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HW6 (Homework)

Current Score: – / 46 POINTS | 0.0 %

Scoring and Assignment Information

QUESTION	1	2	3	4	5	6	7	8	9	10	11	12	13
POINTS	– / 3	– / 2	– / 4	– / 4	– / 4	– / 3	– / 1	– / 3	– / 6	– / 2	– / 6	– / 2	– / 6

Assignment Submission

For this assignment, you submit answers by question parts. The number of submissions remaining for each question part only changes if you submit or change the answer.

Assignment Scoring

Your best submission for each question part is used for your score.

1. [– / 3 Points]

DETAILS

SCalcET9M 14.3.096.

If a, b, c are the sides of a triangle and A, B, C are the opposite angles, find $\partial A/\partial a$, $\partial A/\partial b$, $\partial A/\partial c$ by implicit differentiation of the Law of Cosines.

$\partial A/\partial a$ =

✕ $\boxed{\dfrac{a}{bc\sin(A)}}$

$\partial A/\partial b$ =

✕ $\boxed{\dfrac{c\cos(A)-b}{bc\sin(A)}}$

$\partial A/\partial c$ =

✕ $\boxed{\dfrac{b\cos(A)-c}{bc\sin(A)}}$

Solution or Explanation

Click to View Solution

2. [– / 2 Points]

DETAILS

SCalcET9M 14.3.010.

Find the first partial derivatives of the function.

$f(x, y) = x^2y - 4y^2$

$f_x(x, y) =$

✕ $2xy$

$f_y(x, y) =$

✕ $x^2 - 8y$

Solution or Explanation

$f(x, y) = x^2y - 4y^2 \quad \Rightarrow \quad f_x(x, y) = 2x \cdot y - 0 = 2xy,$

$f_y(x, y) = x^2 \cdot 1 - 4 \cdot 2y^1 = x^2 - 8y^1$

Resources

Master It

3. [– / 4 Points]

DETAILS

SCalcET9M 14.3.033.

Find the first partial derivatives of the function.

$$h(x, y, z, t) = x^8 y \cos\left(\frac{z}{t}\right)$$

$h_x(x, y, z, t) =$

$$8x^7 y \cos\left(\frac{z}{t}\right)$$

$h_y(x, y, z, t) =$

$$x^8 \cos\left(\frac{z}{t}\right)$$

$h_z(x, y, z, t) =$

$$-\frac{x^8 y \sin\left(\frac{z}{t}\right)}{t}$$

$h_t(x, y, z, t) =$

$$\frac{x^8 y z \sin\left(\frac{z}{t}\right)}{t^2}$$

Solution or Explanation

$$h(x, y, z, t) = x^8 y \cos\left(\frac{z}{t}\right) \Rightarrow h_x(x, y, z, t) = 8x^7 y \cos\left(\frac{z}{t}\right),$$

$$h_y(x, y, z, t) = x^8 \cos\left(\frac{z}{t}\right),$$

$$h_z(x, y, z, t) = -x^8 y \sin\left(\frac{z}{t}\right)\left(\frac{1}{t}\right) = -\frac{x^8 y}{t} \sin\left(\frac{z}{t}\right),$$

$$h_t(x, y, z, t) = -x^8 y \sin\left(\frac{z}{t}\right)(-zt^{-2}) = \frac{x^8 yz}{t^2} \sin\left(\frac{z}{t}\right)$$

4. [– / 4 Points]

DETAILS

SCalcET9M 14.3.045.

Find $\partial z/\partial x$ and $\partial z/\partial y$.

(a) $z = f(x) + g(y)$

$\partial z/\partial x$

- 0
- 1
- $f'(x)$
- $g'(y)$
- $f'(x) + g(y)$
- $f(x) + g'(y)$
- $f'(x) + g'(y)$
- none of the above

$\partial z/\partial y$

- 0
- 1
- $f'(x)$
- $g'(y)$
- $f'(x) + g(y)$
- $f(x) + g'(y)$
- $f'(x) + g'(y)$
- none of the above

(b) $z = f(x + y)$

$\partial z/\partial x$

- 0
- 1
- $f'(x)$
- $f'(y)$
- $f'(x + y)$
- none of the above

$\partial z/\partial y$

- 0
- 1
- $f'(x)$
- $f'(y)$
- $f'(x + y)$
- none of the above

Solution or Explanation

Click to View Solution

Resources

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5. [– / 4 Points]

DETAILS

SCalcET9M 14.3.092.

