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MATH 135: Quiz 12

December 2, 2014

Name: Solutions Sec: ____________

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1. You are producing widgets to sell for a profit. If the price of the widgets is p dollars, then you believe you will be able to sell $x = 300 - 2p$ widgets. The cost to produce x widgets is given by

$$C(x) = 20 + 30x - 5x^2 + x^3.$$

(a) How many widgets should you produce to maximize your profit?

(b) How much are you selling the widgets for?

(c) What is the average cost to produce the widgets?

Rearranging: $p(x) = \frac{300-x}{2} = 150 - x/2$

Revenue: $R(x) = x\,p(x) = 150x - x^2/2$. (1)

Profit: $P(x) = R(x) - C(x) = 150x - x^2/2 - 20 - 30x + 5x^2 - x^3$.

To maximize profit, set $P'(x) = 0$. (1)

$$P'(x) = 150 - x - 30 + 10x - 3x^2$$ (1)

$$= 120 + 9x - 3x^2 = 0$$

$$\Rightarrow \quad x^2 - 3x - 40 = 0 = (x-8)(x+5).$$

So, you should produce 8 widgets to maximize profit.

(b) $p(8) = 150 - 8/2 = \$146.00$ (1)

(c) Average Cost $= \frac{C(x)}{x} = \frac{20}{x} + 30 - 5x + x^2$

(1)

$$A(8) = \frac{20}{8} + 30 - 40 + 64 = 54 + \frac{20}{8} = \$56.50$$

2. Compute the indefinite integral

$$\int \cos(x) + 4e^x + x^3 \, dx$$

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$$= \sin(x) + 4e^x + \frac{1}{4}x^4 + C.$$

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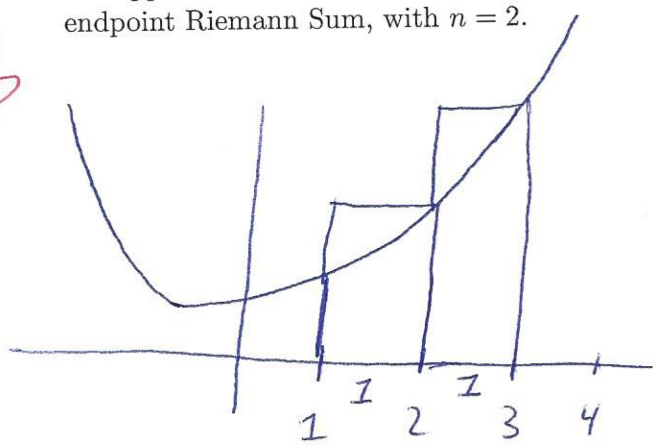
3. Approximate the area under the curve $y = x^2 + 2x$ between $x = 1$ and $x = 3$ using a right-endpoint Riemann Sum, with $n = 2$.



$$\Delta x = \frac{b-a}{n} = \frac{3-1}{2} = 1 \quad (1)$$

Height of first rectangle =

$$f(2) = 2^2 + 2 \cdot 2 = 8$$

(1)

Second: $f(3) = 3^2 + 2 \cdot 3 = 15.$

$$A \approx \Delta x \left(f(2) + f(3) \right)$$

$$= 1(8 + 15) = \boxed{23} \quad (1)$$