This print-out should have 29 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

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001 10.0 points

Find the domain of the function

$$f(x, y) = \sqrt{x^2 + 3y^2 - 2}\,.$$

1. $\left\{(x,\, y) : \frac{1}{3}x^2 + \frac{1}{2}y^2 \geq 1\right\}$

2. $\left\{(x,\, y) : \frac{1}{3}x^2 + \frac{1}{2}y^2 > 1\right\}$

3. $\left\{(x,\, y) : \frac{1}{2}x^2 + \frac{3}{2}y^2 < 1\right\}$

4. $\left\{(x,\, y) : \frac{1}{3}x^2 + \frac{1}{2}y^2 < 1\right\}$

5. $\left\{(x,\, y) : \frac{1}{2}x^2 + \frac{3}{2}y^2 > 1\right\}$

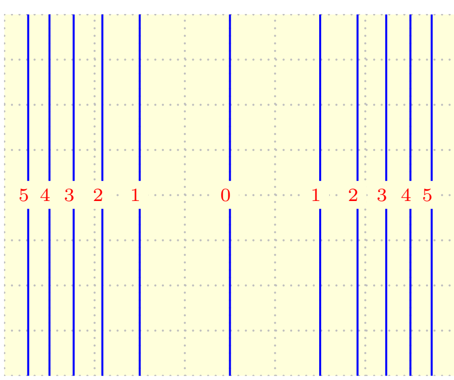
6. $\left\{(x,\, y) : \frac{1}{2}x^2 + \frac{3}{2}y^2 \geq 1\right\}$

---

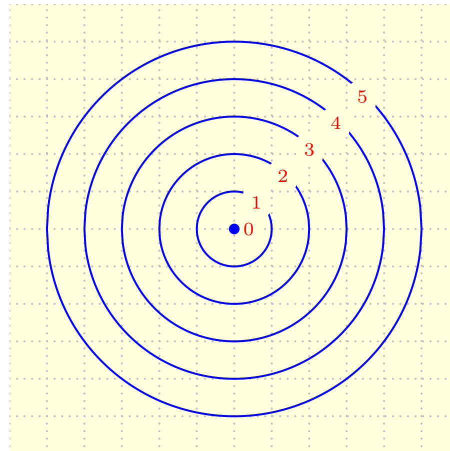
002 10.0 points

Which one of the following could be the contour map of a hyperbolic paraboloid?

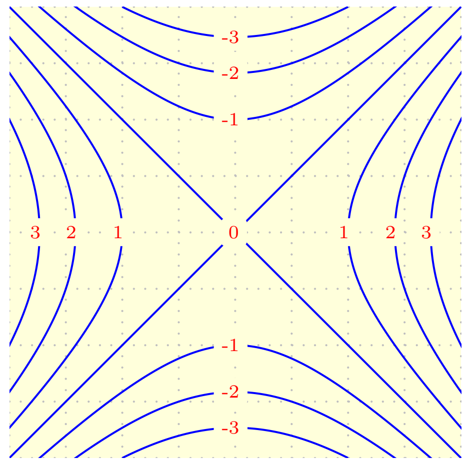
1.



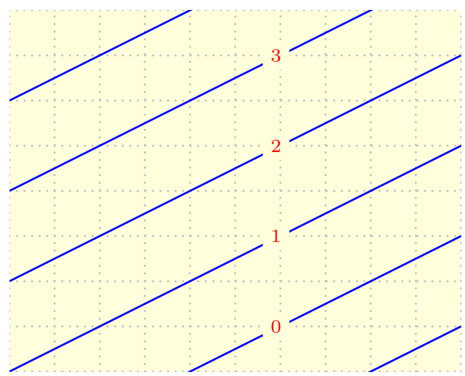
2.



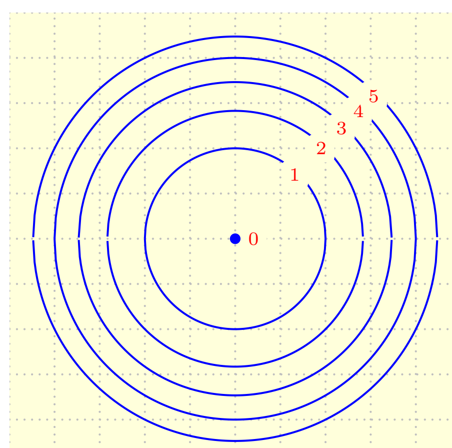
3.



4.



5.



