

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