MATH 2551 Multivariable Calculus: Directional derivatives

1. What is the directional derivative of a function at a point in the direction of a vector v?

A. It is the rate of change of the function in the direction of v at the point.
B. It is the rate of change of the function in the direction of v at the point divided by the magnitude of v.
C. It is the rate of change of the function in the direction of v at the point multiplied by the magnitude of v.
D. It is the rate of change of the function in the direction of v at the point squared.

2. What is the gradient vector of a function at a point?

A. It is the vector of partial derivatives of the function at the point.
B. It is the vector of partial derivatives of the function at the point divided by the magnitude of the vector.
C. It is the vector of partial derivatives of the function at the point multiplied by the magnitude of the vector.
D. It is the vector of partial derivatives of the function at the point squared.

3. What is the directional derivative of a function at a point in the direction of the gradient vector?

A. It is the rate of change of the function in the direction of the gradient vector at the point.
B. It is the rate of change of the function in the direction of the gradient vector at the point divided by the magnitude of the gradient vector.
C. It is the rate of change of the function in the direction of the gradient vector at the point multiplied by the magnitude of the gradient vector.
D. It is the rate of change of the function in the direction of the gradient vector at the point squared.

4. What is the directional derivative of a function at a point in the direction of a unit vector?

A. It is the rate of change of the function in the direction of the unit vector at the point.
B. It is the rate of change of the function in the direction of the unit vector at the point divided by the magnitude of the unit vector.
C. It is the rate of change of the function in the direction of the unit vector at the point multiplied by the magnitude of the unit vector.
D. It is the rate of change of the function in the direction of the unit vector at the point squared.

5. What is the directional derivative of a function at a point in the direction of the negative of a unit vector?

A. It is the rate of change of the function in the direction of the negative of the unit vector at the point.
B. It is the rate of change of the function in the direction of the negative of the unit vector at the point divided by the magnitude of the negative of the unit vector.
C. It is the rate of change of the function in the direction of the negative of the unit vector at the point multiplied by the magnitude of the negative of the unit vector.
D. It is the rate of change of the function in the direction of the negative of the unit vector at the point squared.

6. What is the directional derivative of a function at a point in the direction of a

vector v if the gradient vector is perpendicular to v?

A. It is the rate of change of the function in the direction of v at the point.
B. It is the rate of change of the function in the direction of v at the point divided by the magnitude of v.
C. It is the rate of change of the function in the direction of v at the point multiplied by the magnitude of v.
D. It is the rate of change of the function in the direction of v at the point squared.

7. What is the directional derivative of a function at a point in the direction of the gradient vector if the gradient vector is perpendicular to the direction of the gradient vector?

A. It is the rate of change of the function in the direction of the gradient vector at the point.
B. It is the rate of change of the function in the direction of the gradient vector at the point divided by the magnitude of the gradient vector.
C. It is the rate of change of the function in the direction of the gradient vector at the point multiplied by the magnitude of the gradient vector.
D. It is the rate of change of the function in the direction of the gradient vector at the point squared.

8. What is the directional derivative of a function at a point in the direction of a unit vector if the gradient vector is perpendicular to the direction of the unit vector?

A. It is the rate of change of the function in the direction of the unit vector at the point.
B. It is the rate of change of the function in the direction of the unit vector at the point divided by the magnitude of the unit vector.
C. It is the rate of change of the function in the direction of the unit vector at the point multiplied by the magnitude of the unit vector.
D. It is the rate of change of the function in the direction of the unit vector at the point squared.

9. What is the directional derivative of a function at a point in the direction of the negative of a unit vector if the gradient vector is perpendicular to the direction of the negative of the unit vector?

A. It is the rate of change of the function in the direction of the negative of the unit vector at the point.
B. It is the rate of change of the function in the direction of the negative of the unit vector at the point divided by the magnitude of the negative of the unit vector.
C. It is the rate of change of the function in the direction of the negative of the unit vector at the point multiplied by the magnitude of the negative of the unit vector.
D. It is the rate of change of the function in the direction of the negative of the unit vector at the point squared.

