5. Multivariable functions

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Problem Set A due Aug 4, 2021 20:30 IST Completed

1A-5

1/1 point (graded)

Suppose we are interested in studying how fast the liver metabolizes protein P. The metabolic rate depends on the levels of hormone X and hormone Y. Let x denote the level of hormone X and y the level of hormone Y.

If $x < 1$, then increasing the amount of hormone Y increases the metabolic rate. But if $x > 1$, then increasing the amount of hormone Y decreases the metabolic rate.

Which of the following formulas could be the formula for the metabolic rate in terms of x and y?

- ( ) $10 - y^2 + x$
- (•) $10 - xy + y$
- ( ) $10 - x^2 + xy$

✔

Solution:

The change in the metabolic rate when changing the value of x or y is the partial derivative in that direction. Since we are interested in the change in the metabolic rate when we vary y, we should consider the partial derivative with respect to y. The metabolic rate will increase when we increase y if this partial derivative is positive, thus we are looking for a function whose partial derivative with respect to y is positive when $x < 1$ and negative when $x > 1$.

The derivatives of the three functions with respect to y are

$$\frac{\partial}{\partial y}(10 - y^2 + x) = -2y$$

$$\frac{\partial}{\partial y}(10 - xy + y) = -x + 1$$

and

$$\frac{\partial}{\partial y}(10 - x^2 + xy) = x.$$

Notice that only the second option reflects the desired properties. In the first equation, the partial derivative with respect to y does not depend on x. In the third equation, the partial derivative with respect to y is positive for $x > 1$ rather than negative.

Submit You have used 1 of 2 attempts

Answers are displayed within the problem

1A-6

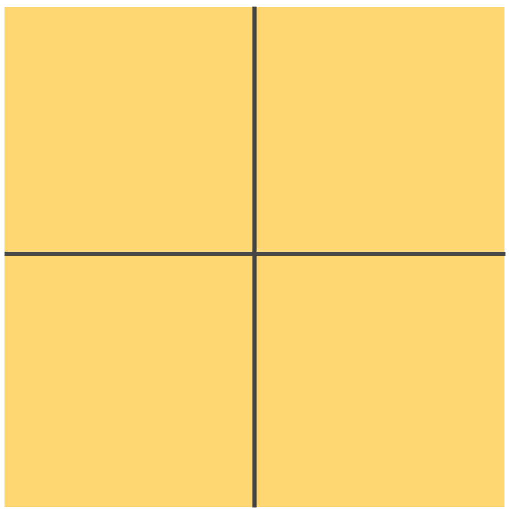
Calculator Hide Notes

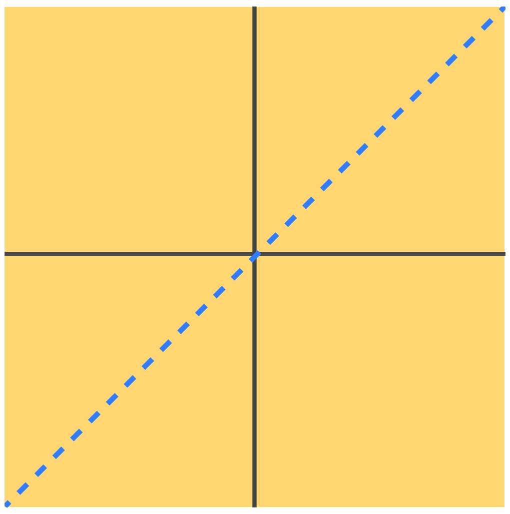
1/1 point (graded)

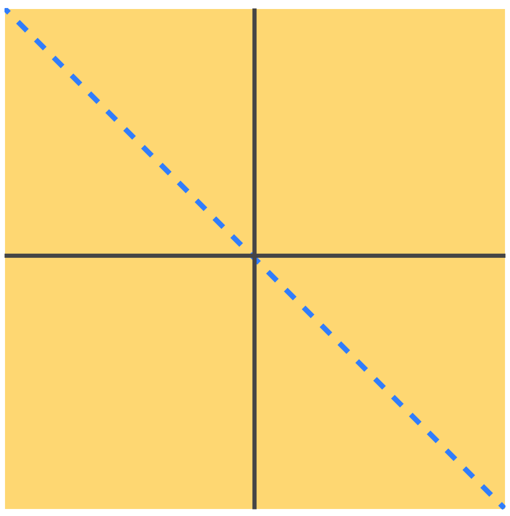
Identify the domain of the following function.

