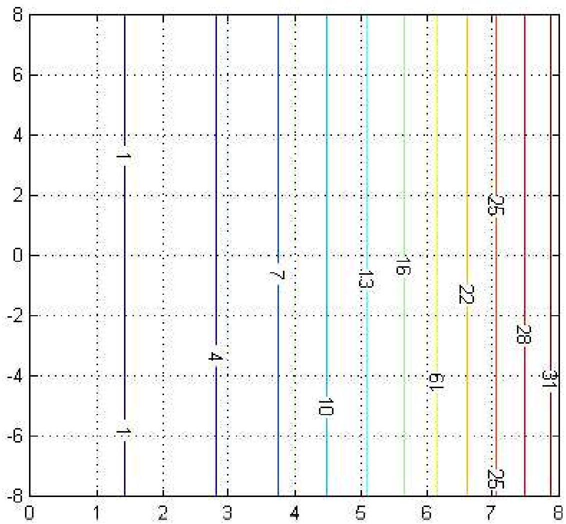
Classroom Voting Questions: Multivariable Calculus

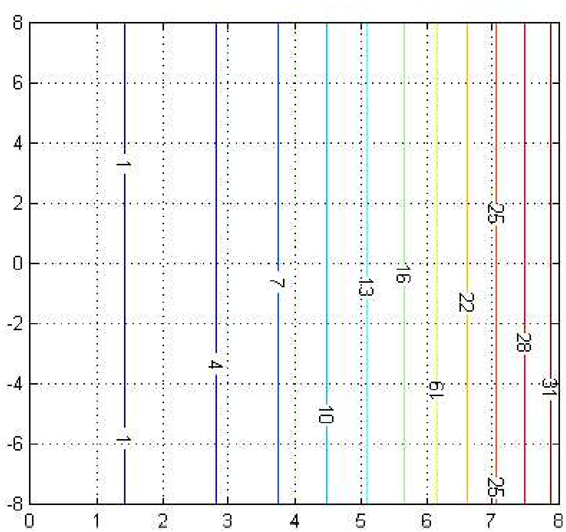
14.7 Second-Order Partial Derivatives

1. At the point (4,0), what is true of the second partial derivatives of $f(x, y)$?



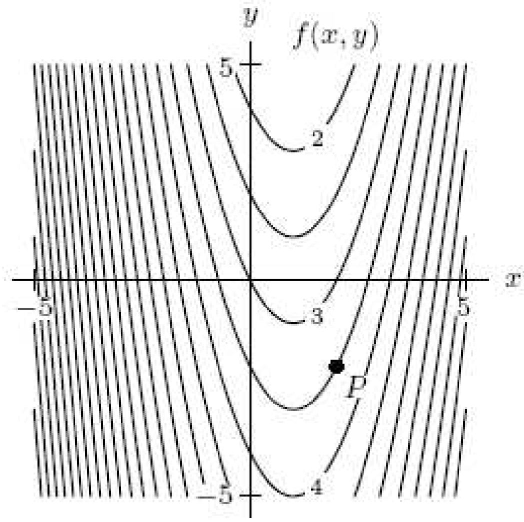
(a) $f_{xx} > 0$ and $f_{yy} > 0$
(b) $f_{xx} < 0$ and $f_{yy} < 0$
(c) $f_{xx} > 0$ and $f_{yy} = 0$
(d) $f_{xx} < 0$ and $f_{yy} = 0$

