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## 8. Gradient connection to level curves

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Lecture due Sep 13, 2021 20:30 IST   Completed

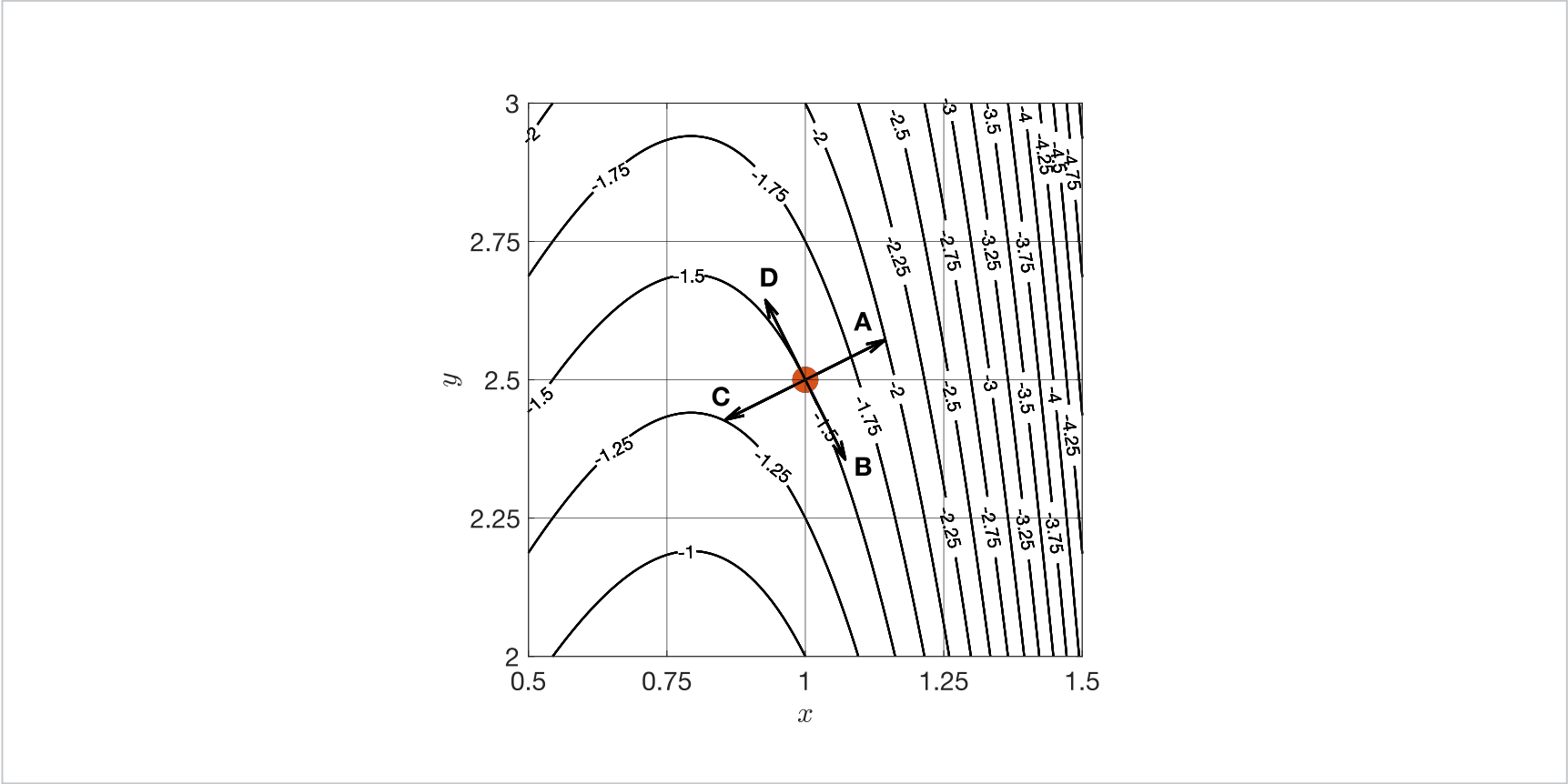


Review

We will now begin making connections between local extrema, gradient fields, and level curves.

Gradient concept check 1

1/1 point (graded)  
Consider the level curves shown in the image below.



Which vector best shows the direction of the gradient at the orange circle marker located at the point  $(1, 2.5)$ .

