Quiz 13 Solution

April 6, 2018

1. (4 points) If a product is sold at a price of p dollars per unit, $1800 - 200p$ units will be sold. What price, p, should the company charge to maximize their revenue?

   Solution: The revenue is given by $R = p(1800 - 200p) = 1800p - 200p^2$.

   We want to maximize the revenue using calculus. $R' = 1800 - 400p$ has a critical value at $p = 1800/400 = 9/2 = 4.5$.

   Since $R'' = -400 < 0$, we have a maximum at the critical value by the Second Derivative Test.

   Answer: $p = \$4.50$

2. (0 points) Which of the following is an antiderivative of $\sin(3x)$?

   (a) $-\frac{1}{3}\sin(3x) + C$ (c) $3\sin(3x) + C$

   (b) $-\frac{1}{3}\cos(3x) + C$ (d) $3\cos(3x) + C$

   Solution: Take the derivative of each answer choice.

   (a) $\dfrac{d}{dx}\left[-\frac{1}{3}\sin(3x) + C\right] = -\frac{1}{3}\cos(3x) \cdot 3 = -\cos(3x)$

   (b) $\dfrac{d}{dx}\left[-\frac{1}{3}\cos(3x) + C\right] = -\frac{1}{3}(-\sin(3x) \cdot 3) = \sin(3x)$

   We can stop here since we found the correct answer.

   Answer: (b)

3. (0 points) Solve the initial value problem $y' = \csc x \cot x$ with $y(\pi/2) = 0$.

   Solution: We take the antiderivative of y' to find the general solution:
   $y = \int \csc x \cot x \, dx = -\csc x + C$ (since the derivative of $\csc x$ is $-\csc x \cot x$).

   To find C, we use the initial value $y(\pi/2) = 0$:

   $$y(\pi/2) = -\csc(\pi/2) + C \overset{\text{set}}{=} 0$$
   $$-1 + C = 0$$
   $$C = 1$$

   Answer: $y = -\csc x + 1$

4. (1 point) What topics do you want to review for Exam 3?

   Answer: Answers will vary.