10. What is the directional derivative of a function at a point in the direction of a vector v if the gradient vector is parallel to v?

A. It is the rate of change of the function in the direction of v at the point.
B. It is the rate of change of the function in the direction of v at the point divided by the magnitude of v.
C. It is the rate of change of the function in the direction of v at the point multiplied by the magnitude of v.

D. It is the rate of change of the function in the direction of v at the point squared.

11. What is the directional derivative of a function at a point in the direction of the gradient vector if the gradient vector is parallel to the direction of the gradient vector?

A. It is the rate of change of the function in the direction of the gradient vector at the point.
B. It is the rate of change of the function in the direction of the gradient vector at the point divided by the magnitude of the gradient vector.
C. It is the rate of change of the function in the direction of the gradient vector at the point multiplied by the magnitude of the gradient vector.
D. It is the rate of change of the function in the direction of the gradient vector at the point squared.

12. What is the directional derivative of a function at a point in the direction of a unit vector if the gradient vector is parallel to the direction of the unit vector?

A. It is the rate of change of the function in the direction of the unit vector at the point.
B. It is the rate of change of the function in the direction of the unit vector at the point divided by the magnitude of the unit vector.
C. It is the rate of change of the function in the direction of the unit vector at the point multiplied by the magnitude of the unit vector.
D. It is the rate of change of the function in the direction of the unit vector at the point squared.

13. What is the directional derivative of a function at a point in the direction of the negative of a unit vector if the gradient vector is parallel to the direction of the negative of the unit vector?

A. It is the rate of change of the function in the direction of the negative of the unit vector at the point.
B. It is the rate of change of the function in the direction of the negative of the unit vector at the point divided by the magnitude of the negative of the unit vector.
C. It is the rate of change of the function in the direction of the negative of the unit vector at the point multiplied by the magnitude of the negative of the unit vector.
D. It is the rate of change of the function in the direction of the negative of the unit vector at the point squared.

14. What is the directional derivative of a function at a point in the direction of a vector v if the gradient vector is zero?

A. It is the rate of change of the function in the direction of v at the point.
B. It is the rate of change of the function in the direction of v at the point divided by the magnitude of v.
C. It is the rate of change of the function in the direction of v at the point multiplied by the magnitude of v.
D. It is the rate of change of the function in the direction of v at the point squared.

15. What is the directional derivative of a function at a point in the direction of the gradient vector if the gradient vector is zero?

A. It is the rate of change of the function in the direction of the gradient vector at the point.

B. It is the rate of change of the function in the direction of the gradient vector at the point divided by the magnitude of the gradient vector.
C. It is the rate of change of the function in the direction of the gradient vector at the point multiplied by the magnitude of the gradient vector.
D. It is the rate of change of the function in the direction of the gradient vector at the point squared.

16. What is the directional derivative of a function at a point in the direction of a unit vector if the gradient vector is zero?

A. It is the rate of change of the function in the direction of the unit vector at the point.
B. It is the rate of change of the function in the direction of the unit vector at the point divided by the magnitude of the unit vector.
C. It is the rate of change of the function in the direction of the unit vector at the point multiplied by the magnitude of the unit vector.
D. It is the rate of change of the function in the direction of the unit vector at the point squared.

17. What is the directional derivative of a function at a point in the direction of the negative of a unit vector if the gradient vector is zero?

A. It is the rate of change of the function in the direction of the negative of the unit vector at the point.
B. It is the rate of change of the function in the direction of the negative of the unit vector at the point divided by the magnitude of the negative of the unit vector.
C. It is the rate of change of the function in the direction of the negative of the unit vector at the point multiplied by the magnitude of the negative of the unit vector.
D. It is the rate of change of the function in the direction of the negative of the unit vector at the point squared.

18. What is the directional derivative of a function at a point in the direction of a vector v if the gradient vector is in the same direction as v?