- ☐ A
- ☐ B
- ☒ C
- ☐ D
- ☐ None of the above



Solution:

The gradient is normal to the level curves and points in the direction that the function is increasing. Thus since the level curve the point is on has height  $-1.5$ , the answer is the arrow perpendicular to the level curve and pointing towards the level curve of height  $-1.25$ , which is option C.

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You have used 2 of 2 attempts

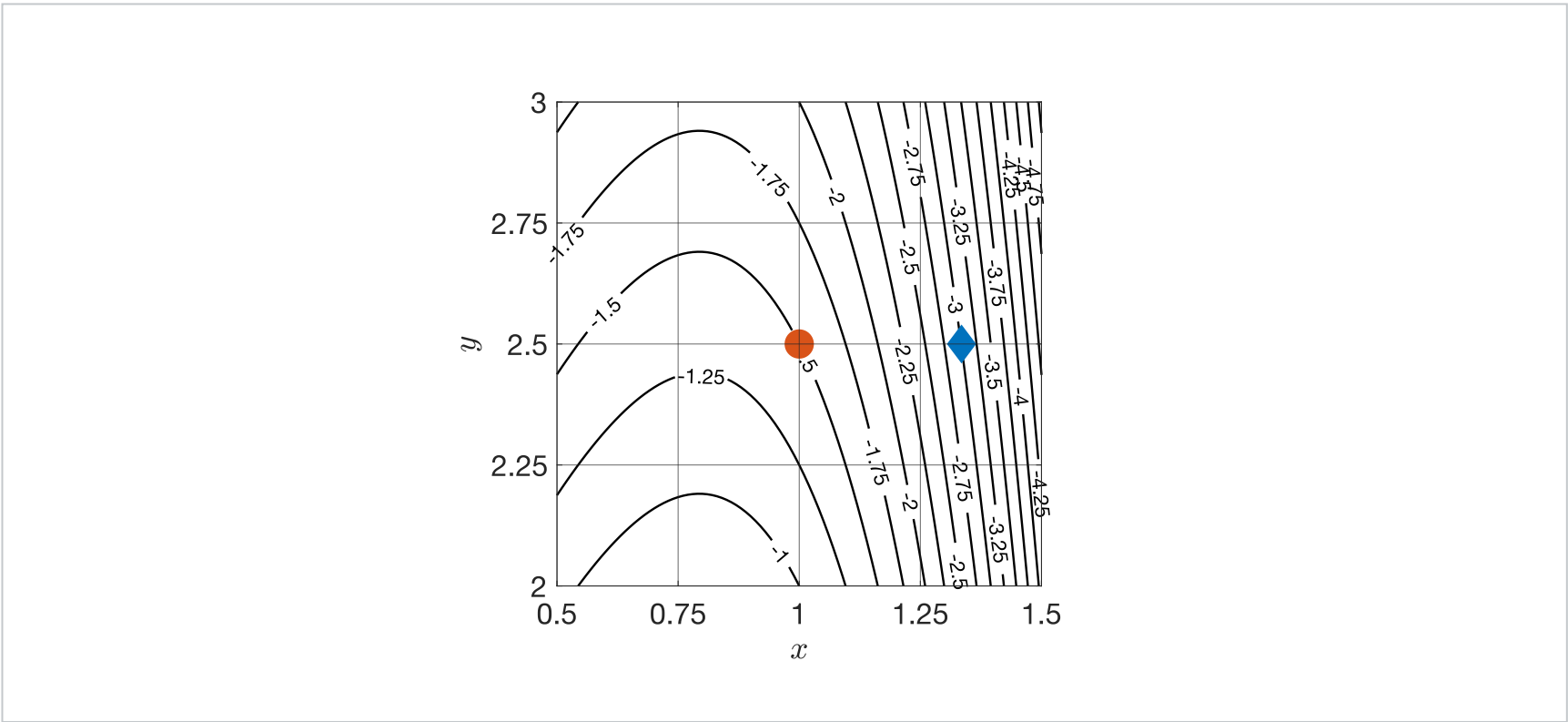
Answers are displayed within the problem

Gradient concept check 2

Calculator

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1/1 point (graded)  
Consider the level curves shown in the image below.



The blue diamond marker is located at the coordinates **(1.34, 2.50)**. The orange circle marker is located at the coordinates **(1, 2.5)**. At which of the two indicated points is the magnitude of the gradient larger?