2. At the point (4,0), what is true of the second partial derivatives of $f(x, y)$?



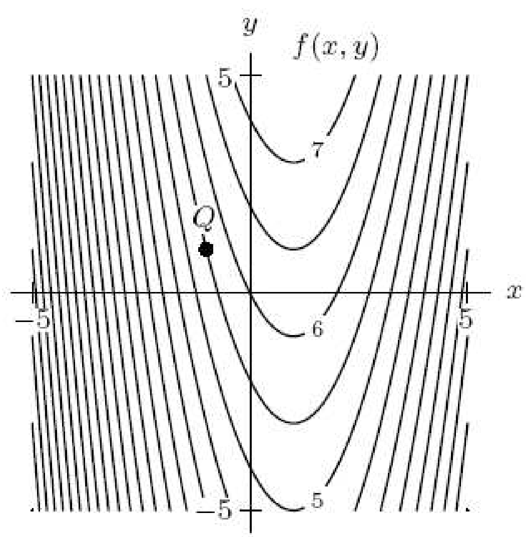
(a) $f_{xy} > 0$
(b) $f_{xy} < 0$
(c) $f_{xy} = 0$

3. The figure below shows level curves of $f(x, y)$. What are the signs of $f_{xx}(P)$ and $f_{yy}(P)$?



(a) $f_{xx}(P) > 0, f_{yy}(P) \approx 0$
(b) $f_{xx}(P) > 0, f_{yy}(P) < 0$
(c) $f_{xx}(P) \approx 0, f_{yy}(P) \approx 0$
(d) $f_{xx}(P) < 0, f_{yy}(P) > 0$

4. The figure below shows level curves of $f(x, y)$. What are the signs of $f_{xx}(Q)$ and $f_{yy}(Q)$?



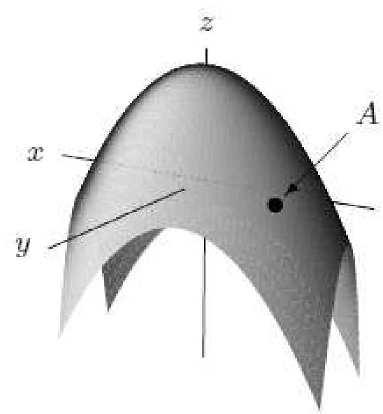
(a) $f_{xx}(Q) > 0, f_{yy}(Q) < 0$

(b) $f_{xx}(Q) < 0, f_{yy}(Q) < 0$

(c) $f_{xx}(Q) \approx 0, f_{yy}(Q) \approx 0$

(d) $f_{xx}(Q) < 0, f_{yy}(Q) \approx 0$

5. The figure below shows the surface $z = f(x, y)$. What are the signs of $f_{xx}(A)$ and $f_{yy}(A)$?



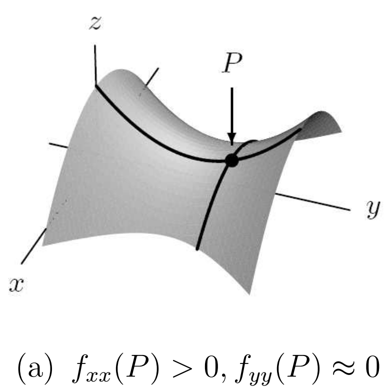
(a) $f_{xx}(A) > 0, f_{yy}(A) < 0$

(b) $f_{xx}(A) < 0, f_{yy}(A) < 0$

(c) $f_{xx}(A) \approx 0, f_{yy}(A) \approx 0$

(d) $f_{xx}(A) < 0, f_{yy}(A) \approx 0$

6. The figure below shows the surface $z = f(x, y)$. What are the signs of $f_{xx}(P)$ and $f_{yy}(P)$?



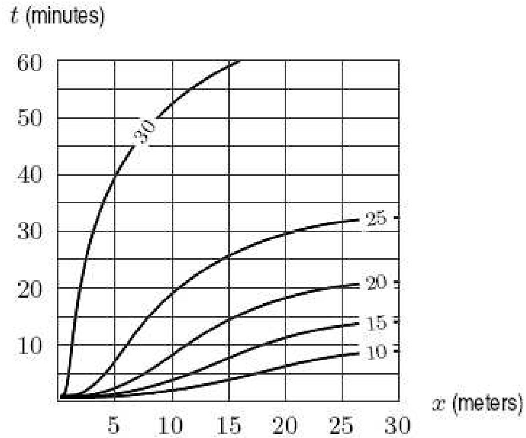
(a) $f_{xx}(P) > 0, f_{yy}(P) \approx 0$

