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.

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

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

A. $f^{-1}(-12) \in [2.15, 3.38]$

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

B. $f^{-1}(-12) \in [1.31, 1.64]$

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

C. $f^{-1}(-12) \in [5.6, 7.09]$

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

D. $f^{-1}(-12) \in [1.78, 2.28]$

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

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

The solution is 2.0, which is option A.

A. $(f \circ g)(-1) \in [0, 4]$

* This is the correct solution

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

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

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

Distractor 1: Corresponds to reversing the composition.

D. $(f \circ g)(-1) \in [-13, -9]$

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!

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

$$f(x) = e^{x+3} + 2$$

The solution is $f^{-1}(8) = -1.208$, which is option E.

A. $f^{-1}(8) \in [4.35, 4.46]$

This solution corresponds to distractor 4.

B. $f^{-1}(8) \in [4.53, 4.96]$

This solution corresponds to distractor 1.

C. $f^{-1}(8) \in [3.57, 3.73]$

This solution corresponds to distractor 3.

D. $f^{-1}(8) \in [4.25, 4.31]$

This solution corresponds to distractor 2.

E. $f^{-1}(8) \in [-1.3, -1.13]$

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

$$f(x) = \sqrt{4x - 16}$$

The solution is yes, which is option B.

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. Yes, the function is 1-1.

* This is the solution.

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

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

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

$$f(x) = -12x^2 + 11x + 56$$

The solution is no, which is option D.

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 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. Yes, the function is 1-1.

Corresponds to believing the function passes the Horizontal Line test.

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

* This is the solution.

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

Corresponds to believing 1-1 means the domain 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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6. Choose the interval below that f composed with g at $x = -1$ is in.

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

The solution is 22.0, which is option B.

A. $(f \circ g)(-1) \in [31, 36]$

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

B. $(f \circ g)(-1) \in [21, 27]$

* This is the correct solution

C. $(f \circ g)(-1) \in [-8, -1]$

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

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

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

$$f(x) = \sqrt[3]{5x - 4}$$

The solution is -674.2, which is option A.

A. $f^{-1}(-15) \in [-674.97, -673.41]$

* This is the correct solution.

B. $f^{-1}(-15) \in [673.81, 675.29]$

This solution corresponds to distractor 2.

C. $f^{-1}(-15) \in [-677.11, -675.68]$

Distractor 1: This corresponds to

D. $f^{-1}(-15) \in [675.31, 676.63]$

This solution corresponds to distractor 3.

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

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

The solution is $f^{-1}(9) = 1100.633$, which is option C.

A. $f^{-1}(9) \in [59875.14, 59882.14]$

This solution corresponds to distractor 1.

B. $f^{-1}(9) \in [442414.39, 442417.39]$

This solution corresponds to distractor 2.

C. $f^{-1}(9) \in [1096.63, 1103.63]$

This is the solution.

D. $f^{-1}(9) \in [144.41, 155.41]$

This solution corresponds to distractor 4.

E. $f^{-1}(9) \in [1087.63, 1093.63]$

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

$$f(x) = 9x^3 + x^2 + 5x + 7 \text{ and } g(x) = \sqrt{6x + 36}$$

The solution is The domain is all Real numbers greater than or equal to$x = -6.0.$, which is option C.

A. The domain is all Real numbers less than or equal to $x = a,$ where $a \in [1, 4]$

B. The domain is all Real numbers except $x = a,$ where $a \in [1.8, 7.8]$

C. The domain is all Real numbers greater than or equal to $x = a,$ where $a \in [-6, -4]$

D. The domain is all Real numbers except $x = a$ and $x = b,$ where $a \in [-0.4, 6.6]$ and $b \in [4.33, 9.33]$

E. The domain is all Real numbers.

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

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

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

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

A. The domain is all Real numbers except $x = a,$ where $a \in [1.33, 6.33]$

B. The domain is all Real numbers less than or equal to $x = a,$ where $a \in [-7.2, -3.2]$

C. The domain is all Real numbers greater than or equal to $x = a,$ where $a \in [7.33, 9.33]$

D. The domain is all Real numbers except $x = a$ and $x = b,$ where $a \in [-6.25, 5.75]$ and $b \in [-11.8, -1.8]$

E. The domain is all Real numbers.

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