

Name _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) Let $f(x, y) = 7x + 2y - 7$. Compute $f(-7, -2)$.
 A) -62 B) -67 C) 12 D) -53 1) _____
- 2) Let $g(x, y) = 6y^2 - 2xy$. Compute $g(7, -2)$.
 A) 45 B) 322 C) 320 D) 52 2) _____
- 3) Let $g(x, y) = \frac{x - 6y}{x^2 + y^2}$. Compute $g(3, 4)$.
 A) $-\frac{5}{21}$ B) $-\frac{21}{5}$ C) $-\frac{21}{25}$ D) $-\frac{25}{21}$ 3) _____
- 4) Let $f(x, y) = \ln(y + 2) + e^{2xy}$. Compute $f(0, -1)$.
 A) 0 B) 1 C) e D) $1 + e$ 4) _____

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 5) Let $f(x, y) = \sqrt{x^2 + y^2}$. Compute $f(3, 4)$.
 Enter just an integer. 5) _____
- 6) Let $f(x, y) = 3x^{1/4}y^{3/4}$. Compute $f(4a, 4b)$.
 Enter your answer as ca^nb^m . 6) _____
- 7) Let $f(x, y, z) = (\sqrt{xyz} + \sqrt{-2z} + \sqrt{x - z})$. Compute $f(1, -2, -1)$.
 Enter your answer as $a\sqrt{b}$. 7) _____
- 8) Let $f(x, y, z) = \frac{xy}{x + z}$. Compute $f(1, -1, -2)$.
 Enter just an integer. 8) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Evaluate the function.

- 9) Find $f(5, 0, 7)$ when $f(x, y, z) = 5x^2 + 5y^2 - z^2$.
 A) 79 B) 76 C) -24 D) 174 9) _____

- 10) Find $f(0, 1, -1)$ when $f(x, y, z) = 2^x - 4yz + 7x$. 10) _____
 A) -3 B) 5 C) -4 D) 4
- 11) A petroleum company has a Cobb-Douglas production function $f(x, y) = 70x^{2/5}y^{3/5}$ where x is the utilization of labor and y is the utilization of capital. Determine the number of units of petroleum produced when 1200 units of labor and 2100 units of capital are used. 11) _____
 A) 105,074 units B) 175,174 units C) 117,517 units D) 150,000 units
- 12) A company has a Cobb-Douglas production function $f(x, y) = 20x^{0.33}y^{0.67}$ where x is the utilization of labor and y is the utilization of capital. Determine the number of units of product produced when 1728 units of labor and 27,000 units of capital are used. 12) _____
 A) 85,612 units B) 46,605 units C) 217,988 units D) 29,292 units
- 13) A rectangular garden is to be surrounded on three sides by a fence costing \$5 per foot and on one side by a stone wall costing \$15 per foot. Let x be the length of the side with the stone wall, and let y be the length of each of the other three sides. Express the cost of enclosing the garden as a function of two variables. 13) _____
 A) $C(x, y) = (20x)(10y)$
 B) $C(x, y) = 15x + 5y$
 C) $C(x, y) = (15x)(5y)$
 D) $C(x, y) = 15x + 15y$
 E) none of these

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

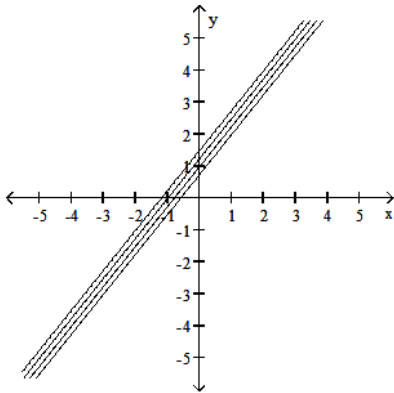
- 14) A company makes cylindrical cans of radius r and height h at a cost of a cents per unit area for the top and bottom and b cents per unit area for the side. Express the cost of producing a can as a function of the two variables r , and h . 14) _____
 Enter your answer in the form: $2\pi r(cr \pm dh)$.
- 15) Let $f(x, y) = xy^2 + x^2$. Simplify $\frac{f(x+h, y) - f(x, y)}{h}$ for $h \neq 0$. 15) _____
 Enter your answer exactly in the form: $ax + y^n + b$.
- 16) Let $f(x, y) = \frac{x}{y} - 2xy$. Compute $f\left(1+h, \frac{1}{2}\right)$. 16) _____
 Enter your answer as a polynomial in h in standard form.
- 17) Let $f(x, y) = xy + 5$. Compute $f(1, 2+k) - f(1, 2)$. 17) _____
 Enter a polynomial in k in standard form.
- 18) Let $f(x, y) = x^2y^2 - 1$. Compute $\frac{f(-1, 1+k) - f(-1, 1)}{k}$ for $k \neq 0$. 18) _____
 Enter your answer as a polynomial in k in standard form.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 19) Suppose the number of leather bags produced by a certain firm, utilizing x units of raw materials and y units of labor, is given by the formula $f(x, y) = 10x^{1/2}y^{1/2}$. What happens to the production of bags if supplies of both raw materials and labor are tripled? 19) _____
- A) Production is increased by a factor of 9.
 - B) Production is increased by a factor of 6.
 - C) Production is increased by a factor of $\sqrt{3}$.
 - D) Production is increased by a factor of 3.
 - E) none of these

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 20) Are these the level curves of heights $-3, -2, -1$, and 0 for $f(x, y) = 5x - 4y + 3$? 20) _____



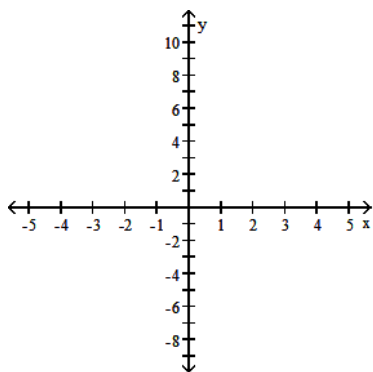
Enter "yes" or "no".

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

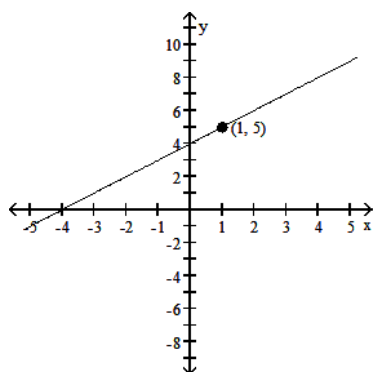
Draw the level curve of the given function $f(x, y)$ at the specified point.

21) $f(x, y) = \frac{x}{y}$; point (1, 5)

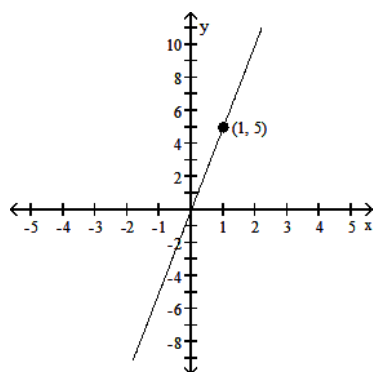
21) _____



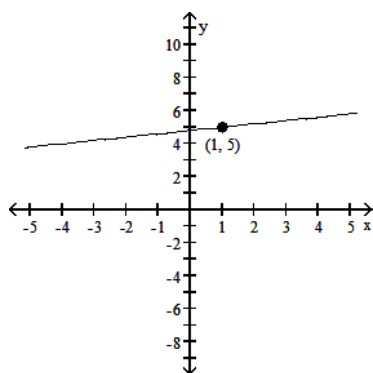
A)



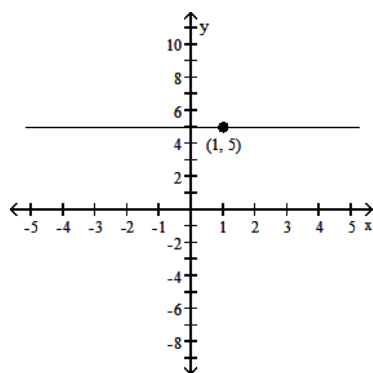
B)



C)



D)



Find the partial derivative.

