x-3)^2 + k \text{ for some constants } a \text{ and } k.$$

Report exact values of the coefficients. Check your answer with a grapher.

Your formula need **not** be in expanded form.

$d(t) =$ _____

- Thomas reaches a maximum speed on $1 < t < 5$ at $t = 3$ hours.

- Report the **exact** value, in miles per hour, of that maximum speed.

_____ mph

- Report, **approximate** to 0.001 hours, the two other times at which he reaches that maximum speed in part 2a on $0 < t < 7$.

You can solve graphically. No work needs to be shown.

$t =$ _____ hrs, _____ hrs

Report to **three decimal** places.

$d(t)$, miles away from Sir Topham Hatt