The average energy E (in kcal) needed for a lizard to walk or run a distance of 1 km has been modeled by the equation

$$E(m, v) = 2.65m^{0.66} + \frac{3.5m^{0.75}}{v}$$

where m is the body mass of the lizard (in grams) and v is its speed (in km/h). Calculate $E_m(800, 9)$ and $E_v(800, 9)$. (Round your answers to three decimal places.)

$E_m(800, 9)$ = ✗ 0.235

$E_v(800, 9)$ = ✗ -6.500

Interpret $E_m(800, 9)$.

- ○ The average energy needed for a lizard to walk or run 1 km is this amount in kcal if the speed is 9 km/h.
- ○ The average energy needed for a lizard to walk or run 1 km changes by this amount in kcal per km/h of speed increase from 9 km/h if the body mass is 800 g.
- ○ The average energy needed for a lizard to walk or run 1 km is this amount in kcal if the body mass is 800 g.
- ○ The average energy needed for a lizard to walk or run 1 km is this amount in kcal if the body mass is 800 g and the speed is 9 km/h.
- ○ The average energy needed for a lizard to walk or run 1 km changes by this amount in kcal per gram of body mass increase from 800 g if the speed is 9 km/h.

✗

Interpret $E_v(800, 9)$.

- ○ The average energy needed for a lizard to walk or run 1 km is this amount in kcal if the speed is 9 km/h.
- ○ The average energy needed for a lizard to walk or run 1 km changes by this amount in kcal per km/h of speed increase from 9 km/h if the body mass is 800 g.
- ○ The average energy needed for a lizard to walk or run 1 km is this amount in kcal if the body mass is 800 g.
- ○ The average energy needed for a lizard to walk or run 1 km is this amount in kcal if the body mass is 800 g and the speed is 9 km/h.
- ○ The average energy needed for a lizard to walk or run 1 km changes by this amount in kcal per gram of body mass increase from 800 g if the speed is 9 km/h.

✗

Solution or Explanation

We have

$$E(m, v) = 2.65m^{0.66} + \frac{3.5m^{0.75}}{v} \Rightarrow E_m(m, v) = 2.65(0.66)m^{0.66 - 1} + \frac{3.5(0.75)m^{0.75 - 1}}{v}$$

$$= 1.749m^{-0.34} + \frac{2.625m^{-0.25}}{v},$$

$$E_v(m, v) = 3.5m^{0.75}(-v^{-2}) = -\frac{3.5m^{0.75}}{v^2}.$$

Then $E_m(800, 9) = 1.749(800)^{-0.34} + \dfrac{2.625(800)^{-0.25}}{9} \approx 0.235$, which means that the average energy needed for a lizard to walk or run 1 km increases at a rate of about 0.235 kcal per gram of body mass increase from 800 g if the speed is 9 km/h.

We have $E_v(800, 9) = -\dfrac{3.5(800)^{0.75}}{9^2} \approx -6.500$, which means that the average energy needed by a lizard with body mass 800g decreases at a rate of about 6.5 kcal per km/h when the speed increases from 9 km/h.

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6. [–/3 Points] DETAILS

SCalcET9M 14.3.AE.005.

Video Example

EXAMPLE 4 Find $\partial z/\partial x$ and $\partial z/\partial y$ if z is defined implicitly as a function of x and y by the equation

$$x^7 + y^7 + z^7 + 14xyz = 1.$$

SOLUTION To find $\partial z/\partial x$, we differentiate implicitly with respect to x, being careful to treat y as a constant:

✕ $\boxed{7x^6} + 7z^6\dfrac{\partial z}{\partial x} + 14yz + 14xy\dfrac{\partial z}{\partial x} = 0.$

Solving this equation for $\partial z/\partial x$, we obtain

$$\frac{\partial z}{\partial x} =$$

✕ $\boxed{-\dfrac{x^6+2yz}{2xy+z^6}}$.

Similarly, implicitly differentiating with respect to y gives

$$\frac{\partial z}{\partial y} =$$

✕ $\boxed{-\dfrac{2xz+y^6}{2xy+z^6}}$.

7. [– / 1 Points]

DETAILS

SCalcET9M 14.3.038.

