

Homework questions for sections 15.7, 15.8

Math 114, Spring 2008

1. You are trying to construct a rectangular box without a lid and with maximum volume. (The box has a base and four sides, but is open at the top). The material that is used for the base is more expensive than that used for the sides. The material for the base costs \$30 per square feet, while the material for the sides costs only \$10 per square feet.

If you cannot spend more than \$40, what is the maximum volume you can achieve?

- A) $\frac{8}{27}$ ft³ B) $\frac{1}{3}$ ft³ C) $\frac{4}{9}$ ft³ D) $\frac{1}{2}$ ft³ E) $\frac{2}{3}$ ft³ F) $\frac{5}{6}$ ft³

2. Which point on the elliptic paraboloid $2z = x^2 + 2y^2$ in the first octant is closest to $(0, 0, 5)$?

Remark. The first octant is the region where $x \geq 0$, $y \geq 0$, $z \geq 0$.

A) $(0, 0, 0)$ B) $(\sqrt{2}, \sqrt{2}, 3)$ C) $(2\sqrt{2}, 0, 4)$ D) $(0, \frac{3}{\sqrt{2}}, \frac{9}{2})$ E) $(\sqrt{10}, 0, 5)$ F) $(0, \sqrt{5}, 5)$

3. If you apply the second derivative test to the critical points of the function

$$f(x, y) = 2x^3 + x^2y + y^2,$$

what do you find?

- A) Two saddle points.
- B) One local maximum and one local minimum.
- C) One local minimum and one saddle point.
- D) One local minimum and one critical point that is not decided by the test.
- E) One saddle point and one critical point that is not decided by the test.
- F) Two critical points that are not decided by the test.