22) $f(x, y) = 10x - 10y^2 - 4$. Find $\frac{\partial f}{\partial x}$.

22) _____

A) 10

B) 6

C) $10x$

D) $-20y$

- 23) $f(x,y) = 3x^2 - 15xy + 7y^3$. Find $\frac{\partial f}{\partial x}$. 23) _____
- A) $6x - 15y + 21y^2$ B) $-15x + 21y^2$
 C) $6x^2 - 15x$ D) $6x - 15y$
- 24) $f(x, y) = (x + y)^5$. Find $\frac{\partial f}{\partial x}$. 24) _____
- A) $5y(x + y)^4$ B) $5x(x + y)^4$ C) $5(x + y)$ D) $5(x + y)^4$
- 25) $f(x, y) = 3(x + 7y - 5)^2$. Find $\frac{\partial f}{\partial y}$. 25) _____
- A) $42x + 294y + 210$ B) $42x + 294y - 210$
 C) $21x + 147y$ D) $21x + 147y - 105$
- 26) $f(x, y) = e^{-2x + 3y}$. Find $\frac{\partial f}{\partial x}$. 26) _____
- A) $f_x(x, y) = -2e^{-2x}$ B) $f_x(x, y) = -2e^{-2x + 3y}$
 C) $f_x(x, y) = 3e^{-2x + 3y}$ D) $f_x(x, y) = e^{-2x + 3}$
- 27) $f(x, y) = e^{2xy}$. Find $\frac{\partial f}{\partial x}$. 27) _____
- A) $f_x(x, y) = 2e^{2xy}$ B) $f_x(x, y) = 2ye^{2xy}$
 C) $f_x(x, y) = 2ye^{2x}$ D) $f_x(x, y) = 2(x + y)e^{2xy}$
- 28) $f(x, y) = x \ln(9x + 4y)$. Find $\frac{\partial f}{\partial x}$. 28) _____
- A) $f_x(x, y) = \frac{9x}{9x + 4y}$ B) $f_x(x, y) = \frac{9x}{9x + 4y} + \ln(9x + 4y)$
 C) $f_x(x, y) = \ln(9x + 4y)$ D) $f_x(x, y) = \ln(9x + 4y) + \frac{9}{9x + 4y}$
- 29) $f(x, y) = \frac{2x}{y} - \frac{y}{2x}$. Find $\frac{\partial f}{\partial x}$. 29) _____
- A) $f_x(x, y) = \frac{2x^2}{y} + \frac{y}{2x^2}$ B) $f_x(x, y) = \frac{2}{y} - \frac{y}{2x^2}$
 C) $f_x(x, y) = \frac{2}{y} + \frac{y}{2x^2}$ D) $f_x(x, y) = -\frac{2}{y^2} - \frac{2}{y}$
- 30) Find $\frac{\partial f}{\partial x}(3, -5)$ when $f(x,y) = 7x^2 - 9xy$. 30) _____
- A) 87 B) 3 C) -3 D) -72

31) Find $\frac{\partial f}{\partial y}(2, -3)$ when $f(x, y) = 7xy - 6y$. 31) _____
 A) 14 B) 8 C) 0 D) -21

32) Find $\frac{\partial f}{\partial x}(-4, 5)$ when $f(x, y) = (2x + 5y)^2$. 32) _____
 A) 34 B) 14 C) -32 D) 68

33) Find $\frac{\partial f}{\partial x}$ for $f(x, y, z) = 2x^8y^3 + 6x^3z^5 + 7y^{10}$. 33) _____
 A) $6x^8y^2 + 30x^3z^4$ B) $48x^7y^2 + 90x^2z^4$
 C) $16x^7y^3 + 18x^2z^5$ D) $16x^7 + 18x^2$

Find the second-order partial derivative.

34) Find $\frac{\partial^2 f}{\partial x^2}$, where $f(x, y) = x^4y^5 + x^5y$. 34) _____
 A) $12x^2y^5 + 20x^3$ B) $4x^3y^5 + 5x^4y$
 C) $12x^2y^5 + 20x^3y$ D) $20y^3$

35) Let $f(x, y) = \frac{1}{2}x^2 \cdot e^{x/y}$. Find $\frac{\partial f}{\partial y}$. 35) _____
 A) $\frac{x^2}{y}e^{x/y}$
 B) $\frac{x^3}{y}e^{x/y} - 1$
 C) $\frac{1}{2}x^2e^{x/y}$
 D) $-\frac{x^3}{2y^2}e^{x/y}$
 E) none of these

36) Let $f(x, y, z) = xyz(1 + e^{YZ})$. Find $\frac{\partial f}{\partial z}$. 36) _____
 A) $xy(1 + e^Y)$
 B) $xy(1 + e^{YZ}) + xy^2ze^{YZ}$
 C) $xy(1 + ye^{YZ})$
 D) $xy(1 + e^{YZ}) + xy(1 + ye^{YZ})$
 E) none of these

37) Let $G(x, r, t) = 2x^2t + \frac{1}{3}t^2 - r^3\sqrt{xt}$. Find $\frac{\partial G}{\partial x}$.

37) _____

A) $4x - \frac{r^3}{2\sqrt{xt}}$

B) $4xt + \frac{1}{3}t^2 - r^3\frac{1}{2\sqrt{xt}}$

C) $4xt - \frac{r^3t}{2\sqrt{xt}}$

D) $4xt - \frac{1}{3}t^2 - \frac{3r^2t}{2\sqrt{xt}}$

E) none of these

38) Let $f(x, y, z) = y^3z - x^2y + \sqrt{xyz} - \frac{1}{x}$. Find $\frac{\partial f}{\partial y}$.

38) _____

A) $3y^2z - x^2 + \frac{xz}{2\sqrt{xyz}}$

B) $3y^2z - x^2 + \sqrt{xz}$

C) $3y^2 - 2x + 1$

D) $3y^2z - x^2 + \frac{xz}{\sqrt{xyz}} + \frac{1}{x^2}$

E) none of these

39) Let $g(x, t, z) = \frac{1}{t}(x - z^2t)$. Find $\frac{\partial^2 g}{\partial z \partial t}$.

39) _____

A) $-2zt + t^2$

B) $-2zt$

C) $-\frac{2z}{t} + 1$

D) 0

E) none of these

40) Let $H(x, y) = \frac{3xy}{x^2 - y}$. Find $\frac{\partial^2 H}{\partial y^2}$. 40) _____

A) $\frac{9x^4 - 6x^3 - 9x^2y}{(x^2 - y)^3}$

B) $\frac{6x^3}{(x^2 - y)^3}$

C) $\frac{3x^3}{(x^2 - y)^2}$

D) $\frac{6x^3y - 6x^5}{(x^2 - y)^4}$

E) none of these

41) Let $F(x, y, z) = \frac{xz}{y^2z + x} - 5x^2y^3$. Compute $\frac{\partial F}{\partial y}(-1, 0, 1)$. 41) _____

A) $-\frac{1}{2}$

B) $\frac{3}{5}$

C) 0

D) 2

E) none of these

42) Let $P(x, y, z) = xy + 2x^3\sqrt{y^2 - 1}$. Compute $\frac{\partial P}{\partial z}(2, 1, 3)$. 42) _____

A) 3

B) 2

C) 1

D) 0

E) none of these

43) Let $f(x, y) = x^3y + e^x + 3y$. Compute $\frac{\partial^2 f}{\partial x \partial y}(1, 0)$. 43) _____

A) $6 + e$

B) 6

C) $3 + 3e$

D) $3 + e$

E) none of these

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

44) Let $f(x, y) = (x^2 + x)e^y - x$. Find $\frac{\partial f}{\partial x}$. 44) _____

Enter your answer as just $(P(x))e^y - x$ where P is a polynomial in x in standard form.