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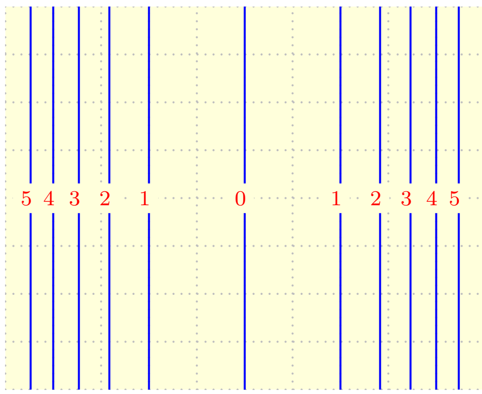
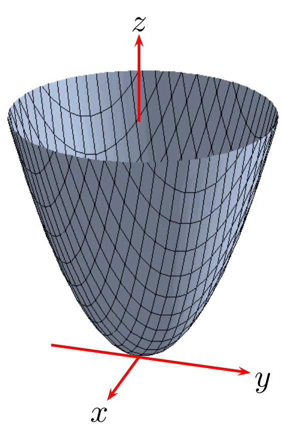
003 10.0 points

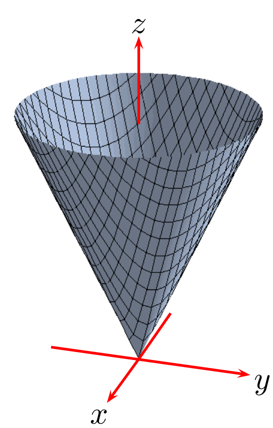
Which of the following surfaces could have contour map



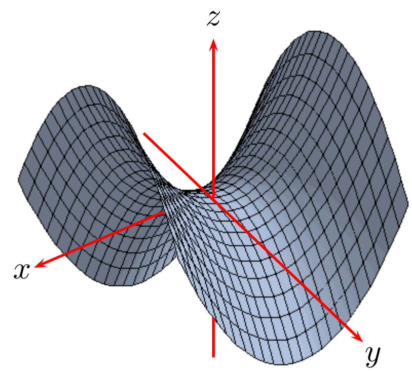
1.



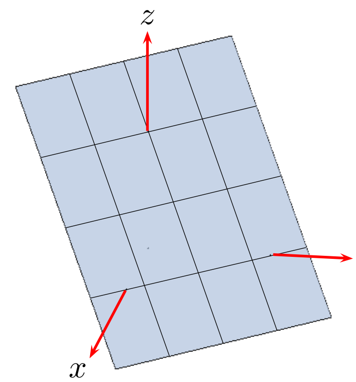
2.



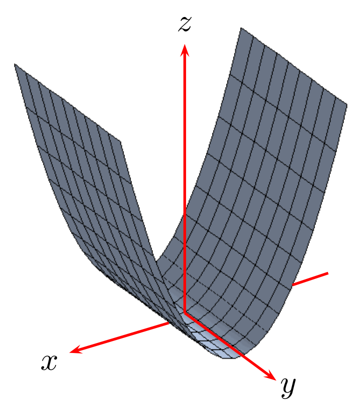
3.



4.



5.



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004 10.0 points

Which one of the following functions has dfig[385,150]
as its graph.