A. It is the rate of change of the function in the direction of v at the point.
B. It is the rate of change of the function in the direction of v at the point divided by the magnitude of v.
C. It is the rate of change of the function in the direction of v at the point multiplied by the magnitude of v.
D. It is the rate of change of the function in the direction of v at the point squared.

19. What is the directional derivative of a function at a point in the direction of the gradient vector if the gradient vector is in the same direction as the gradient vector?

A. It is the rate of change of the function in the direction of the gradient vector at the point.
B. It is the rate of change of the function in the direction of the gradient vector at the point divided by the magnitude of the gradient vector.
C. It is the rate of change of the function in the direction of the gradient vector at the point multiplied by the magnitude of the gradient vector.
D. It is the rate of change of the function in the direction of the gradient vector at the point squared.

20. What is the directional derivative of a function at a point in the direction of a unit vector if the gradient vector is in the same direction as the unit vector?

A. It is the rate of change of the function in the direction of the unit vector at the point.
B. It is the rate of change of the function in the direction of the unit vector at the point divided by the magnitude of the unit vector.
C. It is the rate of change of the function in the direction of the unit vector at the point multiplied by the magnitude of the unit vector.
D. It is the rate of change of the function in the direction of the unit vector at the point squared.

21. What is the directional derivative of a function at a point in the direction of the negative of a unit vector if the gradient vector is in the same direction as the negative of the unit vector?

A. It is the rate of change of the function in the direction of the negative of the unit vector at the point.
B. It is the rate of change of the function in the direction of the negative of the unit vector at the point divided by the magnitude of the negative of the unit vector.
C. It is the rate of change of the function in the direction of the negative of the unit vector at the point multiplied by the magnitude of the negative of the unit vector.
D. It is the rate of change of the function in the direction of the negative of the unit vector at the point squared.

22. What is the directional derivative of a function at a point in the direction of a vector v if the gradient vector is in the same direction as the negative of v?

A. It is the rate of change of the function in the direction of v at the point.
B. It is the rate of change of the function in the direction of v at the point divided by the magnitude of v.
C. It is the rate of change of the function in the direction of v at the point multiplied by the magnitude of v.
D. It is the rate of change of the function in the direction of v at the point squared.

23. What is the directional derivative of a function at a point in the direction of the gradient vector if the gradient vector is in the same direction as the negative of the gradient vector?

A. It is the rate of change of the function in the direction of the gradient vector at the point.
B. It is the rate of change of the function in the direction of the gradient vector at the point divided by the magnitude of the gradient vector.
C. It is the rate of change of the function in the direction of the gradient vector at the point multiplied by the magnitude of the gradient vector.
D. It is the rate of change of the function in the direction of the gradient vector at the point squared.

24. What is the directional derivative of a function at a point in the direction of a unit vector if the gradient vector is in the same direction as the negative of the unit vector?

A. It is the rate of change of the function in the direction of the unit vector at the point.
B. It is the rate of change of the function in the direction of the unit vector at the point divided by the magnitude of the unit vector.
C. It is the rate of change of the function in the direction of the unit vector at the point multiplied by the magnitude of the unit vector.
D. It is the rate of change of the function in the direction of the unit vector at

the point squared.

25. What is the directional derivative of a function at a point in the direction of the negative of a unit vector if the gradient vector is in the same direction as the negative of the negative of the unit vector?

A. It is the rate of change of the function in the direction of the negative of the unit vector at the point.
B. It is the rate of change of the function in the direction of the negative of the unit vector at the point divided by the magnitude of the negative of the unit vector.
C. It is the rate of change of the function in the direction of the negative of the unit vector at the point multiplied by the magnitude of the negative of the unit vector.
D. It is the rate of change of the function in the direction of the negative of the unit vector at the point squared.

Answer Key:

1. A
2. A
3. A
4. A
5. A
6. B
7. B
8. B
9. B
10. A
11. A
12. A
13. A
14. B
15. B
16. B
17. B
18. C
19. C
20. C
21. C
22. B
23. B
24. B
25. B