45) Let $f(x, y) = 4y^2 - 2x^3 + 5xy^2$. Find $\frac{\partial f}{\partial x}$. 45) _____

Enter just a polynomial in x plus or minus a polynomial in y both in standard form (do not label, no parentheses).

46) Let $f(x, y) = e^{x^2}y$. Find $\frac{\partial f}{\partial y}$. 46) _____

Enter your answer exactly as just $e^{x^2}y(P(x))$ where P is a polynomial in x in standard form (do not label).

47) Let $f(x, y) = x^2 + y$. Find $\frac{\partial f}{\partial y}$. 47) _____

Enter just an integer.

48) Let $f(x, y) = 3x^2 + 2xy$. Find $\frac{\partial f}{\partial x}$. 48) _____

Enter your answer exactly as just a polynomial in x plus or minus a polynomial in y both in standard form (do not label, no parentheses).

49) Let $f(x, y) = x^2 + 2xy + e^y$. Find $\frac{\partial f}{\partial y}$. 49) _____

Enter just a polynomial in x plus or minus a polynomial in e^y both in standard form (do not label, no parentheses).

50) Let $f(x, y) = 4x^2 + 2y^{2/3} + e^{x^{4/3}}$. Find $\frac{\partial f}{\partial y}$. 50) _____

Enter just a power function in y in standard form (do not label).

51) Let $f(x, y) = 4x^2 + 2y^2 + 3xy$. Find $\frac{\partial f}{\partial y}$. 51) _____

Enter just a polynomial in y plus or minus a polynomial in x both in standard form (no label, no parentheses).

52) Let $f(x, y) = 2y^3 + 4x^4 + 2xy$. Find $\frac{\partial f}{\partial y}$. 52) _____

Enter just a polynomial in y plus or minus a polynomial in x both in standard form (no label, no parentheses).

- 53) Let $f(x, y, z) = \ln(xy^2z^3)$. Find $\frac{\partial f}{\partial z}$. 53) _____
 Enter your answer in the unlabeled form az^b .
- 54) Let $f(x, y) = x^2y + y^2x + 2xy$. Find $\frac{\partial^2 f}{\partial x \partial y}$. 54) _____
 Enter just a polynomial in x plus or minus a polynomial in y plus or minus two, both polynomials in standard form (no label, no parentheses).
- 55) Let $f(x, y) = \frac{x}{y+1}$. Find $\frac{\partial^2 f}{\partial x \partial y}$. 55) _____
 Enter just $\pm(P(y))^a$ where P is a polynomial in standard form (do not label).
- 56) Let $f(x, y) = y(x + e^y - x)$. Compute $\frac{\partial f}{\partial x}(2, 3)$. 56) _____
 Enter your answer exactly as just $a(b \pm e)$.
- 57) Let $f(x, y) = xy$. Find $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$. Is y, x correct in the corresponding order? 57) _____
 Enter "yes" or "no".
- 58) Let $f(x, y) = x^2y - xy^2$. Find $\frac{\partial f}{\partial x}$. Is $y^2 + 2xy$ the correct answer? 58) _____
 Enter "yes" or "no".
- 59) Let $f(x, y) = (x^2y^3 + x^3)^5$. Find $\frac{\partial f}{\partial y}$. Is $5(x^3 + y^3x^2)^4(3y^2x^2)$ the correct answer? 59) _____
 Enter "yes" or "no".
- 60) Let $f(x, y) = x^2e^{xy}$. Find $\frac{\partial f}{\partial x}$. Is $(yx^2 - 2x)e^{xy}$ the correct answer? 60) _____
 Enter "yes" or "no".
- 61) Let $f(x, y) = \frac{\ln xy}{y}$. Find $\frac{\partial f}{\partial x}$. Is $(xy)^{-1}$ the correct answer? 61) _____
 Enter "yes" or "no".
- 62) Let $f(x, y, z) = e^{xy^2z^3}$. Find $\frac{\partial f}{\partial z}$. Is $3xy^2z^2e^{xy^2z^3}$ the correct answer? 62) _____
 Enter "yes" or "no".
- 63) Let $f(x, y) = \ln(x + 2y)$. Find $\frac{\partial^2 f}{\partial x \partial y}$. Is $-(x + 2y)^{-2}$ the correct answer? 63) _____
 Enter "yes" or "no".

64) Let $f(x, y) = e^x - y$. Find $\frac{\partial^2 f}{\partial x \partial y}$. Is $e^x - y$ the correct answer? 64) _____
Enter "yes" or "no".

65) Let $f(x, y) = (x + y)^2 - (x + y)^3$. Find $\frac{\partial^2 f}{\partial x \partial y}$. Is $-6(x + y) + 2$ the correct answer? 65) _____
Enter "yes" or "no".

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

66) A company has the following production function for a certain product: 66) _____
 $p(x, y) = 32x^{0.3}y^{0.7}$.
Find the marginal productivity with fixed capital, $\frac{\partial p}{\partial x}$.

- A) $9.6\left(\frac{x}{y}\right)^{0.7}$ B) $9.6\left(\frac{y}{x}\right)^{0.7}$ C) $9.6xy^{0.7}$ D) $9.6\left(\frac{y}{x}\right)^{1.3}$

67) A company has the following production function for a certain product: 67) _____
 $p(x, y) = 24x^{0.8}y^{0.2}$.
Find the marginal productivity with fixed labor, $\frac{\partial p}{\partial y}$.

- A) $4.8\left(\frac{x}{y}\right)^{0.8}$ B) $4.8yx^{0.8}$ C) $4.8\left(\frac{y}{x}\right)^{0.2}$ D) $4.8\left(\frac{y}{x}\right)^{0.8}$

68) The production function $f(x, y)$ for an industrial country was estimated as $f(x, y) = x^7y^4$, where x is 68) _____
the amount of labor and y the amount of capital. Find the marginal productivity of labor.
A) $7x^6y^4$ B) $4x^7y^3$ C) $8x^7y^3$ D) $14x^6y^4$

69) Suppose that the manufacturing cost of a precision instrument is approximated by 69) _____
 $M(x, y) = 30x^2 + 20y^2 - 9xy$, where x is the cost of materials and y is the cost of labor. Find
 $\frac{\partial M}{\partial x}(6, 8)$.
A) 848 B) 648 C) 266 D) 288

70) A company's monthly sales, in thousands, is given by $S(x, y) = 5x^{0.7}y^{0.5}$, where x is the amount 70) _____
spent on newspaper advertising per month in thousands of dollars and y is the amount spent on
radio advertising per month in thousands of dollars. Suppose the company currently spends
\$4000 on newspaper advertising per month and \$2000 on radio advertising per month. What
would be the effect on sales if the company increases the amount spent on newspaper advertising
to \$5000, while the amount spent on radio advertising remains constant?
A) Sales would decrease by \$305.42. B) Sales would increase by \$12,559.41.
C) Sales would increase by \$4665.16. D) Sales would increase by \$3054.16.