1. $f(x, y) = y^2 - x^2$

2. $f(x, y) = 8 - 2(2x^2 + 2y^2)^{1/2}$

3. $f(x, y) = 2(x^2 + y^2)^{1/2}$

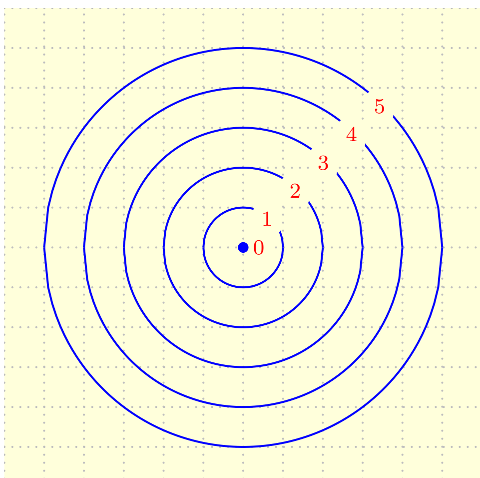
4. $f(x, y) = 2x^2$

5. $f(x, y) = \frac{1}{2}(x^2 + y^2)$

---

005 10.0 points

Which of the following surfaces could have contour map



1. cone

2. paraboloid

3. plane

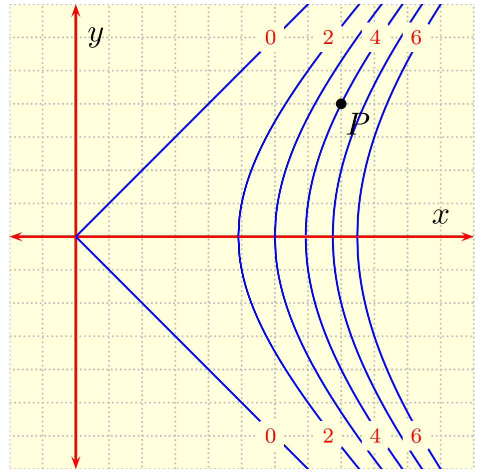
4. hyperbolic paraboloid

5. parabolic cylinder

---

006 10.0 points

From the contour map of f shown below decide whether f_x, f_y are positive, negative, or zero at P.



1. $f_x > 0, \ f_y < 0$

2. $f_x < 0, \ f_y = 0$

3. $f_x > 0, \ f_y = 0$

4. $f_x > 0, \ f_y > 0$

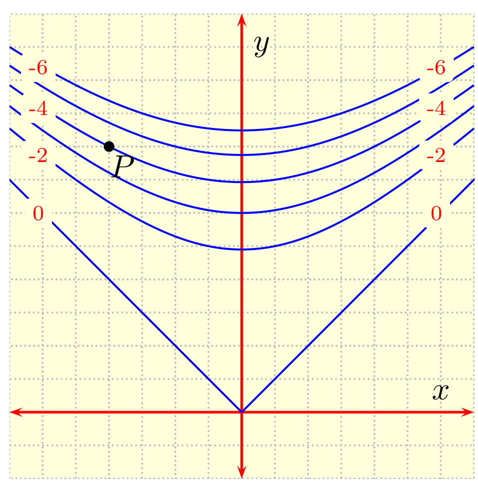
5. $f_x < 0, \ f_y > 0$

6. $f_x < 0, \ f_y < 0$

---

007 10.0 points

From the contour map of f shown below decide whether f_x and f_y are positive, negative, or zero at P.



1. $f_x > 0, \ f_y > 0$

2. $f_x = 0, \ f_y < 0$

3. $f_x > 0\,,\ \ f_y < 0$

4. $f_x < 0\,,\ \ f_y < 0$

5. $f_x = 0\,,\ \ f_y > 0$

6. $f_x < 0\,,\ \ f_y > 0$

---

008 10.0 points

Determine $f_x - f_y$ when

$$f(x, y) = 4x^2 - 2xy + 4y^2 - x + 3y\,.$$

1. $f_x - f_y = 6x + 6y + 2$

2. $f_x - f_y = 10x + 6y - 4$

3. $f_x - f_y = 10x - 10y - 4$

4. $f_x - f_y = 6x + 6y - 4$

5. $f_x - f_y = 6x - 10y + 2$

6. $f_x - f_y = 10x - 10y + 2$

---

009 10.0 points

Determine $f_x + f_y$ when

$$f(x, y) = x^2 + 4xy - 3y^2 + 3x + y\,.$$

1. $f_x + f_y = 6x + 10y + 4$

2. $f_x + f_y = 6x - 2y + 2$

3. $f_x + f_y = -2x + 10y + 4$

4. $f_x + f_y = -2x + 10y + 2$

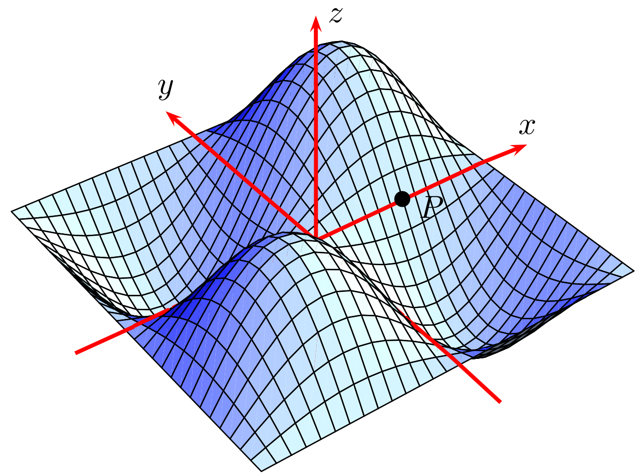
5. $f_x + f_y = -2x - 2y + 2$

6. $f_x + f_y = 6x - 2y + 4$

---

010 10.0 points

Determine whether the partial derivatives f_x, f_y of f are positive, negative or zero at the point P on the graph of f shown in