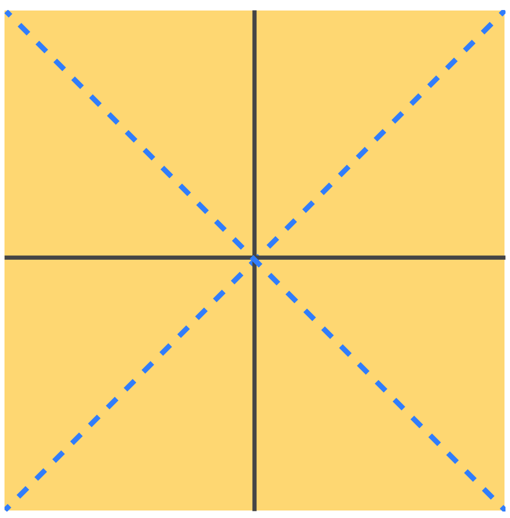
The shaded orange regions indicate locations that are in the domain. The blue dotted lines indicate lines that are not in the domain.

$f(x, y) = xy^2 + y$









None of the above

Solution:

All points in the plane are in the domain. $-\infty < x, y < \infty$

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Answers are displayed within the problem

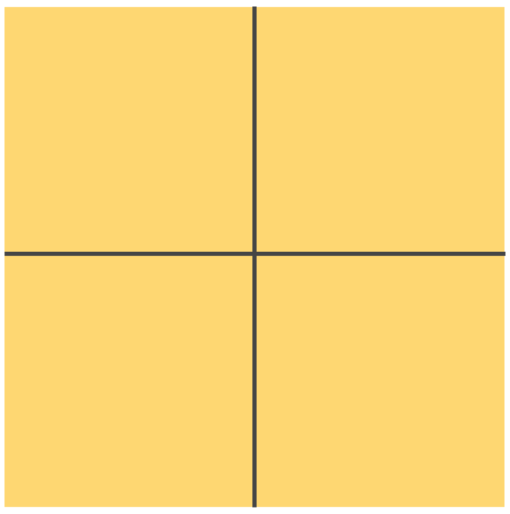
1A-7

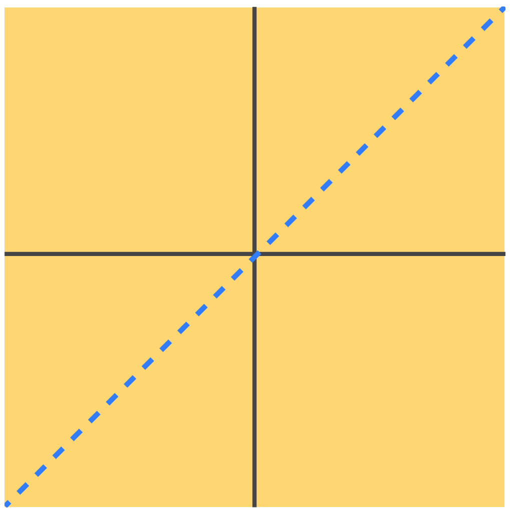
1/1 point (graded)

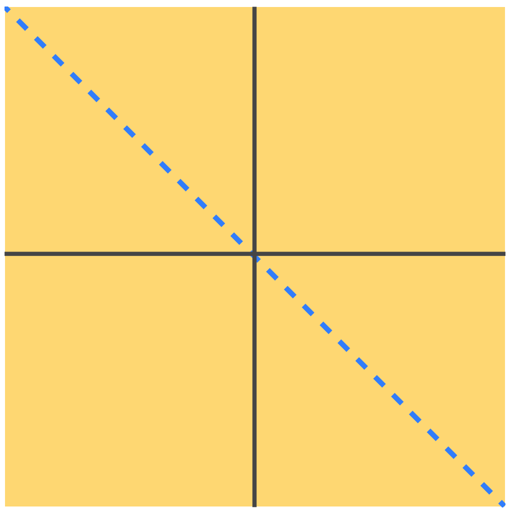
Identify the domain of the following function.

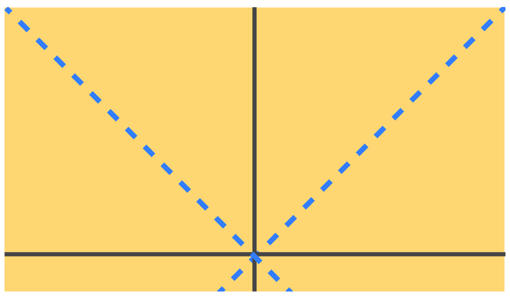
The shaded orange regions indicate locations that are in the domain. The blue dotted lines indicate lines that are not in the domain.

$$g(x, y) = \frac{x}{x+y}$$









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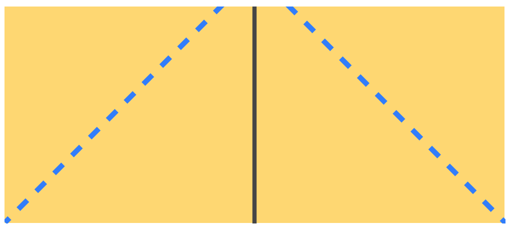


None of the above

Solution:

The points in the domain are all points $x + y \neq 0$, which is all except a diagonal line of slope -1 through the origin.

