

**Time Limit:** 5 minutes

**Instructions:** Closed book. Closed notes. No calculator allowed.

Instructions for all quizzes: **Do not discuss any aspect of this quiz with other midshipmen until after 6th period.**

Print your last name above. Also, fill in the bubble for your section.

Fill the bubble for the correct answer. Also, write your answers in any blanks provided.

Your work will not be graded unless requested.

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In class we discussed five key properties of the gradient of a function  $f$  of several variables. List these properties (in any order).

0 The gradient of  $f$  is a vector.

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1 The gradient vector  $\nabla f(P)$  points in the direction of the maximum rate of change of  $f$  at point  $P$ .

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2 The magnitude  $|\nabla f(P)|$  of the gradient vector equals the maximum rate of change of  $f$  at point  $P$ .

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3 The gradient vector  $\nabla f(P)$  is perpendicular to the level curve (or level surface) of the function  $f$  that passes through the point  $P$ .

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4 The directional derivative of  $f$  at the point  $P$  in the direction of the unit vector  $\mathbf{u}$  is  $D_{\mathbf{u}}(f(P)) = \nabla f(P) \cdot \mathbf{u}$

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