1. $f_x > 0\,,\ \ f_y > 0$

2. $f_x = 0\,,\ \ f_y = 0$

3. $f_x < 0\,,\ \ f_y < 0$

4. $f_x < 0\,,\ \ f_y = 0$

5. $f_x = 0\,,\ \ f_y < 0$

6. $f_x < 0\,,\ \ f_y > 0$

7. $f_x > 0\,,\ \ f_y = 0$

8. $f_x = 0\,,\ \ f_y > 0$

---

011 10.0 points

Determine f_x when

$$f(x\,, y) = (x^2 + 2y)(y^2 - x)\,.$$

1. $f_x = 2xy^2 - 2y - 3x^2$

2. $f_x = 4xy^2 - y + 3x^2$

3. $f_x = y - 4xy^2 + 3x^2$

4. $f_x = 2xy^2 + 2y - 3x^2$

5. $f_x = y + 4xy^2 + 3x^2$

6. $f_x = 2y - 2xy^2 - 3x^2$

---

012 10.0 points

Determine f_x when

$$f(x,\, y) \;=\; \frac{x - 2y}{x + 2y}\,.$$

1. $f_x = \dfrac{3y}{(x+2y)^2}$

2. $f_x = \dfrac{5y}{(x+2y)^2}$

3. $f_x = -\dfrac{3x}{(x+2y)^2}$

4. $f_x = -\dfrac{4x}{(x+2y)^2}$

5. $f_x = -\dfrac{5x}{(x+2y)^2}$

6. $f_x = \dfrac{4y}{(x+2y)^2}$

---

013 10.0 points

Determine f_y when

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

1. $f_y = \dfrac{4\,x}{(\,x + 2\,y)^2}$

2. $f_y = -\dfrac{3\,x}{(\,x + 2\,y)^2}$

3. $f_y = \dfrac{5\,x}{(\,x + 2\,y)^2}$

4. $f_y = -\dfrac{5\,x}{(\,x + 2\,y)^2}$

5. $f_y = \dfrac{3\,x}{(\,x + 2\,y)^2}$

6. $f_y = -\dfrac{4\,x}{(\,x + 2\,y)^2}$

---

014 10.0 points

Determine f_y when

$$f(x,\, y) \;=\; (x^2 - 2y)(2x - y^2)\,.$$

1. $f_y = 6y^2 + 2x^2y - 2x$

2. $f_y = 6y^2 - 2x^2y - 4x$

3. $f_y = -6y^2 - 4x^2y + x$

4. $f_y = -2y^2 - 4x^2y - x$

5. $f_y = -2y^2 - 2x^2y + 4x$

6. $f_y = 2y^2 + 4x^2y - 2x$

---

015 10.0 points

Find f_x when

$$f(x, y) \;=\; 5x^5 + 2x^3y^2 + 4xy^4\,.$$

1. $f_x = 25x^4 + 2x^2y^2 + 4y^4$

2. $f_x = 20x^4 + 4x^2y^2 + 4y^4$

3. $f_x = 4x^3y + 16xy^3$

4. $f_x = 20x^4 + 8x^2y^2 + 8y^4$

5. $f_x = 25x^4 + 6x^2y^2 + 4y^4$

---

016 10.0 points

Find the value of f_x and f_y at $(1, -1)$ when

$$f(x, y) \;=\; \frac{3}{xy} + x^2 - 6y^2.$$

1. $f_x\Big|_{(1,-1)} = 5, \quad f_y\Big|_{(1,-1)} = -15$

2. $f_x\Big|_{(1,-1)} = 4, \quad f_y\Big|_{(1,-1)} = 3$

3. $f_x\Big|_{(1,-1)} = 5, \quad f_y\Big|_{(1,-1)} = 9$

4. $f_x\Big|_{(1,-1)} = 1, \quad f_y\Big|_{(1,-1)} = 9$

5. $f_x\Big|_{(1,-1)} = 1, \quad f_y\Big|_{(1,-1)} = -15$

017 10.0 points

Determine f_{yx} when

$$f(x,\, y) \;=\; x^2 \cos xy\,.$$

1. $f_{yx} \;=\; -2x^2(3\cos xy + xy\sin xy)$

2. $f_{yx} \;=\; -y^2(3\sin xy + xy\cos xy)$

3. $f_{yx} \;=\; x^2(3\cos xy - xy\sin xy)$

4. $f_{yx} \;=\; 2x^2(3\sin xy - xy\cos xy)$