- 71) Let $f(x, y, z)$ be the amount of heat lost each day by a rectangular building x feet wide, y feet long, and z feet high. Suppose that $\frac{\partial f}{\partial z}(50, 80, 15) = 45$. Which one of the following conclusions can be drawn? 71) _____
- A) A building with dimensions $50 \times 80 \times 15$ loses about 45 units of heat each day.
 - B) A building with dimensions $51 \times 81 \times 16$ will lose about 45 more units of heat each day than a building with dimensions $50 \times 80 \times 15$.
 - C) A building with dimensions $50 \times 80 \times 15$ loses about 45 units of heat from the top of the building each day
 - D) The marginal heat loss per day is 45 units of heat per square foot of surface area of the roof.
 - E) A building with dimensions $50 \times 80 \times 16$ will lose about 45 more units of heat each day than a building with dimensions $50 \times 80 \times 15$.
- 72) The demand for a certain energy-efficient home is given by $f(p_1, p_2)$, where p_1 is the price of the home and p_2 is the price of electricity. Which of the following explains why $\frac{\partial f}{\partial p_2} > 0$? 72) _____
- A) As the price of electricity goes up, demand for the home goes up.
 - B) The price of electricity keeps going up due to increased demand.
 - C) As the price of electricity goes up, demand for the home goes down.
 - D) Homes are too expensive during energy crises.
 - E) As the price of electricity increases, demand for the home depends more on the price of the home than on the price of electricity.
- 73) Assume that a manufacturer has productivity function $P(l, c)$ where l and c are the amounts of labor and capital utilized. Which of the following indicates that a slight increase in the amount of labor utilized will result in an increase in productivity of 3 units. 73) _____
- A) $\frac{\partial P}{\partial l}(100, 75) = 3$
 - B) $P(10, 75) = 3$
 - C) $\frac{\partial P}{\partial c}(100, 75) = 3$
 - D) $P(1, 75) = 3$
 - E) none of these
- 74) Suppose that a retailer sells $f(p, a)$ units of an item, where p is the price per unit of the item and a is the amount of money spent on advertising that item. Which of the following indicates that as the amount spent on advertising is decreased, demand for the item also decreases? 74) _____
- A) $\frac{\partial f}{\partial a}(50, 75) = -10$
 - B) $\frac{\partial f}{\partial p}(50, -1) = -5$
 - C) $\frac{\partial f}{\partial p}(50, 25) = -1$
 - D) $\frac{\partial f}{\partial a}(50, 25) = 10$

- 75) A certain manufacturer can produce $f(x, y) = 10(6x^3 + y^2)$ units of goods by utilizing x units of labor and y units of capital. What is the marginal productivity of labor when $x = 10$ and $y = 20$? 75) _____
- A) 1800 units
B) 22,000 units
C) 2200 units
D) 18,000 units
E) none of these
- 76) The productivity of a certain country is $P(x, y) = 1600x^{1/4}y^{3/4}$ units, where x and y are the amounts of labor and capital utilized. What is the marginal productivity of capital when $x = 16$ and $y = 625$? 76) _____
- A) 480
B) 1600
C) 5000
D) 2500
E) none of these
- 77) Suppose that a company can produce $P(x, y) = 50\sqrt{\frac{(x^3 + y^3)}{10}}$ items using x units of labor and y units of capital. What is the productivity of capital when $x = 10$ and $y = 20$? 77) _____
- A) 2500
B) 3000
C) 100
D) 500
E) none of these
- 78) Let $f(x, y) = x^2 + 2xy + 5y^2 + 2x + 10y - 3$. At which point(s) does $f(x, y)$ have possible maximum/minimum values? 78) _____
- A) $(-1, 17)$ and $(0, 5)$
B) $(0, -1)$
C) $(1, 0)$
D) $(-1, 0)$ and $(0, 1)$
E) none of these
- 79) Let $f(x, y) = 5x^2 - 5y^2 + 2xy + 34x + 38y + 12$. At which point does $f(x, y)$ have a possible maximum or minimum value? 79) _____
- A) $(-4, -3)$ B) $(-4, 3)$ C) $(4, -3)$ D) $(4, 3)$

- 80) Let $f(x, y) = ye^x + xy^2$. At which point does $f(x, y)$ have a possible maximum or minimum value? 80) _____
- A) $(0, 0)$
- B) $\left\{\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}e^{\sqrt{2}/2}}{2}\right\}$
- C) $\left\{\frac{1}{2}, -\frac{e^{1/2}}{2}\right\}$
- D) $\left\{\frac{1}{2}, -e^{1/2}\right\}$
- E) none of these

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 81) Find all points (x, y) where $f(x, y) = 3xy - x^2 - y^2 - 2x - y + 3$ has a possible relative maximum or minimum. 81) _____
Enter your answer as just (a, b) where a, b are reduced fractions of form $\frac{c}{d}$.
- 82) Find all points (x, y) where $f(x, y) = x^2 - 2y^2 + 4x - 6y + 8$ has a possible relative maximum or minimum. 82) _____
Enter your answer as just (a, b) where a, b are either integers or reduced fractions of form $\frac{c}{d}$.
- 83) Find all points (x, y) where $f(x, y) = 2x^2 + 2y^3 - x - 6y + 14$ has a possible relative maximum or minimum. 83) _____
Enter your answer exactly as just $(a, b), (c, d)$ with $b > d$ and where a, b, c, d are either integers or reduced fractions of form $\frac{e}{f}$.
- 84) Find all points (x, y) where $f(x, y) = x^3 - y^2 - 3x + y + 5$ has a possible relative maximum or minimum. 84) _____
Enter your answer exactly as just $(a, b), (c, d)$ with $a > c$ and where a, b, c, d are either integers or reduced fractions of form $\frac{e}{f}$.
- 85) Find all points (x, y) where $f(x, y) = x^2 + y^3 - 6y^2 + 6x - 15y$ has a possible relative maximum or minimum. 85) _____
Enter your answer exactly as just $(a, b), (c, d)$ with $b < d$ and where a, b, c, d are all integers.

- 86) Find all points (x, y) where $f(x, y) = x^2 + xy + y^2 - x - y + 2$ has a possible relative maximum or minimum. 86) _____
 Enter your answer exactly as just (a, b) where a, b are reduced fractions of form $\frac{c}{d}$ or integers.
- 87) Find all points (x, y) where $f(x, y) = xy - 2x^2 + x - 4y + 1$ has a possible relative maximum or minimum. 87) _____
 Enter your answer exactly as just (a, b) where a, b are either reduced fractions of form $\frac{c}{d}$ or integers.
- 88) Let $f(x, y, z) = x^2y + \frac{x}{z}$. Find $\frac{\partial f}{\partial z}$. 88) _____
 Enter your answer as a polynomial in x in standard form (unlabeled).
- 89) Let $f(x, y, z) = e^{x^2 + y^2 + z^2}$. Find $\frac{\partial f}{\partial z}$. 89) _____
 Enter your answer as a polynomial in $e^{x^2 + y^2 + z^2}$ in standard form (unlabeled).
- 90) Let $f(x, y) = \sqrt{x^2 + y^2}$. Compute $\frac{\partial f}{\partial x}$ at $(3, 4)$. 90) _____
 Enter just a reduced fraction $\frac{a}{b}$.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 91) Let $f(x, y) = x^4 - y^2 + 3x^2 + 2y - 7$. The first partial derivatives of $f(x, y)$ are zero at the points $(0, 1)$ and $(-1, 1)$. Use the second derivative test to determine the nature of $f(x, y)$ at each of these points. 91) _____
 A) $(0, 1)$ no conclusion possible, $(-1, 1)$ minimum
 B) $(-1, 1)$ relative maximum, $(0, 1)$ neither relative maximum nor minimum
 C) $(0, 1)$ neither relative maximum nor minimum, $(-1, 1)$ maximum
 D) $(0, 1)$ relative maximum, $(-1, 1)$ relative minimum
 E) none of these
- 92) Find all points (x, y) where $f(x, y) = x^2 + xy + y^2 - 3x + 2$ has a possible relative maximum or minimum. Use the second-derivative test to determine, if possible, the nature of $f(x, y)$ at each of these points. 92) _____
 A) $(-2, 1)$ is a relative minimum
 B) $(2, -1)$ is a relative maximum
 C) $(-2, 1)$ is a relative maximum
 D) $(2, -1)$ is a relative minimum

