Problems for 1.2

1) Find $Y(x)$ solving $\begin{cases} Y' = 2x+1 \\ Y(0)=3 \end{cases}$

8) Find Y solving $\begin{cases} Y' = \cos(2x) \\ Y(0)=1 \end{cases}$

11) Find the position $X(t)$ of a particle moving in a straight line with $a(t)=50$, $V_0=10$, $X_0=20$.

13) Find the position $X(t)$ of a particle moving in a straight line with $a(t)=3t$, $V_0=5$, $X_0=0$.

20) A ball is dropped from the top of a building 400 ft high. How long does it take to reach the ground?

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1) $Y = \int (2x+1)\,dx + C = x^2 + x + C$

$Y(0) = 3 = 0^2 + X + C,\ C = 3$

8) $Y = \int \cos(2x)\,dx + C$

$Y = \frac{1}{2}\sin(2x) + C$

$Y(0) = 1 = \frac{1}{2}\sin(0) + C,\ C = 1.$

11) $\frac{dv}{dt} = 50 \Rightarrow V = \int 50\,dt + V_0 = 50t + V_0$

or $\frac{dx}{dt} = 50t + 10 \Rightarrow X = \int 50t\,dt + \int 10\,dt + X_0 \Rightarrow X = 25t^2 + 10t + 20.$

13) $a(t) = 3t \Rightarrow V(t) = \frac{3}{2}t^2 + 5 \Rightarrow X(t) = \frac{1}{2}t^3 + 5t$

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20) Recall $g = \frac{a}{m} = 32\,\text{ft/sec}^2$ under Earth's gravity

So $\frac{dv}{dt} = -32 \Rightarrow V(t) = -32t + V_0$ Here $V_0 = 0$.

$V(t) = -32t. \Rightarrow X(t) = -16t^2 + X_0 = -16t^2 + 400.$

This assume $X(t) = 0$ is the height of the ground. Now refind

$0 = -16t^2 + 400,\ t = \left(\frac{400}{16}\right)^{1/2} = \frac{20}{4} = 5.$