Course: Machine Learning - Foundations
Week 2 - Test Questions

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1. (2 points)

   Answer: D
   Option A and B are discontinuous at x=1.Option C is discontinuous at x=2. So correct option is D

2. (1 point)

   Answer: D
   A, B, C are equivalent statements.

3. (2 points)

   Answer: B, D
   Right hand limit and left hand limit at x=3 are different so function is not continuous at x=3

4. (1 point)

   Answer: 1.011
   Linear approximation of e^x is 1+x. Here x=0.011

5. (1 point)

   Answer: 1.975
   Linear approximation of $\sqrt{x}$ is,
   $\sqrt{x} - (x - x^*)\frac{1}{2\sqrt{x}}$.
   Here x= 4 and $x^* = 3.9$ $\sqrt{3}.9 = \sqrt{4} - (4 - 3.9)\frac{1}{2\sqrt{4}}$=1.975

6. (1 point)

   Answer: Two vectors are perpendicular if their inner product is zero

7. (2 points)

   Answer: B
   $f(x) \approx f(v) + \nabla f(v)^T (x - v)$
   $= 16 + [12 \quad 12] \begin{bmatrix} x-2 \\ y-2 \end{bmatrix}$
   $= 12x + 12y - 32$

8. (1 point)

   Answer: A
   $[\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}]$
   $= [3x^2y^2 \quad 2x^3y]$
   $= [12 \quad 4]$

9. (1 point)

Answer: C
$[\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}, \frac{\partial f}{\partial z}]$
$= [3x^2 \quad 2y \quad 3z^2]$
$= [0 \quad 2 \quad 3]$

10. (1 point)

Answer: As per Cauchy Shwarz inequality,
$- \parallel a \parallel\parallel b \parallel \leq a.b \leq \parallel a \parallel\parallel b$

11. (2 points)

Answer: 0.816
$\nabla f = [3x^2 \quad 2y \quad 3z^2]^T$
at (1,1,1)
$\nabla f = [3 \quad 2 \quad 3]^T$
$\parallel i - 2j + k \parallel = \sqrt{6}$
Directional derivative=$\frac{3\times1-2\times2+3\times1}{\sqrt{6}}$

12. (2 points)

Answer: A
$\nabla f = [2 \quad 3y^2 \quad 4z]^T$
at (1,0,1)
$\nabla f = [2 \quad 0 \quad 4]^T$
$\parallel [2 \quad 0 \quad 4]^T \parallel = \sqrt{20}$
direction of steepest ascent=$\nabla f / \parallel f \parallel$

13. (2 points)

Answer: 0.577
$\nabla f = [1 \quad 1 \quad 1]^T$
at (-1,1,0)
$\nabla f = [1 \quad 1 \quad 1]^T$
$\parallel i - j + k \parallel = \sqrt{3}$
Directional derivative=$\frac{1\times1-1\times1+1\times1}{\sqrt{3}}$

14. (1 point)

Answer: Line through $u \in R^d$ along $v \in R^d$ is given by
$x = u + \alpha v$
where, $\alpha \in R$ and $x \in R^d$