5. $f_{yx} \;=\; -x^2(3\sin xy + xy\cos xy)$

6. $f_{yx} \;=\; -2y^2(3\cos xy + xy\sin xy)$

7. $f_{yx} \;=\; y^2(3\cos xy - xy\sin xy)$

8. $f_{yx} \;=\; 2y^2(3\sin xy - xy\cos xy)$

018 0.0 points

WITHDRAWN

Determine $\partial z/\partial y$ when $z = z(x,\, y)$ is defined by

$$6x^2 + 3xy + 5yz + 4z^2 \;=\; 5\,.$$

1. $\dfrac{\partial z}{\partial y} \;=\; -\dfrac{3x+5z}{5y+8z}$

2. $\dfrac{\partial z}{\partial y} \;=\; \dfrac{3x-5z}{5x+8y}$

3. $\dfrac{\partial z}{\partial y} \;=\; -\dfrac{3x+5z}{8z}$

4. $\dfrac{\partial z}{\partial y} \;=\; -\dfrac{3y-5x}{5x+8y}$

5. $\dfrac{\partial z}{\partial y} \;=\; \dfrac{3x-5z}{8z}$

019 10.0 points

Determine $\dfrac{\partial z}{\partial y}$ when

$$z \;=\; \frac{x}{y} f(xy)\,.$$

1. $\dfrac{\partial z}{\partial y} \;=\; x\,\big(f(xy) + xyf'(xy)\big)$

2. $\dfrac{\partial z}{\partial y} \;=\; \dfrac{1}{x}\,\big(f(xy) + xyf'(xy)\big)$

3. $\dfrac{\partial z}{\partial y} \;=\; \dfrac{x}{y^2}\,\big(f(xy) - xyf'(xy)\big)$

4. $\dfrac{\partial z}{\partial y} \;=\; x\,\big(f(xy) - xyf'(xy)\big)$

5. $\dfrac{\partial z}{\partial y} \;=\; -\dfrac{1}{x}\,\big(f(xy) + xyf'(xy)\big)$

6. $\dfrac{\partial z}{\partial y} \;=\; -\dfrac{x}{y^2}\,\big(f(xy) - xyf'(xy)\big)$

020 10.0 points

Find the value of $f_{xx} + f_{yy}$ at $(1, -1)$ when

$$f(x, y) \;=\; \frac{5}{xy} + 4x^2 + y^2.$$

1. $(f_{xx} + f_{yy})\Big|_{(1,-1)} \;=\; -11$

2. $(f_{xx} + f_{yy})\Big|_{(1,-1)} \;=\; -9$

3. $(f_{xx} + f_{yy})\Big|_{(1,-1)} \;=\; -10$

4. $(f_{xx} + f_{yy})\Big|_{(1,-1)} \;=\; 31$

5. $(f_{xx} + f_{yy})\Big|_{(1,-1)} \;=\; 30$

021 10.0 points

Determine $f_{xx} + f_{yx}$ when

$$f(x, y) \;=\; 5x^2 + xy^3 - 4y^2 + 6\,.$$

1. $f_{xx} + f_{yx} \;=\; 10 + 3y^2$

2. $f_{xx} + f_{yx} \;=\; 10x + 10 + y^3$

3. $f_{xx} + f_{yx} \;=\; 5 + y$

4. $f_{xx} + f_{yx} \;=\; 5xy - 8 + 5y^2$

5. $f_{xx} + f_{yx} \;=\; 10x + y^2 - 8y$

---

022 10.0 points

Determine the second partial f_{xy} of f when

$$f(x, y) = \frac{2x^2}{y} + \frac{y^2}{10x}.$$

1. $f_{xy} = \dfrac{4x}{y^2} + \dfrac{y}{5x^2}$

2. $f_{xy} = -\dfrac{4x}{y^2} - \dfrac{y}{5x^2}$

3. $f_{xy} = 4x - y$

4. $f_{xy} = \dfrac{4x}{y^2} - \dfrac{y}{5x^2}$

5. $f_{xy} = 4x + y$

---

023 (part 1 of 4) 10.0 points

A function f is defined by

$$f(x, y) \;=\; (x + 1)(y - 6)(x + y - 3)\,.$$

(i) Determine f_x.