Submit You have used 1 of 2 attempts

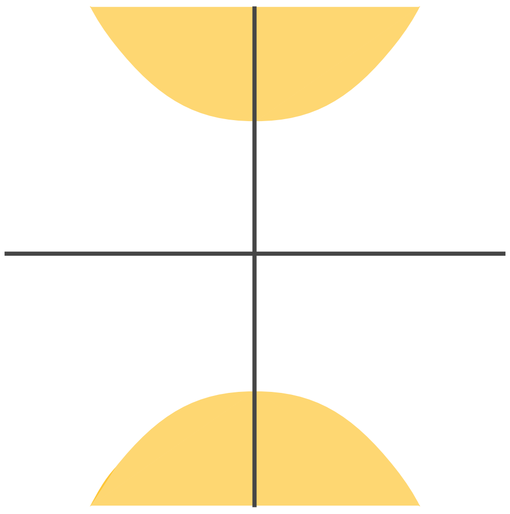
Answers are displayed within the problem

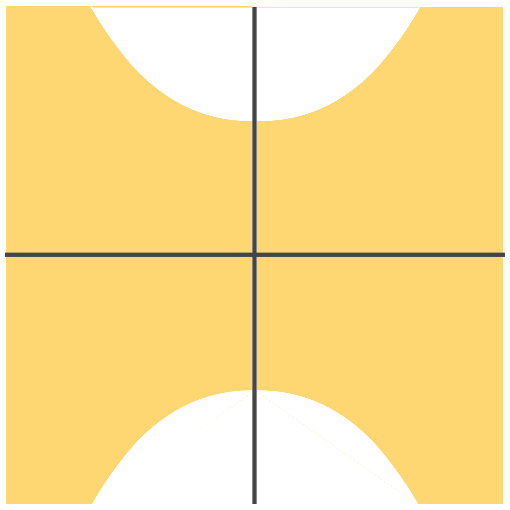
1A-8

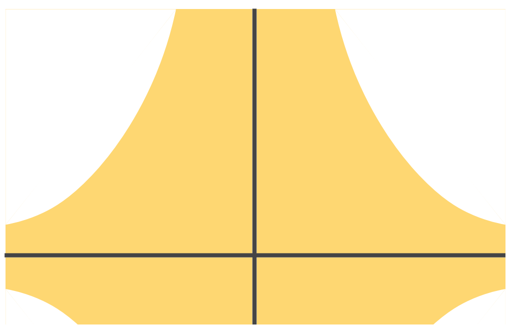
1/1 point (graded)
Identify the domain of the following function.

The shaded orange regions indicate locations that are in the domain. The white regions indicate locations that are not in the domain.

$h(x, y) = \arcsin(x^2 y)$







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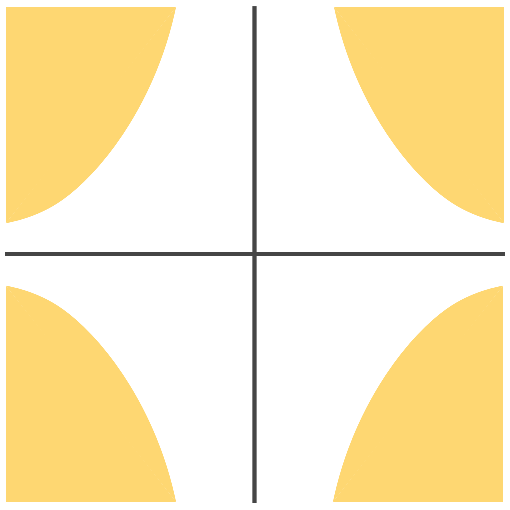

None of the above

Solution:

The domain is where $-1 \leq x^2 y \leq 1$. This is the region between the curves $-x^{-2} \leq y \leq x^{-2}$ and including the line $x = 0$.

Submit You have used 1 of 2 attempts

Answers are displayed within the problem

5. Multivariable functions

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Solution to 1A-5
I solved this question by matching the constrains imposed by the problem statement agaist the three choices. There was only one c... 2

Solution to 1 A 6
Hello, I thought nothing could equal infinity. Perhaps check the inequalities. Best wishes. 3

Answer to 1A-8 2

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