- 93) Find all points (x, y) where $f(x, y) = x^3 - 12y + y^2$ has a possible relative maximum or minimum. Use the second-derivative test to determine, if possible, the nature of $f(x, y)$ at each of these points. 93) _____
- A) $(0, 0)$ gives a relative maximum
 B) $(0, 6)$ gives a relative maximum
 C) Test Inconclusive
 D) $(0, 0)$ gives a relative minimum
- 94) Find all points (x, y) where $f(x, y) = \frac{1}{x} + xy - \frac{1}{y}$ has a possible relative maximum or minimum. Use the second-derivative test to determine, if possible, the nature of $f(x, y)$ at each of these points. 94) _____
- A) Neither a relative maximum nor a relative minimum at $(-1, 1)$
 B) $(-1, 1)$ gives a relative maximum point
 C) $(-1, 1)$ gives a relative minimum point
 D) $(1, 1)$ gives a relative minimum point
- 95) Find all points (x, y) where $f(x, y) = e^{(x^2 + y^2)}$ has a possible relative maximum or minimum. Use the second-derivative test to determine, if possible, the nature of $f(x, y)$ at each of these points. 95) _____
- A) $(0, 1)$ gives a relative minimum point
 B) $(0, 1)$ gives a relative maximum point
 C) $(0, 0)$ gives a relative maximum point
 D) $(0, 0)$ gives a relative minimum point
- 96) Let $f(x, y) = x^2 - xy + y^2 + 2y - 4$. The point $\left(-\frac{2}{3}, -\frac{4}{3}\right)$ is a 96) _____
- A) absolute maximum
 B) not a relative extreme point
 C) relative maximum
 D) relative minimum
- 97) Let $Q(x, y) = x^2y + y^3x^4$. The point $(1, 0)$ is 97) _____
- A) not a relative extreme point
 B) absolute maximum
 C) a relative minimum point
 D) a relative maximum point
- 98) The function $H(x, y) = x^4 - 9y^2 - 2x^2y + 20y + 4$ has 98) _____
- A) neither a relative maximum nor minimum at $(1, 4)$
 B) a relative maximum at the point $(-1, 1)$
 C) a relative minimum at the point $(0, 0)$
 D) a relative maximum at the point $(0, 1)$
 E) none of these

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 99) Let $f(x, y) = xe^{2y} + ye^{2x}$. Compute $\frac{\partial^2 f}{\partial x^2}$. 99) _____

Enter your answer as just an unlabeled polynomial in e^{2x} in standard form.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 100) A tennis racket manufacturer produces two types of rackets, standard and competition. The weekly revenue function, in dollars, for x standard rackets and y competition rackets is given by 100) _____

$$R(x, y) = 54x + 2xy + 398y - 2x^2 - 9y^2$$

- i) How many of each type of racket must be produced each week to maximize revenue?
ii) What is the maximum weekly revenue?

- A) i) 25 standard rackets and 26 competition rackets;
ii) \$5664
B) i) 26 standard rackets and 26 competition rackets;
ii) \$5668
C) i) 26 standard rackets and 25 competition rackets;
ii) \$5677
D) i) 25 standard rackets and 25 competition rackets;
ii) \$5675

- 101) A rectangular box of length x , width y , and height z with no top is to be constructed having a volume of 32 cubic inches. Determine the dimensions that will require the least amount of material to construct the box. 101) _____

- A) 2 inches by 2 inches by 4 inches
B) 4 inches by 4 inches by 2 inches
C) 4 inches by 4 inches by 4 inches
D) 4 inches by 2 inches by 4 inches

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 102) Find the greatest possible volume of a rectangular box that has length plus girth equal to 60 inches. Enter your answer as a single integer (no units). 102) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

- 103) Suppose that the labor cost for a building is approximated by 103) _____

$C(x, y) = 2x^2 + 3y^2 - 400x - 420y + 20,000$, where x is the number of days of skilled labor and y is the number of days of semiskilled labor required. Find the x and y that minimize cost C .

- A) $x = 200$, $y = 140$
B) $x = 210$, $y = 210$
C) $x = 100$, $y = 70$
D) $x = 70$, $y = 210$

- 104) The profit (in thousands of dollars) that a company earns from producing x tons of brass and y tons of steel can be approximated by $P(x, y) = 36xy - 8x^3 - y^3$. Find the amount of brass and steel that maximize profit and find the value of the maximum profit. 104) _____
- A) $\frac{18}{5}$ tons of brass and $\frac{9}{2}$ tons of steel; maximum profit is \$118,833
- B) 6 tons of brass and 3 tons of steel; maximum profit is \$216,000
- C) $\frac{18}{7}$ tons of brass and $\frac{36}{5}$ tons of steel; maximum profit is \$157,977
- D) 3 tons of brass and 6 tons of steel; maximum profit is \$216,000

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 105) Let $f(x, y) = 8x - 2y$. Find the point(s) where $f(x, y)$ may have a possible relative maximum or minimum, subject to the constraint $x^2 + \frac{1}{2}y = 18$. Use the method of Lagrange multipliers. Enter your answer as just (a, b) where a, b are integers. 105) _____
- 106) Let $f(x, y) = x^2 - 6xy + 10$. Find the point(s) where $f(x, y)$ may have a possible relative maximum or minimum, subject to the constraint that $5x + 3y = 11$. Use the method of Lagrange multipliers. Enter your answer as just (a, b) where a, b are both integers. 106) _____
- 107) Let $f(x, y, z) = xyz$. Find the point(s) where $f(x, y, z)$ may have a possible relative maximum or minimum, subject to the constraint $x + 6y + 3z = 36$ and where $x > 0, y > 0, z > 0$. Use the method of Lagrange multipliers. Enter your answer as just (a, b, c) where a, b, c are all integers. 107) _____
- 108) Minimize the function $f(x) = x + y$, subject to the constraint $xy = 100, x > 0, y > 0$. Use the method of Lagrange multipliers. Enter your answer exactly as just $(a, b), c$ where (a, b) gives the minimum and c is the Lagrange multiplier as a reduced fraction of form $\frac{d}{e}$ (no words or labels). 108) _____
- 109) Determine the minimum of $f(x, y) = x^2 + 2y^2$ subject to the constraint $x - 2y + 3 = 0$. Enter your answer exactly as just a, b where a is the minimum and b is the Lagrange multiplier, both as integers (no labels). 109) _____
- 110) Determine the maximum value of $f(x, y) = 4 - x^2 - y^2$ subject to the constraint $y = 3x - 4$. Enter your answer as exactly just a, b where a is the maximum and b is the Lagrange multiplier as either integers or reduced fractions of form $\frac{c}{d}$ (no words or labels). 110) _____

- 111) Determine the minimum value of $f(x, y) = x^2 - xy + 2y^2 + 4$ subject to the constraint $x - y - 1 = 0$. 111) _____
 Enter your answer exactly as just a, b where a is the minimum and b is the Lagrange multiplier, using integers or reduced fractions of form $\frac{c}{d}$ (no words or units).
- 112) Find the pairs (x, y) that give the extreme values of $2x + 10y$, subject to the constraint $4x^2 + 5y^2 = 8400$, using the method of Lagrange multipliers. 112) _____
 Enter your answer as exactly just (a, b) , (c, d) where $a > c$ (no words).