1. $f_x \;=\; (y + 6)(2x + y - 4)$

2. $f_x \;=\; (y - 6)(2x + y - 2)$

3. $f_x \;=\; (y + 6)(2x + y - 2)$

4. $f_x \;=\; (y - 6)(2x - y - 2)$

5. $f_x \;=\; (y - 6)(2x + y + 4)$

6. $f_x \;=\; (y - 6)(2x + y - 4)$

---

024 (part 2 of 4) 10.0 points

(ii) Determine f_y.

1. $f_y \;=\; (x + 1)(x + 2y + 3)$

2. $f_y \;=\; (x + 1)(x + 2y + 9)$

3. $f_y \;=\; (x + 1)(x + 2y - 3)$

4. $f_y \;=\; (x + 1)(x - 2y - 9)$

5. $f_y \;=\; (x + 1)(x + 2y - 9)$

---

025 (part 3 of 4) 10.0 points

(iii) Determine $f_{xx} + f_{yy}$.

1. $f_{xx} + f_{yy} \;=\; 2(x + y - 7)$

2. $f_{xx} + f_{yy} \;=\; 2(x + y - 5)$

3. $f_{xx} + f_{yy} \;=\; x + y - 5$

4. $f_{xx} + f_{yy} \;=\; 2(x + y + 7)$

5. $f_{xx} + f_{yy} \;=\; x + y + 7$

---

026 (part 4 of 4) 10.0 points

(iv) Determine f_{xy}.

1. $f_{xy} \;=\; x + 2y - 8$

2. $f_{xy} \;=\; 2x + y - 8$

3. $f_{xy} \;=\; 2x - 2y - 8$

4. $f_{xy} \;=\; 2x - y - 10$

5. $f_{xy} \; = \; 2x + 2y - 8$

6. $f_{xy} \; = \; 2x - y + 10$

---

027 10.0 points

Use the Chain Rule to find $\dfrac{\partial z}{\partial t}$ when

$$z \; = \; x^2 - 4xy + y^2 \,,$$

and

$$x \; = \; 3s - 4t \,, \qquad y \; = \; st \,.$$

1. $\dfrac{\partial z}{\partial t} \; = \; 6x - 12y - 4xs + 2ys$

2. $\dfrac{\partial z}{\partial t} \; = \; -8x + 16y - 4xs + 2ys$

3. $\dfrac{\partial z}{\partial t} \; = \; 6x - 12y - 4xt + 2yt$

4. $\dfrac{\partial z}{\partial t} \; = \; 6x + 16y - 4xt + 2yt$

5. $\dfrac{\partial z}{\partial t} \; = \; -8x - 12y - 4xs + 2ys$

6. $\dfrac{\partial z}{\partial t} \; = \; -8x + 16y - 4xt + 2yt$

---

028 10.0 points

Use the Chain Rule to find $\dfrac{\partial z}{\partial s}$ when

$$z \; = \; x^2 - 4xy + y^2 \,,$$

and

$$x \; = \; 2s + 3t \,, \qquad y \; = \; st \,.$$

1. $\dfrac{\partial z}{\partial s} \; = \; 4x - 12y - 4xt + 2yt$

2. $\dfrac{\partial z}{\partial s} \; = \; 6x - 12y - 4xs + 2ys$

3. $\dfrac{\partial z}{\partial s} \; = \; 4x - 8y - 4xt + 2yt$

4. $\dfrac{\partial z}{\partial s} \; = \; 4x - 8y - 4xs + 2ys$

5. $\dfrac{\partial z}{\partial s} \; = \; 6x - 8y - 4xs + 2ys$

6. $\dfrac{\partial z}{\partial s} \; = \; 6x - 12y - 4xt + 2yt$

---

029 10.0 points

Use the Chain Rule to find $\dfrac{\partial z}{\partial t}$ when

$$z \; = \; \frac{x}{y} \,,$$

and

$$x \; = \; 2se^t \,, \qquad y \; = \; 5 + se^{-t} \,.$$

1. $\dfrac{\partial z}{\partial t} \; = \; \dfrac{sye^{2t} - xs}{ye^t}$

2. $\dfrac{\partial z}{\partial t} \; = \; \dfrac{2sye^{2t} - xs}{ye^t}$

3. $\dfrac{\partial z}{\partial t} \; = \; \dfrac{2sye^{2t} + xs}{y^2e^t}$

4. $\dfrac{\partial z}{\partial t} \; = \; \dfrac{2sye^t + xs}{y^2e^t}$

5. $\dfrac{\partial z}{\partial t} \; = \; \dfrac{sye^t + xs}{y^2e^t}$

6. $\dfrac{\partial z}{\partial t} \; = \; \dfrac{sye^t - xs}{ye^t}$