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 $x = -2$ is in.

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

The solution is 18.0, which is option A.

A. $(f \circ g)(-2) \in [13, 21]$

* This is the correct solution

B. $(f \circ g)(-2) \in [9, 17]$

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

C. $(f \circ g)(-2) \in [1, 3]$

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

D. $(f \circ g)(-2) \in [-3, -1]$

Distractor 1: Corresponds to reversing the composition.

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. Determine whether the function below is 1-1.

$$f(x) = -9x^2 - 75x - 136$$

The solution is no, which is option E.

A. Yes, the function is 1-1.

Corresponds to believing the function passes the Horizontal Line test.

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 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 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 a y-value that goes to 2 different x-values.

* 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.

$$f(x) = 16x^2 + 112x + 196$$

The solution is no, which is option C.

A. Yes, the function is 1-1.

Corresponds to believing the function passes the Horizontal Line test.

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 there is a y-value that goes to 2 different x-values.

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

$$f(x) = \frac{2}{6x + 31} \text{ and } g(x) = \frac{5}{5x + 24}$$

The solution is The domain is all Real numbers except $x = -5.166666666666667$ and $x = -4.8$, which is option D.

A. The domain is all Real numbers greater than or equal to $x = a$, where $a \in [5, 9]$

B. The domain is all Real numbers except $x = a$, where $a \in [-7.75, 1.25]$

C. The domain is all Real numbers less than or equal to $x = a$, where $a \in [-6.67, -2.67]$

D. The domain is all Real numbers except $x = a$ and $x = b$, where $a \in [-11.17, -3.17]$ and $b \in [-6.8, -2.8]$

E. The domain is all Real numbers.

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

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

$$f(x) = e^{x+3} + 5$$

The solution is $f^{-1}(8) = -1.901$, which is option A.

A. $f^{-1}(8) \in [-2.04, -1.82]$

This is the solution.

B. $f^{-1}(8) \in [7.42, 7.68]$

This solution corresponds to distractor 2.

C. $f^{-1}(8) \in [7.24, 7.41]$

This solution corresponds to distractor 4.

D. $f^{-1}(8) \in [3.93, 4.35]$

This solution corresponds to distractor 1.

E. $f^{-1}(8) \in [6.48, 6.61]$

This solution corresponds to distractor 3.

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

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

The solution is 0.0, which is option A.

A. $(f \circ g)(-1) \in [-4, 1]$

* This is the correct solution

B. $(f \circ g)(-1) \in [4, 12]$

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

C. $(f \circ g)(-1) \in [-10, -2]$

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

D. $(f \circ g)(-1) \in [-4, 1]$

Distractor 1: Corresponds to reversing the composition.

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

$$f(x) = \ln(x - 2) + 4$$

The solution is $f^{-1}(6) = 9.389$, which is option B.

A. $f^{-1}(6) \in [22027.47, 22032.47]$

This solution corresponds to distractor 1.

B. $f^{-1}(6) \in [8.39, 13.39]$

This is the solution.

C. $f^{-1}(6) \in [2982.96, 2986.96]$

This solution corresponds to distractor 2.

D. $f^{-1}(6) \in [53.6, 59.6]$

This solution corresponds to distractor 4.

E. $f^{-1}(6) \in [-1.61, 8.39]$

This solution corresponds to distractor 3.

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 $x = 14$ and choose the interval that $f^{-1}(14)$ belongs to.

$$f(x) = 5x^2 + 3$$

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

A. $f^{-1}(14) \in [1.82, 1.88]$

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

B. $f^{-1}(14) \in [7.27, 7.53]$

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

C. $f^{-1}(14) \in [4.19, 4.63]$

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

D. $f^{-1}(14) \in [1.11, 1.71]$

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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9. 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.

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

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

A. $f^{-1}(-15) \in [6.54, 7.25]$

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

B. $f^{-1}(-15) \in [4.53, 5.15]$

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

C. $f^{-1}(-15) \in [1.27, 1.96]$

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

D. $f^{-1}(-15) \in [1.81, 2.37]$

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

$$f(x) = 8x^2 + 6x + 5 \text{ and } g(x) = 9x^3 + 6x^2 + 4x + 4$$

The solution is $(-\infty, \infty)$, which is option E.

A. The domain is all Real numbers less than or equal to $x = a,$ where $a \in [-2.6, 0.4]$

B. The domain is all Real numbers except $x = a,$ where $a \in [-9.2, -0.2]$

C. The domain is all Real numbers greater than or equal to $x = a,$ where $a \in [-0.5, 6.5]$

D. The domain is all Real numbers except $x = a$ and $x = b,$ where $a \in [-6.6, -0.6]$ and $b \in [-8.2, -5.2]$

E. The domain is all Real numbers.

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