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 113) Suppose the partial derivatives of a Lagrange function $F(x, y, \lambda)$ are $\frac{\partial F}{\partial x} = 2 - 8\lambda x$, $\frac{\partial F}{\partial y} = 1 - 2\lambda y$, 113) _____
 $\frac{\partial F}{\partial \lambda} = 32 - 4x^2 - y^2$. What values of x and y minimize $F(x, y, \lambda)$? (Assume x and y are positive.)
 A) $(2\sqrt{2}, \sqrt{4})$
 B) $(2, 4)$
 C) $(2, \sqrt{2})$
 D) $(4, 2)$
 E) none of these
- 114) Which of the following pairs of values (x, y) maximizes the function $f(x, y) = x + 3y$ subject to the constraint $x^2 + 9y^2 = 72$ assuming x and y are positive? 114) _____
 (I) $(-6, -2)$ (II) $\left(8, \sqrt{\frac{8}{9}}\right)$ (III) $(2, -6)$ (IV) $(6, 2)$
 A) I only
 B) III only
 C) I and II
 D) IV only
 E) none of these

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 115) Maximize $f(x, y, z) = x + y + z$ subject to the constraint $x^2 + y^2 + z^2 = 1$, $x, y, z > 0$. 115) _____
 Enter your answer as just 3^a where a is a reduced fraction of form $\frac{b}{c}$.
- 116) Minimize the function $f(x, y, z) = x^2 + y^2 + z^2$ subject to the constraint $x + y + z = 2$. 116) _____
 Enter your answer as just a reduced fraction of form $\frac{a}{b}$.

117) Maximize the function $f(x, y) = x^2 - y^2$ subject to the constraint $y - x^2 = -\frac{1}{2}$, $x, y > 0$. 117) _____

Enter your answer as just a reduced fraction of form $\frac{a}{b}$.

118) Maximize the function $f(x, y) = e^{xy}$ subject to the constraint $x^2 + y^2 = 18$, $x, y > 0$. 118) _____

Enter your answer as just e^a .

119) Maximize the function $f(x, y) = 2x + y$ subject to the constraint $x^2 + y^2 = 1$. 119) _____

Enter your answer exactly in the form $\left(a\sqrt{\frac{b}{c}}, \sqrt{\frac{d}{e}}\right), \left(-h\sqrt{\frac{i}{j}}, \sqrt{\frac{k}{l}}\right)$.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

120) Find two positive numbers x and y such that $x + y = 60$ and xy^2 is maximized. 120) _____

A) $x = 20$ and $y = 40$

B) $x = 1$ and $y = 59$

C) $x = 30$ and $y = 30$

D) $x = 15$ and $y = 45$

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

121) A business produces two products A and B. Let x and y denote, respectively, the quantity of A and B to be produced. Limitations on the company resources require that $500x^2 + 100y$ be at most 100,000. Each unit of A yields a \$5000 profit and each unit of B yields a \$500 profit. What should x and y be to yield a maximum profit? 121) _____

Enter your answer exactly as just (a, b) an ordered pair of integers.

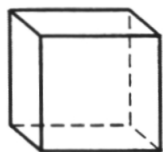
122) Design a cylindrical can of volume 100 cubic units that requires a minimum amount of aluminum; that is, the can is to have a minimum surface area. 122) _____

Enter your answer exactly as just r, h where r is exactly of form $\sqrt[3]{\frac{a}{b}}$ representing radius,

and h is exactly of form $c\sqrt[3]{\frac{d}{e}}$ representing height (no labels, words, or units).

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 123) A closed rectangular box with square ends is to be designed so that the surface area of the box is minimized. [Note: Surface area = $2x^2 + 4xy$.] It is required that the volume be 32 cubic inches. Which of the following is the Lagrange function $F(x, y, \lambda)$ for this problem? 123) _____



- A) $2x^2 + 4xy + \lambda(32)$
 B) $(x^2y - 32) + \lambda(2x^2 + 4xy)$
 C) $2x^2 + 4xy + \lambda(x^2y - 32)$
 D) $x^2y + \lambda(2x^2 + 4xy - 32)$
 E) none of these
- 124) An artist produces two items for sale. Each unit of item I costs \$50 to produce, while each unit of item II costs \$200. The revenue function is $R(x, y) = 40x + 7xy + 80y^2 + 10y$, where x is units of item I and y is units of item II. Suppose the artist has only \$1000 to spend on production. Which of the following is the Lagrange function the artist should use to determine what combination of production amounts (x, y) will yield maximum profits subject to the constraint that his costs must equal \$1000. 124) _____
- A) $-10x + 7xy + 80y^2 - 190y + \lambda(50x + 200y - 1000)$
 B) $40x + 7xy + 80y^2 + 10y + \lambda(50x + 200y - 1000)$
 C) $40x + 7xy + 80y^2 + 10y + \lambda(200x + 50y - 1000)$
 D) $-10x + 7xy + 80y^2 - 190y + \lambda(200x + 50y - 1000)$
 E) none of these

Solve the problem.

- 125) Find two positive numbers whose sum is 64 and whose product is a maximum. 125) _____
 A) 32 and 48 B) 32 and 32 C) 48 and 48 D) 16 and 48
- 126) Find three positive numbers whose sum is 108 and whose product is a maximum. 126) _____
 A) 54, 27, and 27 B) 54, 54, and 54 C) 36, 27, and 27 D) 36, 36, and 36
- 127) The production level P of a factory during one time period is modeled by $P(x, y) = Kx^{1/2}y^{1/2}$ where K is a positive integer, x is the number of units of labor scheduled and y is the number of units of capital invested. If labor costs \$4500/unit, capital costs \$700/unit and the owner has \$1,900,000 available for one time period, what amount of labor and capital would maximize production? 127) _____
 A) 1357.1 units of labor and 211.1 units of capital
 B) 206.5 units of labor and 1187.5 units of capital
 C) 211.1 units of labor and 1357.1 units of capital
 D) 422.2 units of labor and 2714.3 units of capital

