Your Name: ____________________________

1 (13) ______
2 (13) ______
3 (13) ______
4 (13) ______
5 (13) ______
6 (13) ______
7 (13) ______
8 (13) ______
9 (13) ______
10 (13) ______
11 (13) ______
12 (13) ______
Total (156) ______
1. Find the partial derivative \( f_x \) of the function

\[
f(x, y) = \frac{x - y}{y + 2x}.
\]

- a) \( \frac{3y}{(2x + y)^2} \) Right answer
- b) \( \frac{3y}{(x + 2y)^2} \)
- c) \( \frac{y}{(2x + y)^2} \)
- d) \( \frac{1}{(2x + y)^2} \)

2. The U.S. market (in billions of dollars) for cholesterol-reducing drugs from 1999 to 2004 is given in the following table

<table>
<thead>
<tr>
<th>Year (x)</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market (y)</td>
<td>12.07</td>
<td>14.07</td>
<td>16.21</td>
<td>18.28</td>
<td>20.00</td>
<td>21.72</td>
</tr>
</tbody>
</table>

Find an equation of the least square line for this data. Use the results to estimate the US market for drugs in 2005, assuming the trends continue.
3. For the function \( f(x, y) = x^4 + y^4 - 4xy + 1 \), determine and classify the critical points. There are

- a) one minimum, one maximum and one saddle point
- b) two local minimums and one local maximum
- c) two local minimums
- d) two local minimums and one saddle point Right answer

4. Find the maximum and the minimum value of \( f(x, y) = x^2 + 2y^2 \) subject to the constraint \( x^2 + y^2 = 1 \).

- a) \( 0.5 \leq f(x, y) \) and \( f(x, y) \leq 2 \).
- b) \( 1 \leq f(x, y) \) and \( f(x, y) \leq 2 \) Right answer
- c) \( \sqrt{2}/2 \leq f(x, y) \) and \( f(x, y) \leq 1 \)
- d) \( 1 \leq f(x, y) \) and \( f(x, y) \leq \sqrt{2} \).
5. Closed rectangular box of volume $4\text{ ft}^3$ is to be constructed. If the material for the sides costs $1.00/\text{ft}^2$ and the material for the top and the bottom costs $1.50/\text{ft}^2$, find the dimensions of the box that can be constructed with minimum cost.

- a) $2(3^{-1/3}) \times 2(3^{-1/3}) \times 3^{2/3}$ Right answer
- b) $2(3^{-1/3}) \times 2(3^{-1/3}) \times 9^{2/3}$
- c) $4(3^{-1/3}) \times 4(3^{-1/3}) \times 3^{2/3}$
- d) $(4/3)^{1/3} \times (4/3)^{1/3} \times 3^{2/3}$
- e) none of the above

6. Compute the double integral $\int \int_R x\,dxdy$, where $R$ is the region bounded by $x = 0$, $x = 1$, $y = 4x$ and $y = x^2$

- a) $4/3$
- b) 1
- c) $13/12$ Right answer
- d) $2/3$
7. Compute \[ \int \int_R x^2 y \, dx \, dy, \]
where \( R \) is the rectangle with vertices \((0, 1), (0, 2), (3, 1), (3, 2)\)

- a) 13.5 Right answer
- b) 12
- c) 11/5
- d) 24.75

8. Compute \[ \int \int_R \frac{2y}{x^2 + 1} \, dx \, dy, \]
where \( R \) is the region bounded by \( x = 0, x = 1, y = 0, y = \sqrt{x} \).

- a) \( 2 \ln(2) \)
- b) \( \ln(2) \)
- c) \( \ln(2)/2 \) Right answer
- d) \( 2 - \ln(2) \)
9. Find the minimum value of the function \( f(x, y) = x^2 y \), subject to the constraint \( x^2 + y^2 = 1 \).

- a) \( \sqrt{2}/4 \)
- b) 1/2
- c) -1/2
- d) -2(3^{-3/2}) Right answer

10. Compute

\[ \int \int_R \frac{y}{x} \, dx \, dy, \]

where \( R \) is the region bounded by \( x = 1, x = 3, y = 0, y = 1 \).

- a) ln(3)/3
- b) 9/4
- c) ln(3)
- d) ln(3)/2 Right answer.
- e) none of the above
11. Compute 
\[ \int \int_R x e^{xy} \, dx \, dy, \]
where \( R \) is the rectangle \( 0 \leq x \leq 1, \ 0 \leq y \leq 1. \)
\textbf{Hint:} Compute the integral as 
\[ \int_0^1 \left( \int_0^1 x e^{xy} \, dy \right) \, dx, \]
• a) 1/2
• b) e
• c) 1
• d) e – 1
• e) none of the above. Right answer

12. Find the partial derivative \( f_{xy} \) for the function 
\[ f(x, y) = \frac{x}{x+y} \]
• a) \[ \frac{y-x}{(x+y)^3} \]
• b) \[ \frac{x-y}{(x+y)^3} \] Right answer
• c) \[ \frac{-2y}{(x+y)^3} \]
• d) \[ \frac{2x}{(x+y)^3} \]