

5. Consider the differential equation  $\frac{dy}{dx} = \frac{1}{2} \sin\left(\frac{\pi}{2}x\right)\sqrt{y+7}$ . Let  $y = f(x)$  be the particular solution to the differential equation with the initial condition  $f(1) = 2$ . The function  $f$  is defined for all real numbers.
- (b) Write an equation for the line tangent to the solution curve in part (a) at the point  $(1, 2)$ . Use the equation to approximate  $f(0.8)$ .
- (c) It is known that  $f''(x) > 0$  for  $-1 \leq x \leq 1$ . Is the approximation found in part (b) an overestimate or an underestimate for  $f(0.8)$ ? Give a reason for your answer.
- (d) Use separation of variables to find  $y = f(x)$ , the particular solution to the differential equation  $\frac{dy}{dx} = \frac{1}{2} \sin\left(\frac{\pi}{2}x\right)\sqrt{y+7}$  with the initial condition  $f(1) = 2$ .

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**Write your responses to this question only on the designated pages in the separate Free Response booklet. Write your solution to each part in the space provided for that part.**