- 128) A farmer has 780 m of fencing. Find the dimensions of the rectangular field of maximum area that can be enclosed by this amount of fencing. 128) _____
- A) 185 m by 205 m B) 195 m by 195 m
C) 195 m by 585 m D) 78 m by 312 m
- 129) Assuming that a cylindrical container can be mailed only if the sum of its height and circumference do not exceed 330 centimeters, what are the dimensions of the cylinder with the largest volume that can be mailed? 129) _____
- A) Height 330 centimeters and radius $110/\pi$ centimeters
B) Height 220 centimeters and radius 110 centimeters
C) Height 110 centimeters and radius $110/\pi$ centimeters
D) Height 110 centimeters and radius $330/\pi$ centimeters
- 130) What is the least squares error E for the points (1, -3), (-2, 5), and (0, 10) and the line $y = Ax + B$? 130) _____
- A) $E = (A + B + 3)^2 + (-2A + B - 5)^2 + (B - 10)^2$
B) $E = (A + B - 3)^2 + (-2A + B - 5)^2 + (B - 10)^2$
C) $E = (A - 3B + 3)^2 + (-2A + 5B - 5)^2 + (10B - 10)^2$
D) $E = (A - 3B)^2 + (-2A + 5B)^2 + (10B)^2$
- 131) The table below gives the height and weight of four randomly selected University undergraduate women. What is the least squares error E for these data points? 131) _____
- | | | | | |
|-------------|-----|-----|-----|-----|
| height (cm) | 150 | 155 | 165 | 170 |
| weight (kg) | 60 | 55 | 70 | 62 |
- A) $E = 150(A + B - 60)^2 + 155(A + B - 55)^2 + 165(A + B - 70)^2 + 170(A + B - 62)^2$
B) $E = (150A - 60B)^2 + (155A - 55B)^2 + (165A - 70B)^2 + (170A - 62B)^2$
C) $E = (150A + 60B)^2 + (155A + 55B)^2 + (165A + 70B)^2 + (170A + 62B)^2$
D) $E = (150A + B - 60)^2 + (155A + B - 55)^2 + (165A + B - 70)^2 + (170A + B - 62)^2$
E) none of these
- 132) Find the formula that gives the least squares error for the points (-2, -3), (1, -1), (3, 4). 132) _____
- A) $(-2A + B + 3)^2 + (A + B + 1)^2 + (A + B - 4)^2$
B) $(-A + B + 3)^2 + (A + B + 1)^2 + (A + B - 4)^2$
C) $(-2A + B + 3)^2 + (A + B + 1)^2 + (3A + B - 4)^2$
D) $(-2A + B + 1)^2 + (A + B + 3)^2 + (3A + B - 4)^2$
- 133) Find the formula that gives the least squares error for the points (-1, 5), (2, 2), (5, -1). 133) _____
- A) $(-A + B - 5)^2 + (2A + B - 2)^2 + (A + B + 5)^2$
B) $(A - B + 5)^2 + (2A + B - 2)^2 + (A + B + 1)^2$
C) $(-2A + B - 5)^2 + (A + B - 2)^2 + (5A + B + 1)^2$
D) $(-A + B - 5)^2 + (2A + B - 2)^2 + (5A + B + 1)^2$

134) Let $E = (2A + B - 3)^2 + (A + B + 2)^2 + (4A + B - 1)^2$. What is $\frac{\partial E}{\partial A}$?

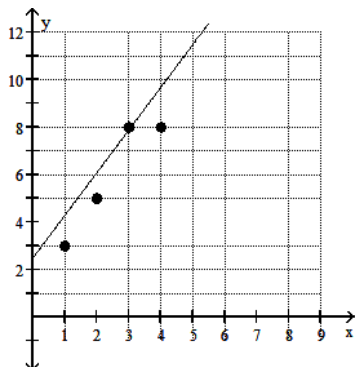
134) _____

- A) $42A + 24B - 9$
- B) $42A + 14B - 9$
- C) $14A + 6B - 4$
- D) $24A + 6B - 4$
- E) none of these

Find the least-squares error E for the least-squares line fit to the points in the figure.

135) $y = 1.8x + 2.5$

135) _____



- A) $E = 4.7$
- B) $E = 5.05$
- C) $E = 5.2$
- D) $E = 5.8$

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

136) Use partial derivatives to obtain the formula for the best least-squares fit to the data points $(0, 3)$, $(2, 5)$, $(4, 5)$.
Enter your answer in standard point-intercept form with any fractions reduced of form $\frac{a}{b}$.

136) _____

137) Use the method of your choice to obtain the formula for the least-squares line to fit the data $(0, 6)$, $(1, 3)$, $(2, 3)$.
Enter your answer in standard point-intercept form with any fractions reduced of form $\frac{a}{b}$.

137) _____

138) Use the method of your choice to obtain the formula for the least-squares line to fit the data $(0, 0)$, $(1, 2)$, $(2, 3)$.
Enter your answer in standard point-intercept form with any fractions reduced of form $\frac{a}{b}$.

138) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

139) Which straight line best fits the data points (0, 1), (1, 3), (2, 7)? Use partial derivatives. 139) _____

A) $y = 3Ax + B + \frac{2}{3}$

B) $y = -3x + \frac{2}{3}$

C) $y = \frac{2}{3}x + 3$

D) $y = 3x + \frac{2}{3}$

E) none of these

Solve the problem.

140) The chart shows the amount of money in a student's bank account for four consecutive months. 140) _____

| Year | Dollars |
|------|---------|
| 1 | \$1037 |
| 2 | 1032 |
| 3 | 1051 |
| 4 | 1096 |

Use the method of least squares to find the line that best fits these data. Then, use the least-squares line to predict how much will be in the bank account after 7 years.

A) $y = 39.2x + 1005$; \$1279.40

B) $y = 19.6x + 1005$; \$1142.20

C) $y = 19.6x + 1069$; \$1206.20

D) $y = 19.6x + 1005$; \$1206.20

141) An ecologist is studying pollution in a local river. He takes water samples from various distances away from a factory on the river. He then measures the amount of a certain chemical in each sample. 141) _____

| Distance from Factory (hundreds of yards) | Amount of Chemical (parts per thousand) |
|--|--|
| 0 | 301 |
| 5 | 214 |
| 10 | 158 |
| 15 | 137 |
| 20 | 112 |

Use the method of least squares to find the line that best fits these data. Using the least-squares, how much of the chemical should the ecologist expect to find 7 yards from the factory?

A) $y = -9.1x + 252.4$; 188.7 parts per thousand

B) $y = -9.1x + 212.6$; 148.9 parts per thousand

C) $y = -9.1x + 275.4$; 211.7 parts per thousand

D) $y = 9.1x + 274.6$; 338.3 parts per thousand

Evaluate the iterated integral.

142) $\int_0^9 \int_0^7 (8x - 7y) \, dx \, dy$ 142) _____
A) $-\frac{7}{2}$ B) $-\frac{49}{2}$ C) $-\frac{441}{2}$ D) $-\frac{63}{2}$

143) $\int_0^5 \int_0^4 (1 + x + y) \, dx \, dy$ 143) _____
A) 110 B) $\frac{81}{2}$ C) $\frac{43}{2}$ D) $\frac{145}{2}$

144) $\int_0^5 \int_0^2 2xy \, dx \, dy$ 144) _____
A) 25 B) 50 C) 200 D) 100

145) $\int_0^1 \int_{3x}^3 y \, dy \, dx$ 145) _____
A) $\frac{27}{2}$ B) 9 C) 3 D) $\frac{9}{2}$

Find the double integral over the rectangular region R with the given boundaries.

