This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Choose the interval below that f composed with g at $x = -1$ is in.

$$f(x) = -2x^3 + 2x^2 + x \text{ and } g(x) = 2x^3 - 2x^2 - 3x - 2$$

The solution is 69.0, which is option C.

A. $(f \circ g)(-1) \in [21, 26]$

Distractor 1: Corresponds to reversing the composition.

B. $(f \circ g)(-1) \in [71, 79]$

Distractor 2: Corresponds to being slightly off from the solution.

C. $(f \circ g)(-1) \in [66, 70]$

* This is the correct solution

D. $(f \circ g)(-1) \in [13, 19]$

Distractor 3: Corresponds to being slightly off from the solution.

E. It is not possible to compose the two functions.

General Comment: f composed with g at x means $f(g(x))$. The order matters!

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2. Subtract the following functions, then choose the domain of the resulting function from the list below.

$$f(x) = 7x + 6 \text{ and } g(x) = \frac{3}{3x - 14}$$

The solution is The domain is all Real numbers except $x = 4.666666666666667$, which is option C.

A. The domain is all Real numbers less than or equal to $x = a$, where $a \in [1.5, 7.5]$

B. The domain is all Real numbers greater than or equal to $x = a$, where $a \in [3, 8]$

C. The domain is all Real numbers except $x = a$, where $a \in [-3.33, 10.67]$

D. The domain is all Real numbers except $x = a$ and $x = b$, where $a \in [-5.8, -4.8]$ and $b \in [-0.33, 6.67]$

E. The domain is all Real numbers.

General Comment: The new domain is the intersection of the previous domains.

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3. Find the inverse of the function below. Then, evaluate the inverse at $x = 7$ and choose the interval that $f^{-1}(7)$ belongs to.

$$f(x) = e^{x+3} + 3$$

The solution is $f^{-1}(7) = -1.614$, which is option B.

A. $f^{-1}(7) \in [3.79, 5.03]$

This solution corresponds to distractor 3.

B. $f^{-1}(7) \in [-1.91, -0.72]$

This is the solution.

C. $f^{-1}(7) \in [5.14, 5.92]$

This solution corresponds to distractor 4.

D. $f^{-1}(7) \in [3.79, 5.03]$

This solution corresponds to distractor 1.

E. $f^{-1}(7) \in [5.14, 5.92]$

This solution corresponds to distractor 2.

General Comment: Natural log and exponential functions always have an inverse. Once you switch the x and y, use the conversion $e^y = x \leftrightarrow y = \ln(x)$.

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4. Find the inverse of the function below (if it exists). Then, evaluate the inverse at $x = -11$ and choose the interval the $f^{-1}(-11)$ belongs to.

$$f(x) = \sqrt[3]{3x - 5}$$

The solution is -442.0, which is option D.

A. $f^{-1}(-11) \in [439.9, 442.5]$

This solution corresponds to distractor 2.

B. $f^{-1}(-11) \in [443.6, 445.4]$

This solution corresponds to distractor 3.

C. $f^{-1}(-11) \in [-446.5, -444.3]$

Distractor 1: This corresponds to

D. $f^{-1}(-11) \in [-442.2, -441.3]$

* This is the correct solution.

E. The function is not invertible for all Real numbers.

This solution corresponds to distractor 4.

General Comment: Be sure you check that the function is 1-1 before trying to find the inverse!

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5. Determine whether the function below is 1-1.

$$f(x) = -30x^2 - 251x - 494$$

The solution is no, which is option A.

A. No, because there is a y-value that goes to 2 different x-values.

* This is the solution.

B. Yes, the function is 1-1.

Corresponds to believing the function passes the Horizontal Line test.

C. No, because the range of the function is not $(-\infty, \infty)$.

Corresponds to believing 1-1 means the range is all Real numbers.

D. No, because the domain of the function is not $(-\infty, \infty)$.

Corresponds to believing 1-1 means the domain is all Real numbers.

E. No, because there is an x-value that goes to 2 different y-values.

Corresponds to the Vertical Line test, which checks if an expression is a function.

General Comment: There are only two valid options: The function is 1-1 OR No because there is a y-value that goes to 2 different x-values.