Find the indicated partial derivative.

$$f(x, y) = y \sin^{-1}(xy); \quad f_y\left(4, \frac{1}{8}\right)$$

$f_y\left(4, \frac{1}{8}\right) =$

✕ $\boxed{\frac{1}{\sqrt{3}} + \frac{\pi}{6}}$

Solution or Explanation

$$f(x, y) = y \sin^{-1}(xy) \;\Rightarrow\; f_y(x, y) = y \cdot \frac{1}{\sqrt{1 - (xy)^2}}(x) + \sin^{-1}(xy) \cdot 1 = \frac{xy}{\sqrt{1 - x^2y^2}} + \sin^{-1}(xy), \text{ so}$$

$$f_y\left(4, \frac{1}{8}\right) = \frac{4 \cdot \frac{1}{8}}{\sqrt{1 - 4^2\left(\frac{1}{8}\right)^2}} + \sin^{-1}\left(4 \cdot \frac{1}{8}\right) = \frac{\frac{1}{2}}{\sqrt{\frac{3}{4}}} + \sin^{-1}\left(\frac{1}{2}\right) = \frac{1}{\sqrt{3}} + \frac{\pi}{6}.$$

8. [– / 3 Points]

DETAILS

SCalcET9M 14.3.029.

Find the first partial derivatives of the function.

$w = \ln(x + 9y + 4z)$

$\dfrac{\partial w}{\partial x} =$

✖ $\boxed{\dfrac{1}{x+9y+4z}}$

$\dfrac{\partial w}{\partial y} =$

✖ $\boxed{\dfrac{9}{x+9y+4z}}$

$\dfrac{\partial w}{\partial z} =$

✖ $\boxed{\dfrac{4}{x+9y+4z}}$

Solution or Explanation

Click to View Solution

Resources

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9. [–/6 Points] DETAILS

SCalcET9M 14.3.051.EP.

Consider the following.

$$v = \sin(4s^2 - 3t^2)$$

Find the first partial derivatives.

v_s =

✕ $8s\cos\left(4s^2 - 3t^2\right)$

v_t =

✕ $-6t\cos\left(4s^2 - 3t^2\right)$

Find all the second partial derivatives.

v_{ss} =

✕ $8\cos\left(4s^2 - 3t^2\right) - 64s^2\sin\left(4s^2 - 3t^2\right)$

v_{st} =

✕ $48st\sin\left(4s^2 - 3t^2\right)$

v_{ts} =

✕ $48st\sin\left(4s^2 - 3t^2\right)$

v_{tt} =

✕ $-36t^2\sin\left(4s^2 - 3t^2\right) - 6\cos\left(4s^2 - 3t^2\right)$

Solution or Explanation

We have

$$v = \sin(4s^2 - 3t^2) \quad \Rightarrow \quad \begin{aligned} v_s &= \cos(4s^2 - 3t^2) \cdot 8s = 8s\cos(4s^2 - 3t^2), \\ v_t &= \cos(4s^2 - 3t^2) \cdot (-6t) = -6t\cos(4s^2 - 3t^2). \end{aligned}$$

Then we get the following.

$$v_{ss} = 8s\left[-\sin(4s^2 - 3t^2)\cdot 8s\right] + \cos(4s^2 - 4t^2)\cdot 8 = 8\cos(4s^2 - 3t^2) - 64s^2\sin(4s^2 - 3t^2)$$
$$v_{st} = 8s\left[-\sin(4s^2 - 3t^2)\cdot(-6t)\right] + \cos(4s^2 - 3t^2)\cdot 0 = 48st\sin(4s^2 - 3t^2)$$
$$v_{ts} = -6t\left[-\sin(4s^2 - 3t^2)\cdot 8s\right] + \cos(4s^2 - 3t^2)\cdot 0 = 48st\sin(4s^2 - 3t^2)$$
$$v_{tt} = -6t\left[-\sin(4s^2 - 3t^2)\cdot(-6t)\right] + \cos(4s^2 - 3t^2)\cdot(-6) = -6\cos(4s^2 - 3t^2) - 36t^2\sin(4s^2 - 3t^2)$$

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10. [–/2 Points] DETAILS

SCalcET9M 14.3.017.