(b) $f_{xx}(P) > 0, f_{yy}(P) < 0$

(c) $f_{xx}(P) \approx 0, f_{yy}(P) \approx 0$

(d) $f_{xx}(P) < 0, f_{yy}(P) > 0$

7. The figure below shows the temperature T °C as a function of distance x in meters along a wall and time t in minutes. Choose the correct statement and explain your choice without computing these partial derivatives.



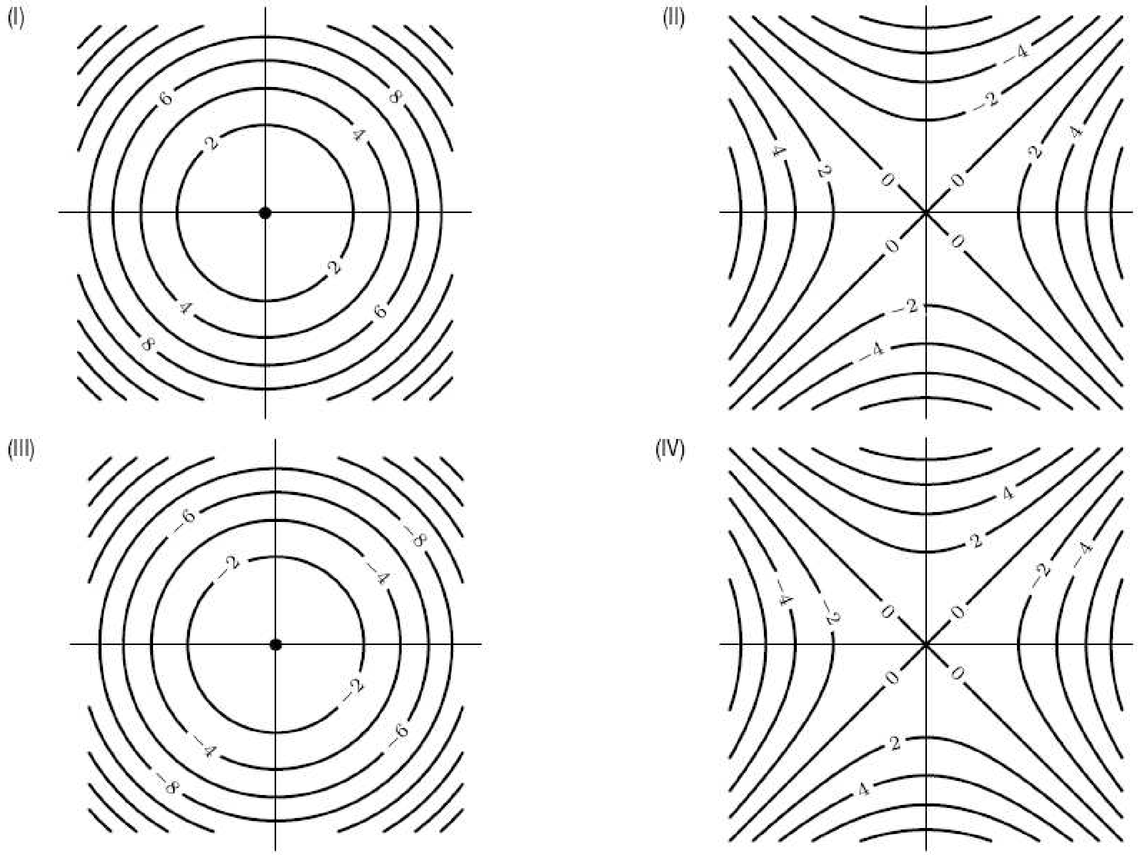
(a) $\frac{\partial T}{\partial t}(t, 10) < 0$ and $\frac{\partial^2 T}{\partial t^2}(t, 10) < 0$.

