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. Find the inverse of the function below (if it exists). Then, evaluate the inverse at $x = -12$ and choose the interval that $f^{-1}(-12)$ belongs to.

$$f(x) = 4x^2 - 3$$

The solution is The function is not invertible for all Real numbers. , which is option E.

A. $f^{-1}(-12) \in [2.2, 2.68]$

Distractor 3: This corresponds to finding the (nonexistent) inverse and dividing by a negative.

B. $f^{-1}(-12) \in [1.23, 1.57]$

Distractor 1: This corresponds to trying to find the inverse even though the function is not 1-1.

C. $f^{-1}(-12) \in [4.36, 4.55]$

Distractor 4: This corresponds to both distractors 2 and 3.

D. $f^{-1}(-12) \in [1.57, 2.36]$

Distractor 2: This corresponds to finding the (nonexistent) inverse and not subtracting by the vertical shift.

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

* This is the correct option.

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

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

$$f(x) = (6x + 24)^3$$

The solution is yes, which is option E.

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

Corresponds to believing 1-1 means the range 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. 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.

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. Yes, the function is 1-1.

* This is the solution.

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

$$f(x) = \sqrt{3x + 15}$$

The solution is yes, which is option E.

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

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

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

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

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 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. Yes, the function is 1-1.

* This is the solution.

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

$$f(x) = e^{x-4} - 2$$

The solution is $f^{-1}(8) = 6.303$, which is option C.

A. $f^{-1}(8) \in [-1.77, -1.45]$

This solution corresponds to distractor 1.

B. $f^{-1}(8) \in [-0.88, -0.58]$

This solution corresponds to distractor 4.

C. $f^{-1}(8) \in [6.06, 6.45]$

This is the solution.

D. $f^{-1}(8) \in [0.26, 0.51]$

This solution corresponds to distractor 3.

E. $f^{-1}(8) \in [-0.52, -0.02]$

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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5. Multiply the following functions, then choose the domain of the resulting function from the list below.

$$f(x) = 9x \text{ and } g(x) = \sqrt{-3x - 4}$$

The solution is The domain is all Real numbers less than or equal to$x = -1.3333333333333333$., which is option A.

A. The domain is all Real numbers less than or equal to $x = a,$ where $a \in [-2.33, 0.67]$

B. The domain is all Real numbers except $x = a,$ where $a \in [4.33, 7.33]$

C. The domain is all Real numbers greater than or equal to $x = a,$ where $a \in [-9.67, -4.67]$

D. The domain is all Real numbers except $x = a$ and $x = b,$ where $a \in [-5.8, -3.8]$ and $b \in [-11.8, -2.8]$

E. The domain is all Real numbers.

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

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6. Find the inverse of the function below (if it exists). Then, evaluate the inverse at $x = 12$ and choose the interval that $f^{-1}(12)$ belongs to.

$$f(x) = 5x^2 - 4$$

The solution is The function is not invertible for all Real numbers. , which is option E.

A. $f^{-1}(12) \in [4.1, 5.34]$

Distractor 4: This corresponds to both distractors 2 and 3.

B. $f^{-1}(12) \in [3.09, 3.9]$

Distractor 3: This corresponds to finding the (nonexistent) inverse and dividing by a negative.

C. $f^{-1}(12) \in [1.02, 1.28]$

Distractor 2: This corresponds to finding the (nonexistent) inverse and not subtracting by the vertical shift.

D. $f^{-1}(12) \in [1.55, 2.02]$

Distractor 1: This corresponds to trying to find the inverse even though the function is not 1-1.

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

* This is the correct option.

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

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

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

The solution is -2.0, which is option B.

A. $(f \circ g)(-1) \in [3.4, 6.7]$

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

B. $(f \circ g)(-1) \in [-2.9, -1.2]$

* This is the correct solution

C. $(f \circ g)(-1) \in [7.4, 8.1]$

Distractor 1: Corresponds to reversing the composition.

D. $(f \circ g)(-1) \in [-1.7, 2.1]$

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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8. Multiply the following functions, then choose the domain of the resulting function from the list below.

$$f(x) = 7x^4 + 7x^3 + 4x^2 + 2x + 9 \text{ and } g(x) = \sqrt{3x + 20}$$

The solution is The domain is all Real numbers greater than or equal to$x = -6.666666666666667.$, which is option A.

A. The domain is all Real numbers greater than or equal to $x = a,$ where $a \in [-13.67, -3.67]$

B. The domain is all Real numbers except $x = a,$ where $a \in [7.25, 9.25]$

C. The domain is all Real numbers less than or equal to $x = a,$ where $a \in [-5.67, -1.67]$

D. The domain is all Real numbers except $x = a$ and $x = b,$ where $a \in [-11.2, 0.8]$ and $b \in [-10.6, -0.6]$

E. The domain is all Real numbers.

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

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

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

The solution is -3.0, which is option D.

A. $(f \circ g)(-1) \in [-0.2, 4.5]$

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

B. $(f \circ g)(-1) \in [-6.2, -5.4]$

Distractor 1: Corresponds to reversing the composition.

C. $(f \circ g)(-1) \in [-15, -10.3]$

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

D. $(f \circ g)(-1) \in [-3.2, -1.6]$

* This is the correct 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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10. Find the inverse of the function below. Then, evaluate the inverse at $x = 9$ and choose the interval that $f^{-1}(9)$ belongs to.

$$f(x) = e^{x+5} - 4$$

The solution is $f^{-1}(9) = -2.435$, which is option D.

A. $f^{-1}(9) \in [-1.45, -1.25]$

This solution corresponds to distractor 4.

B. $f^{-1}(9) \in [-2.74, -2.58]$

This solution corresponds to distractor 3.

C. $f^{-1}(9) \in [7.52, 7.58]$

This solution corresponds to distractor 1.

D. $f^{-1}(9) \in [-2.48, -2.4]$

This is the solution.

E. $f^{-1}(9) \in [-2.4, -2.25]$

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 $e^y = x \leftrightarrow y = \ln(x)$.