Find the first partial derivatives of the function.

$$g(x, y) = y(x + x^2y)^9$$

$g_x(x, y) =$

✕ $9y(2xy+1)\left(x^2y+x\right)^8$

$g_y(x, y) =$

✕ $\left(x^2y+x\right)^9 + 9x^2y\left(x^2y+x\right)^8$

Solution or Explanation

$g(x, y) = y(x + x^2y)^9 \;\Rightarrow\; g_x(x, y) = 9y(x + x^2y)^8(1 + 2xy),$

$g_y(x, y) = y\cdot 9(x + x^2y)^8\cdot x^2 + (x + x^2y)^9\cdot 1 = 9x^2y(x + x^2y)^8 + (x + x^2y)^9$

11. [–/6 Points] DETAILS

SCalcET9M 14.3.088.

One of Poiseuille's laws states that the resistance of blood flowing through an artery is

$$R = C\frac{L}{r^4}$$

where L and r are the length and radius of the artery and C is a positive constant determined by the viscosity of the blood.

Calculate $\frac{\partial R}{\partial L}$ and $\frac{\partial R}{\partial r}$ and interpret them.

$\frac{\partial R}{\partial L} =$

✕ $\frac{C}{r^4}$

$\frac{\partial R}{\partial L}$ is the rate at which the resistance of the flowing blood changes with respect to the ---Select--- ✕ length of the artery when the ---Select--- ✕ radius stays constant.

$\frac{\partial R}{\partial r} =$

✕ $-\frac{4CL}{r^5}$

$\frac{\partial R}{\partial r}$ is the rate at which the resistance of the flowing blood changes with respect to the ---Select--- ✕ radius of the artery when the ---Select--- ✕ length stays constant.

Solution or Explanation

We have

$$R = C\frac{L}{r^4} \quad \Rightarrow \quad \frac{\partial R}{\partial L} = \frac{C}{r^4} \text{ and } \frac{\partial R}{\partial r} = CL(-4r^{-5}) = -4C\frac{L}{r^5}.$$

$\frac{\partial R}{\partial L}$ is the rate at which the resistance of the flowing blood changes with respect to the length of the artery when the radius stays constant.

$\frac{\partial R}{\partial r}$ is the rate at which the resistance of the flowing blood changes with respect to the radius of the artery when the length stays constant.

Because $\frac{\partial R}{\partial r}$ is negative, the resistance decreases if the radius increases.

12. [– / 2 Points]

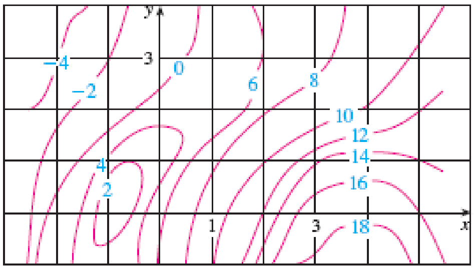
DETAILS

SCalcET9M 14.3.006.

A contour map is given for a function f. Use it to estimate $f_x(2, 1)$ and $f_y(2, 1)$.

$f_x(2, 1)$ = ✗ 2.8

$f_y(2, 1)$ = ✗ -2.1



Solution or Explanation

Click to View Solution

13. [– / 6 Points]

DETAILS

SCalcET9M 14.3.046.

Find $\partial z/\partial x$ and $\partial z/\partial y$.

(a) $z = f(x)g(y)$

$\partial z/\partial x$

- 0
- 1
- $f'(x)$
- $g'(y)$
- $f'(x)g(y)$
- $f(x)g'(y)$
- $f'(x)g'(y)$
- none of the above

$\partial z/\partial y$

- 0
- 1
- $f'(x)$
- $g'(y)$
- $f'(x)g(y)$
- $f(x)g'(y)$
- $f'(x)g'(y)$
- none of the above

(b) $z = f(xy)$

$\partial z/\partial x$

- 0
- 1
- $f'(x)f(y)$
- $f(x)f'(y)$
- $xf'(xy)$
- $yf'(xy)$
- $xyf'(xy)$
- none of the above

$\partial z/\partial y$

- 0
- 1
- $f'(x)f(y)$
- $f(x)f'(y)$
- $xf'(xy)$
- $yf'(xy)$
- $xyf'(xy)$
- none of the above

(c) $z = f(x/y)$

$\partial z/\partial x$

$\partial z/\partial y$

- 0
- 1
- $f'(x/y)/x$
- $f'(x/y)/y$
- $-yf'(x/y)/x^2$
- $-xf'(x/y)/y^2$
- none of the above

- 0
- 1
- $f'(x/y)/x$
- $f'(x/y)/y$
- $-yf'(x/y)/x^2$
- $-xf'(x/y)/y^2$
- none of the above

Solution or Explanation

[Click to View Solution]