(b) $\frac{\partial T}{\partial t}(t, 10) > 0$ and $\frac{\partial^2 T}{\partial t^2}(t, 10) > 0$.

(c) $\frac{\partial T}{\partial t}(t, 10) > 0$ and $\frac{\partial^2 T}{\partial t^2}(t, 10) < 0$.

(d) $\frac{\partial T}{\partial t}(t, 10) < 0$ and $\frac{\partial^2 T}{\partial t^2}(t, 10) > 0$.

8. The quadratic Taylor Polynomials (A)-(D) each approximate a function of two variables near the origin. Figures (I)-(IV) are contours near the origin. Match (A)-(D) to (I)-(IV).



A $-x^2 + y^2$

B $x^2 - y^2$

C $-x^2 - y^2$

D $x^2 + y^2$

(a) A - I, B - III, C - II, D - IV

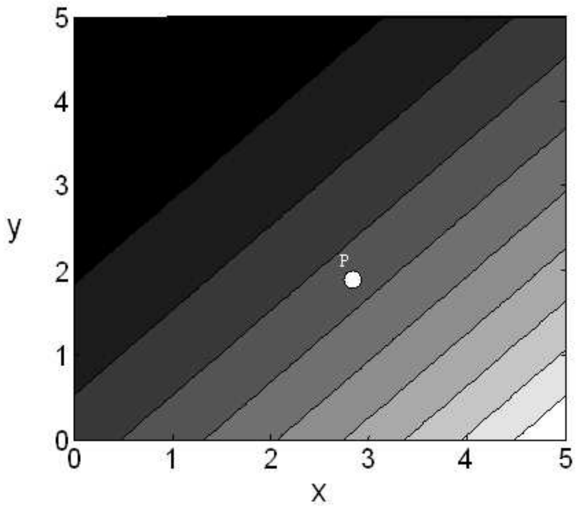
(b) A - II, B - IV, C - I, D - III

(c) A - IV, B - II, C - III, D - I

(d) A - III, B - I, C - IV, D - II

(e) A - II, B - IV, C - III, D - I

9. In the contour plot below dark shades represent small values of the function and light shades represent large values of the function. What is the sign of the mixed partial derivative?



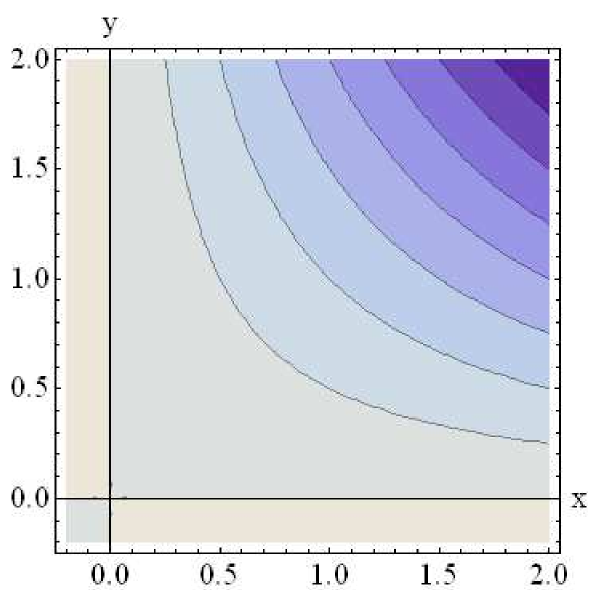
(a) $f_{xy} > 0$

(b) $f_{xy} < 0$

(c) $f_{xy} \approx 0$

(d) This cannot be determined from the figure.

10. In the contour plot below dark shades represent small values of the function and light shades represent large values of the function. What is the sign of the mixed partial derivative?



(a) $f_{xy} > 0$

(b) $f_{xy} < 0$

(c) $f_{xy} \approx 0$

(d) This cannot be determined from the figure.