9. [15 points] For each question below, there is only one correct answer. Circle exactly one answer. Unclear answers will receive no credit. There is no penalty for guessing.

    a. [3 points] A company's maximum profit is earned when it produces $q = 20$ goods. If its *marginal cost* function is given by

$$MC(q) = 7q,$$

    which of the following could be the company's *revenue* function?

    A. $R(q) = q + 120$

    B. $R(q) = 7$

    C. $R(q) = q^7 + 2$

    D. $R(q) = 2q^2 + 60q$

    E. $R(q) = \frac{1}{20}q^7 + 2$

    b. [3 points] The number ℓ is a positive constant. Which of the following numbers is the maximum value of the function $f(x) = (x - \ell)^3 + 12\ell^3$ on the closed interval $[-\ell, 2\ell]$? (These numbers are y-values, not x-values).

    A. $11\ell^3$

    B. $20\ell^3$

    C. $13\ell^3$

    D. $4\ell^3$

    E. $12\ell^3$

    c. [3 points] The number p is a constant. Which of the following functions is an antiderivative of $g(x) = \ln(x + p)$?

    A. $G(x) = \frac{p}{x+p}$

    B. $G(x) = \frac{1}{x+p}$

    C. $G(x) = (x + p)(\ln(x + p)) - x$

    D. $G(x) = \frac{\ln(x+p)}{p} - x$

    E. $G(x) = x^2 \ln(x + p) - x$

d. [3 points] Suppose $g'(x) > 0$ on the interval $[3, 5]$, $g(3) = 12$, and $g(5) = 20$. We want to use a Riemann sum with equal-size subdivisions to approximate

$$\int_3^5 g(x)dx,$$

If we want to guarantee that the error in our estimate is no larger than $1/4$, then what is the minimum number of subdivisions that we must use?

A. 8

B. 16

C. 32

D. 64

E. We cannot guarantee this much accuracy, no matter how many subdivisions we use.

e. [3 points] If

$$\int_{-1}^4 (2f(x) - 7)dx = -31,$$

then which of the following values is equal to

$$\int_{-1}^4 f(x)dx?$$

A. -24

B. -12

C. 2

D. 4

E. 31