1. For $f(x,y) = 2^x + 3xy$, find $f(2,3)$

A. 8

B. 18

C. 26

D. 22

E. 10

2. Given $f(x,y) = e^y + 2xy^3 + 3x^2y$, find $\frac{\partial f}{\partial y}$

A. $e^y + 3x^2$

B. $e^y + 6xy^2 + 6xy$

C. $2y^3 + 6xy$

D. $e^y + 6xy^2 + 3x^2$

E. $e^y + 6y^2 + 3$

3. Given $f(x,y) = \sin(x^2 y)$, find $f_x(1, \frac{\pi}{3})$

A. $\frac{\sqrt{3}}{2}$

B. $\frac{\pi}{6}$

C. 1

D. $\frac{\pi}{2}$

E. $\frac{\pi}{3}$

4. Given $f(x,y)=\frac{x^2}{y}$, use linearization and the values of f, f_x, f_y at $(4,2)$ to estimate $f(4.02,\ \ 1.97)$

A. 7.96
B. 8.08
C. 8.12
D. 8.20

E. 8.24

5. Given $f(x,y)=e^{3xy}$,find $\frac{\partial^2 f}{\partial x \partial y}$

A. $9y^2e^{3xy}$
B. $9xye^{3xy}$
C. $9x^2e^{3xy}$
D. $(9xy+3)e^{3xy}$
E. $(9xy+6)e^{3xy}$

6. Given $f(x) = x^3 + y^3 - 6xy$, please choose the correct statement about its relative Max/Min or saddle point.

A. There are 1 relative max and 1 relative min.

B. There are 1 relative max and 1 saddle point.

C. There are 1 relative min and 1 saddle point

D. There is only 1 saddle point, no max/min.

E. There are 2 saddle points.

7. A flat metal plate is located on a coordinate plane. The temperature of the plate, in degrees Fahrenheit, at point (x, y) is given by

$$T(x, y) = x^2 + 3y^2 - 4x + 6y .$$

What is the minimal temperature?

A. $-3^\circ F$

B. $-4^\circ F$

C. $-7^\circ F$

D. $-10^\circ F$

E. $-11^\circ F$

8. Evaluate $\int_0^2 \int_0^x (x^2 + y) dy dx$

A. $\frac{8}{3}$

B. $\frac{14}{3}$

C. $\frac{16}{3}$

D. 10

E. 4

9. Let $f(x,y)=x+y$, G is the plane region between the graphs of $y=x^2$ and $y=x$, find $\iint_G (x+y)dydx$

A. $\int_0^1 \int_0^x (x+y)dydx$

B. $\int_0^1 \int_{x^2}^x (x+y)dydx$

C. $\int_0^1 \int_x^{x^2} (x+y)dydx$

D. $\int_0^1 \int_x^1 (x+y)dydx$

E. $\int_0^1 \int_{x^2}^1 (x+y)dydx$

10. $g(x)$ is the unique solution to the initial-value problem:

$$\begin{cases} g'(x)=\ln x \\ g(1)=2 \end{cases}$$

Evaluate the value of $g(2)$

A. $g(2)=\frac{1}{2}(\ln 2)^2+2$

B. $g(2)=2\ln 2+2$

C. $g(2)=2\ln 2+3$

D. $g(2)=2\ln 2+1$

E. $g(2)=(\ln 2)^2+2$

11. Let $f(x)$ be the unique solution to the second-order initial-value problem:

$$\begin{cases} f''(x) = \cos 2x, \\ f(\frac{\pi}{4}) = \frac{\pi}{4}, \\ f'(\frac{\pi}{4}) = 1. \end{cases}$$

Evaluate the value of $f(0)$

A. $f(0) = -1 + \frac{\pi}{4}$

B. $f(0) = \frac{\pi}{8}$

C. $f(0) = -4 + \frac{\pi}{2}$

D. $f(0) = -\frac{1}{4} + \frac{\pi}{8}$

E. $f(0) = \frac{1}{4} + \frac{3}{8}\pi$

12. What is the slope of the direction field of $y' = x + y$ at point $(-1,2)$?

A. -2

B. -1

C. $-1/2$

D. 1

E. 2