146) $\iint_R (2xy) \, dx \, dy$ 146) _____
R
 $0 \leq x \leq 4, 0 \leq y \leq 1$
A) 16 B) 4 C) 8 D) 32

147) $\iint_R (x^2 + y^2) \, dx \, dy$ 147) _____
R
 $0 \leq x \leq 4, -2 \leq y \leq 1$
A) 112 B) 76 C) $\frac{73}{3}$ D) 67

148) Calculate the iterated integral $\int_0^{\ln 2} \left(\int_1^2 xy + ye^{xy} dx \right) dy$. 148) _____

A) $\frac{3}{2} \ln - e^{2 \ln 2} - \frac{3}{2}$

B) $\frac{3}{4}(\ln 2) + \frac{1}{2}$

C) $\frac{3}{2} \ln 2 - \frac{1}{2} e^{x^2} - \frac{5}{2}$

D) $\frac{3}{4}(\ln 2)^2 + \frac{1}{2}$

E) none of these

149) Calculate the iterated integral $\int_{-1}^2 \left(\int_{-2}^1 32x^3y^3 dy \right) dx$. 149) _____

A) -450

B) 30

C) 450

D) -480

150) Calculate the iterated integral $\int_1^2 \int_2^4 \frac{x}{y} dy dx$. 150) _____

A) $6 \ln 2$

B) $\frac{3}{2} \ln 2$

C) $\frac{1}{2} \ln 2$

D) $\frac{3}{2} \ln 4$

E) none of these

151) Calculate the iterated integral $\int_0^1 \int_{x^2}^x (x - 1) dy dx$. 151) _____

A) $-\frac{1}{12}$

B) $-\frac{3}{4}$

C) $-\frac{1}{2}$

D) $\frac{1}{2}$

E) none of these

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

152) Calculate the iterated integral $\int_1^2 \left(\int_0^1 \frac{1}{xy+y} dx \right) dy$. 152) _____

Enter in the form $(\ln a)^b$.

153) Calculate the iterated integral $\int_0^1 \left(\int_0^1 (x^3 + y^2 + xy) dy \right) dx$. 153) _____

Enter just a reduced fraction of form $\frac{a}{b}$.

154) Calculate the iterated integral $\int_1^2 \left(\int_2^3 xy dy \right) dx$. 154) _____

Enter just a reduced fraction of form $\frac{a}{b}$.

155) Calculate the iterated integral $\int_0^2 \left(\int_0^x (x+2y) dy \right) dx$. 155) _____

Enter just a reduced fraction of form $\frac{a}{b}$.

156) Calculate the iterated integral $\int_0^1 \left(\int_0^{\sqrt{x}} (x-2y-7) dy \right) dx$. 156) _____

Enter just a reduced fraction of form $\frac{a}{b}$.

157) Calculate the iterated integral $\int_{-1}^2 \left(\int_0^{1/x^2} x^3 e^{x^3 y} dy \right) dx$. 157) _____

Enter your answer exactly in the form $e^a \pm b - e^c$.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

158) Let R be the rectangle consisting of all points (x, y) such that $0 \leq x \leq 3$, $0 \leq y \leq 1$. Calculate 158) _____

$$\int \int_R 4x^2 y^2 dy dx.$$

A) 12

B) 24

C) 15

D) -12

159) Let R be the rectangle consisting of all points (x, y) such that $1 \leq x \leq 16$, $1 \leq y \leq 9$. Calculate

159) _____

$$\int \int_R 3\sqrt{xy} \, dy \, dx.$$

A) 2184

B) 61,200

C) 15,300

D) 19,656

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

160) Let R be the rectangle consisting of all points (x, y) such that $0 \leq x \leq 1$, $0 \leq y \leq 2$. Calculate

160) _____

$$\int \int_R (e^x - y) \, dx \, dy.$$

Enter your answer exactly in the form $(e - a)(1 - e^b)$.

161) Let R be the rectangle consisting of all points (x, y) such that $0 \leq x \leq 3$, $0 \leq y \leq 4$. Calculate

161) _____

$$\int \int_R xy \, dy \, dx.$$

Enter just an integer.

162) Let R be the rectangle consisting of all points (x, y) such that $2 \leq x \leq 3$, $0 \leq y \leq 2$. Calculate

162) _____

$$\int \int_R (x + y) \, dy \, dx.$$

Enter just an integer.

Answer Key

Testname: UNTITLED7

- 1) C
- 2) D
- 3) C
- 4) B
- 5) 5
- 6) $12a^{1/4}b^{1/4}$
- 7) $3\sqrt{2}$
- 8) 1
- 9) B
- 10) B
- 11) C
- 12) C
- 13) D
- 14) $2\pi r(ar + bh)$
- 15) $2x + y^2 + h$
- 16) $h + 1$
- 17) k
- 18) $k + 2$
- 19) D
- 20) yes
- 21) B
- 22) A
- 23) D
- 24) D
- 25) B
- 26) B
- 27) B
- 28) B
- 29) C
- 30) A
- 31) B
- 32) D
- 33) C
- 34) C
- 35) D
- 36) B
- 37) C
- 38) A
- 39) D
- 40) B
- 41) C
- 42) D
- 43) C

Answer Key

Testname: UNTITLED7

44) $(-x^2 + x + 1)e^y - x$

45) $-6x^2 + 5y^2$

46) $e^{x^2}y(x^2)$

47) 1

48) $6x + 2y$

49) $2x + e^y$

50) $\frac{4}{3}y^{-1/3}$

51) $4y + 3x$

52) $6y^2 + 2x$

53) $3z^{-1}$

54) $2x + 2y + 2$

55) $-(y + 1)^{-2}$

56) $3(1 - e)$

57) yes

58) no

59) yes

60) no

61) yes

62) yes

63) no

64) no

65) yes

66) B

67) A

68) A

69) D

70) B

71) E

72) A

73) A

74) D

75) D

76) A

77) C

78) B

79) B

80) D

81) $\left(\frac{7}{5}, \frac{8}{5}\right)$

82) $\left\{-2, -\frac{3}{2}\right\}$

Answer Key

Testname: UNTITLED7

83) $\left\{\frac{1}{4}, 1\right\}, \left\{\frac{1}{4}, -1\right\}$

84) $\left\{1, \frac{1}{2}\right\}, \left\{-1, \frac{1}{2}\right\}$

85) $(-3, -1), (-3, 5)$

86) $\left\{\frac{1}{3}, \frac{1}{3}\right\}$

87) $(4, 15)$

88) $-z^{-2}x$

89) $2ze^{x^2 + y^2 + z^2}$

90) $\frac{3}{5}$

91) B

92) D

93) C

94) B

95) D

96) D

97) A

98) E

99) $4ye^{2x}$

100) C

101) B

102) 2000

103) C

104) D

105) $(-1, 34)$

106) $(1, 2)$

107) $(12, 2, 4)$

108) $(10, 10), -\frac{1}{10}$

109) 3, 2

110) $\frac{12}{5}, \frac{4}{5}$

111) $\frac{39}{8}, -\frac{7}{4}$

112) $(10, 40), (-10, -40)$

113) B

114) D

115) $3^{1/2}$

116) $\frac{4}{3}$

Answer Key

Testname: UNTITLED7

117) $\frac{3}{4}$

118) e^9

119) $\left(2\sqrt{\frac{1}{5}}, \sqrt{\frac{1}{5}}\right), \left(-2\sqrt{\frac{1}{5}}, \sqrt{\frac{1}{5}}\right)$

120) A

121) (1, 995)

122) $\sqrt[3]{\frac{50}{\pi}}, 2\sqrt[3]{\frac{50}{\pi}}$

123) C

124) B

125) B

126) D

127) C

128) B

129) C

130) A

131) D

132) C

133) D

134) E

135) D

136) $y = \frac{1}{2}x + \frac{10}{3}$

137) $y = -\frac{3}{2}x + \frac{11}{2}$

138) $y = \frac{3}{2}x + \frac{1}{6}$

139) D

140) B

141) C

142) C

143) A

144) B

145) C

146) C

147) B

148) D

149) A

150) B

151) A

152) $(\ln 2)^2$

Answer Key

Testname: UNTITLED7

153) $\frac{5}{6}$

154) $\frac{15}{4}$

155) $\frac{16}{3}$

156) $-\frac{143}{30}$

157) $e^2 - 3 - e^{-1}$

158) A

159) A

160) $(e - 1)(1 - e^{-2})$

161) 36

162) 7