1. Suppose the line $2x - y + 1 = 0$ is tangent to the level curve $f(x, y) = 2$ at the point $(0, 1)$. Determine which of the vectors below is parallel to $\nabla f(0, 1)$.
   a. $\mathbf{i} + \mathbf{2j}$
   b. $2\mathbf{i} + \mathbf{j}$
   c. $\mathbf{i} - \mathbf{2j}$
   d. $-2\mathbf{i} + \mathbf{j}$
   e. $\mathbf{i} + \mathbf{j}$
   f. None of these

2. The points $(x, y)$ at which the tangent plane to the surface $z = x^2 + \frac{1}{2}y^2 + x^2y - 6$ is horizontal are:
   a. $(-1,1), (-1,-1)$
   b. $(0,0), (1,-1), (-1,-1)$
   c. $(0,0), (1,-1)$
   d. $(1,1), (1,-1), (-1,1)$
   e. none of these

3. Which of the following best describes the function $f(x, y) = 2x^3 - 3x^2 - y^2$ at the point $(0,0)$?
   a. Local maximum
   b. Local minimum
   c. Saddle point
   d. It is a stationary point but the 2\textsuperscript{nd} partials test is inconclusive
   e. It is not a stationary point

4. Which of the following best describes the function $f(x, y) = 2x^3 - 3x^2 - y^2$ at the point $(-1,0)$?
   a. Local maximum
   b. Local minimum
   c. Saddle point
   d. It is a stationary point but the 2\textsuperscript{nd} partials test is inconclusive
   e. It is not a stationary point
5. Which of the following best describes the function \( f(x, y) = 2x^3 - 3x^2 - y^2 \) at the point (1,0)?
   a. Local maximum
   b. Local minimum
   c. Saddle point
   d. It is a stationary point but the 2nd partials test is inconclusive
   e. It is not a stationary point

6. What is the maximum value of \( f(x, y) = 4x^2 - y^2 \) on the region where \( x^2 + y^2 \leq 1 \)?
   a. 4
   b. 2
   c. -1
   d. -2
   e. 0
   f. None of these

7. What is the maximum value of \( f(x, y) = x^2 - x - y \) on the region where 
\( \{(x, y) : 0 \leq x \leq 1, 0 \leq y \leq 1 \} \) ?
   a. -2
   b. -3/2
   c. -5/4
   d. -1
   e. -3/4
   f. None of these

8. What is the maximum value of \( f(x, y) = y(x - 3) \) on the region where \( \{(x, y) : x^2 + y^2 \leq 9 \} \) ?
   a. \( \frac{27}{4} \)
   b. \( -\frac{27}{4} \)
   c. \( \frac{27\sqrt{3}}{4} \)
   d. \( -\frac{27\sqrt{3}}{4} \)
   e. None of these

9. What is the minimum value of \( f(x, y) = y(x - 3) \) on the region where \( \{(x, y) : x^2 + y^2 \leq 9 \} \) ?
   a. \( \frac{27}{4} \)
   b. \( -\frac{27}{4} \)
   c. \( \frac{27\sqrt{3}}{4} \)
   d. \( -\frac{27\sqrt{3}}{4} \)
   e. None of these
10. Find the minimum value of \( f(x,y) = (x-1)^2 + (y-4)^2 + (3 - x - 2y)^2 \)
   a. 0
   b. 1
   c. 3
   d. 6
   e. -1
   f. None of these

11. The stationary point(s) of the function \( z = x^2 + \frac{1}{3}y^3 - y^2 - 2x - 8y + 5 \) are:
   a. (4, 1) and (-1, 2)
   b. (1, 0) and (3, 2)
   c. (1, 2) and (-1, 4)
   d. (1, 4) and (1, -2)
   e. None of the above

12. The stationary point (1, 4) of the function \( f(x,y) = 2x^2 + y^2 - xy - 7y \) is a
   a. Local maximum
   b. Local minimum
   c. Saddle point

13. – 20. Choose A