- ☒ at the blue diamond
- ☐ at the orange circle
- ☐ the magnitude is the same at both points

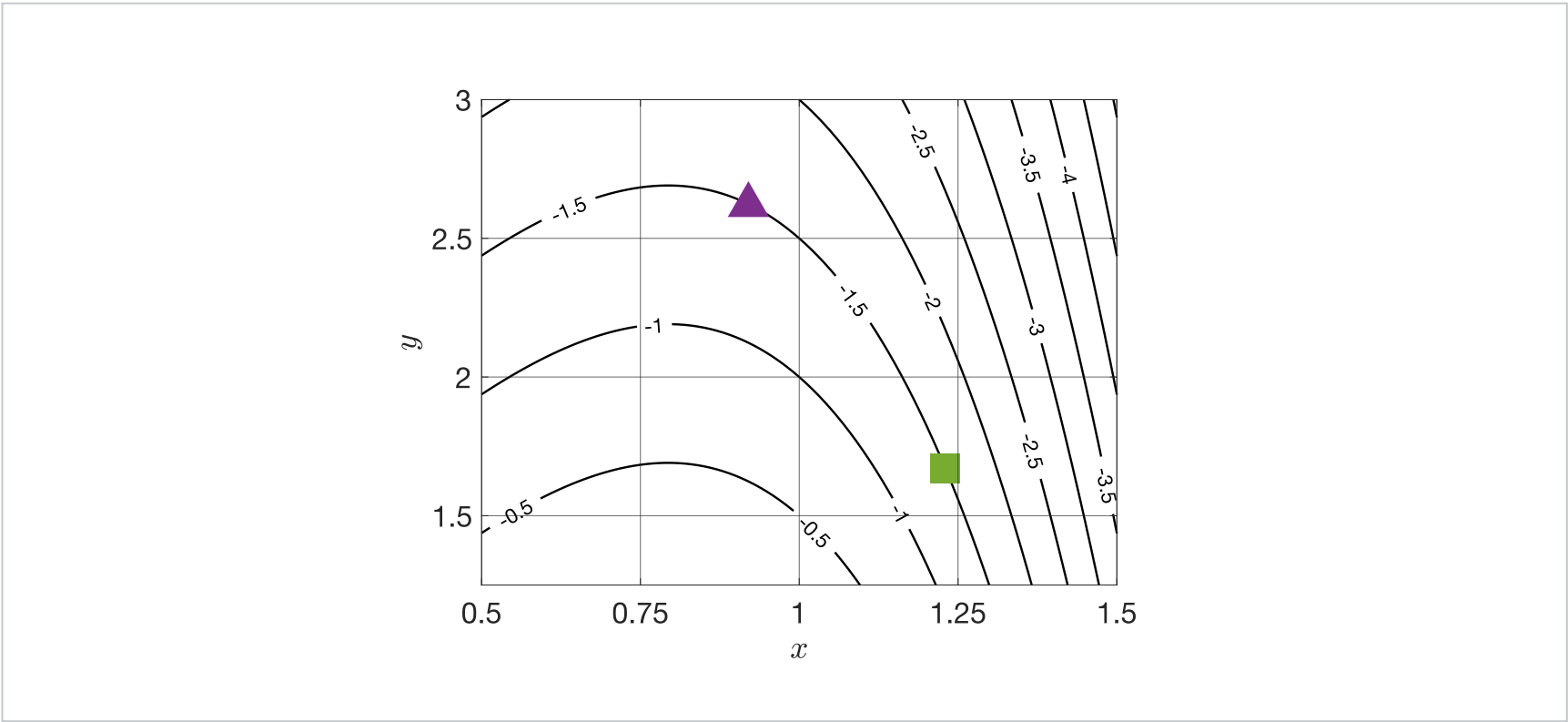


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You have used 1 of 1 attempt

Gradient concept check 3

1/1 point (graded)  
Consider the level curves shown in the image below.



The purple triangle marker is located at the coordinates **(0.92, 2.62)**. The green square marker is located at the coordinates **(1.23, 1.67)**. At which of the two indicated points is the magnitude of the gradient larger?

☐ at the purple triangle

☒ at the green square

☐ the magnitude is the same at both points



Solution:

The magnitude of the gradient at the point  $(x, y)$  measures how steep the function is at that point. If  $|\nabla f(x, y)|$  is large, then the function is steep. If  $|\nabla f(x, y)|$  is small, then the function is shallow. Because the level curves of the function are closer together near the green square than at the purple triangle, the function is steeper at the green square and therefore the magnitude of the gradient is larger at that point than at the purple triangle.

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You have used 1 of 1 attempt

**i** Answers are displayed within the problem

8. Gradient connection to level curves

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