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6. Determine whether the function below is 1-1.

$$f(x) = (6x + 30)^3$$

The solution is yes, which is option C.

A. No, because the domain of the function is not $(-\infty, \infty)$.

Corresponds to believing 1-1 means the domain is all Real numbers.

B. No, because there is a y-value that goes to 2 different x-values.

Corresponds to the Horizontal Line test, which this function passes.

C. Yes, the function is 1-1.

* This is the solution.

D. No, because there is an x-value that goes to 2 different y-values.

Corresponds to the Vertical Line test, which checks if an expression is a function.

E. No, because the range of the function is not $(-\infty, \infty)$.

Corresponds to believing 1-1 means the range is all Real numbers.

General Comment: There are only two valid options: The function is 1-1 OR No because there is a y-value that goes to 2 different x-values.

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7. Find the inverse of the function below. Then, evaluate the inverse at $x = 8$ and choose the interval that $f^{-1}(8)$ belongs to.

$$f(x) = e^{x-3} - 3$$

The solution is $f^{-1}(8) = 5.398$, which is option D.

A. $f^{-1}(8) \in [-1.9, -0.73]$

This solution corresponds to distractor 4.

B. $f^{-1}(8) \in [-0.66, 0.08]$

This solution corresponds to distractor 1.

C. $f^{-1}(8) \in [-0.66, 0.08]$

This solution corresponds to distractor 3.

D. $f^{-1}(8) \in [5.18, 5.8]$

This is the solution.

E. $f^{-1}(8) \in [-1.9, -0.73]$

This solution corresponds to distractor 2.

General Comment: Natural log and exponential functions always have an inverse. Once you switch the x and y, use the conversion $e^y = x \leftrightarrow y = \ln(x)$.

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8. Find the inverse of the function below (if it exists). Then, evaluate the inverse at $x = -11$ and choose the interval the $f^{-1}(-11)$ belongs to.

$$f(x) = \sqrt[3]{5x - 3}$$

The solution is -265.6, which is option B.

A. $f^{-1}(-11) \in [-267.24, -266.28]$

Distractor 1: This corresponds to

B. $f^{-1}(-11) \in [-266.11, -263.86]$

* This is the correct solution.

C. $f^{-1}(-11) \in [266.35, 267.67]$

This solution corresponds to distractor 3.

D. $f^{-1}(-11) \in [265.37, 266.28]$

This solution corresponds to distractor 2.

E. The function is not invertible for all Real numbers.

This solution corresponds to distractor 4.

General Comment: Be sure you check that the function is 1-1 before trying to find the inverse!

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9. Add the following functions, then choose the domain of the resulting function from the list below.

$$f(x) = \frac{3}{5x - 31} \text{ and } g(x) = 9x^3 + 6x^2 + 8x + 2$$

The solution is The domain is all Real numbers except $x = 6.2$, which is option C.

A. The domain is all Real numbers less than or equal to $x = a$, where $a \in [-6.2, -3.2]$

B. The domain is all Real numbers greater than or equal to $x = a$, where $a \in [4.25, 9.25]$

C. The domain is all Real numbers except $x = a$, where $a \in [4.2, 10.2]$

D. The domain is all Real numbers except $x = a$ and $x = b$, where $a \in [-0.4, 12.6]$ and $b \in [4.4, 6.4]$

E. The domain is all Real numbers.

General Comment: The new domain is the intersection of the previous domains.

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10. Choose the interval below that f composed with g at $x = 1$ is in.

$$f(x) = 3x^3 - 2x^2 + x \text{ and } g(x) = 3x^3 + 2x^2 - 4x + 1$$

The solution is 18.0, which is option A.

A. $(f \circ g)(1) \in [17, 19.3]$

* This is the correct solution

B. $(f \circ g)(1) \in [22.9, 26.7]$

   Distractor 1: Corresponds to reversing the composition.

C. $(f \circ g)(1) \in [22.9, 26.7]$

   Distractor 2: Corresponds to being slightly off from the solution.

D. $(f \circ g)(1) \in [31.1, 32.9]$

   Distractor 3: Corresponds to being slightly off from the solution.

E. It is not possible to compose the two functions.

General Comment: f composed with g at x means $f(g(x))$. The order matters!