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 $x = -15$ and choose the interval that $f^{-1}(-15)$ belongs to.

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

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

A. $f^{-1}(-15) \in [1.71, 3.74]$

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

B. $f^{-1}(-15) \in [3.46, 5.19]$

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

C. $f^{-1}(-15) \in [6.17, 7.76]$

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

D. $f^{-1}(-15) \in [0.86, 2.11]$

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

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

The solution is The domain is all Real numbers less than or equal to$x = 2.0$., which is option B.

A. The domain is all Real numbers except $x = a,$ where $a \in [-6.33, -3.33]$

B. The domain is all Real numbers less than or equal to $x = a,$ where $a \in [1, 6]$

C. The domain is all Real numbers greater than or equal to $x = a,$ where $a \in [-8, -4]$

D. The domain is all Real numbers except $x = a$ and $x = b,$ where $a \in [-7.33, -3.33]$ and $b \in [4.33, 7.33]$

E. The domain is all Real numbers.

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

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

$$f(x) = (5x + 23)^3$$

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 the range of the function is not $(-\infty, \infty)$.

Corresponds to believing 1-1 means the range 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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4. Find the inverse of the function below. Then, evaluate the inverse at $x = 6$ and choose the interval that $f^{-1}(6)$ belongs to.

$$f(x) = \ln(x + 4) + 4$$

The solution is $f^{-1}(6) = 3.389$, which is option E.

A. $f^{-1}(6) \in [22027.47, 22031.47]$

This solution corresponds to distractor 4.

B. $f^{-1}(6) \in [7.39, 16.39]$

This solution corresponds to distractor 2.

C. $f^{-1}(6) \in [7.39, 16.39]$

This solution corresponds to distractor 3.

D. $f^{-1}(6) \in [22019.47, 22024.47]$

This solution corresponds to distractor 1.

E. $f^{-1}(6) \in [-0.61, 6.39]$

This is the solution.

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. 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 $f^{-1}(9) = -3.391$, which is option C.

A. $f^{-1}(9) \in [6.61, 6.65]$

This solution corresponds to distractor 4.

B. $f^{-1}(9) \in [6.57, 6.63]$

This solution corresponds to distractor 1.

C. $f^{-1}(9) \in [-3.4, -3.38]$

This is the solution.

D. $f^{-1}(9) \in [5.37, 5.4]$

This solution corresponds to distractor 3.

E. $f^{-1}(9) \in [6.55, 6.57]$

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

$$f(x) = 9x^2 - 120x + 400$$

The solution is no, which is option D.

A. Yes, the function is 1-1.

Corresponds to believing the function passes the Horizontal Line test.

B. 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.

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

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

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

* This is the solution.

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

$$f(x) = 7x \text{ and } g(x) = \sqrt{5x - 32}$$

The solution is The domain is all Real numbers greater than or equal to$x = 6.4$., which is option C.

A. The domain is all Real numbers except $x = a$, where $a \in [-7.67, -1.67]$

B. The domain is all Real numbers less than or equal to $x = a$, where $a \in [-7.17, -2.17]$

C. The domain is all Real numbers greater than or equal to $x = a$, where $a \in [3.4, 9.4]$

D. The domain is all Real numbers except $x = a$ and $x = b$, where $a \in [-5.67, -0.67]$ and $b \in [-14.33, -0.33]$

E. The domain is all Real numbers.

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

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

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

The solution is -72.0, which is option B.

A. $(f \circ g)(1) \in [-2, 2]$

Distractor 1: Corresponds to reversing the composition.

B. $(f \circ g)(1) \in [-74, -69]$

* This is the correct solution

C. $(f \circ g)(1) \in [6, 12]$

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

D. $(f \circ g)(1) \in [-87, -74]$

Distractor 2: 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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9. Choose the interval below that f composed with g at $x = 1$ is in.

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

The solution is -17.0, which is option D.

A. $(f \circ g)(1) \in [-26, -19]$

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

B. $(f \circ g)(1) \in [-5, -2]$

Distractor 1: Corresponds to reversing the composition.

C. $(f \circ g)(1) \in [2, 6]$

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

D. $(f \circ g)(1) \in [-19, -11]$

* 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 (if it exists). Then, evaluate the inverse at $x = -15$ and choose the interval that $f^{-1}(-15)$ belongs to.

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

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

A. $f^{-1}(-15) \in [1.78, 2.12]$

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

B. $f^{-1}(-15) \in [5.99, 6.23]$

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

C. $f^{-1}(-15) \in [3.05, 3.15]$

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

D. $f^{-1}(-15) \in [2.25, 2.46]$

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!
