This is the Answer Key for Module 5 Version A.

21. What is the domain of the function below?

$$f(x) = \sqrt[7]{6x - 7}$$

The solution is $(-\infty, \infty)$

A. $(-\infty, \infty)$

   * This is the correct option.

B. The domain is $(-\infty, a]$, where $a \in [0.75, 1.08]$

   This distractor corresponds to the radical having an even power AND reversing the direction of the domain AND the pivot 0.857000.

C. The domain is $[a, \infty)$, where $a \in [0.38, 0.97]$

   This distractor corresponds to the radical having an even power AND the pivot 0.857000.

D. The domain is $[a, \infty)$, where $a \in [1.09, 1.27]$

   This distractor corresponds to the radical having an even power.

E. The domain is $(-\infty, a]$, where $a \in [1.12, 1.25]$

   This distractor corresponds to radical having an even power AND reversing the direction of the domain.

Remember that we cannot take the even root of a negative number - this is why the domain is only sometimes restricted! If we have an even root, we solve $6x - 7 \geq 0$. Since this is an inequality, remember to flip the inequality if we divide by a negative number.

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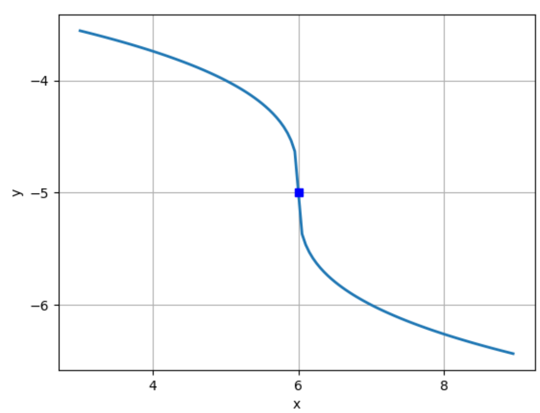
22. Choose the equation of the function graphed below.

Graph of the function $f(x) = -\sqrt[3]{x - 6} - 5$



The solution is $-\sqrt[3]{x - 6} - 5$

A. $-\sqrt[3]{x - 6} - 5$

   This is the correct option.

B. $\sqrt[3]{x - 6} - 5$

   Corresponds to switching the coefficient and having the correct vertex.

C. $\sqrt[3]{x + 6} - 5$

   Corresponds to switching the coefficient AND switching the x-value of the vertex.

D. $-\sqrt[3]{x+6}-5$

Corresponds to the correct coefficient and switching the x-value of the vertex.

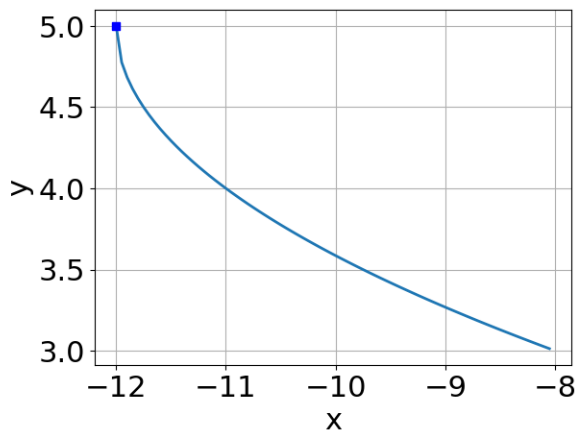
General Comments: Remember that the general form of a radical equation is $f(x)=a\sqrt[b]{x-h}+k$, where a is the leading coefficient (and in this case, we assume is either 1 or -1), b is the root degree (in this case, either 2 or 3), and (h,k) is the vertex.

---

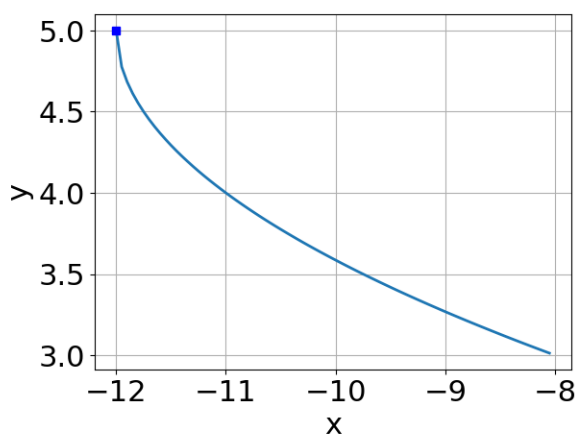
23. Choose the graph of the equation below.

$$-\sqrt{x+12}+5$$

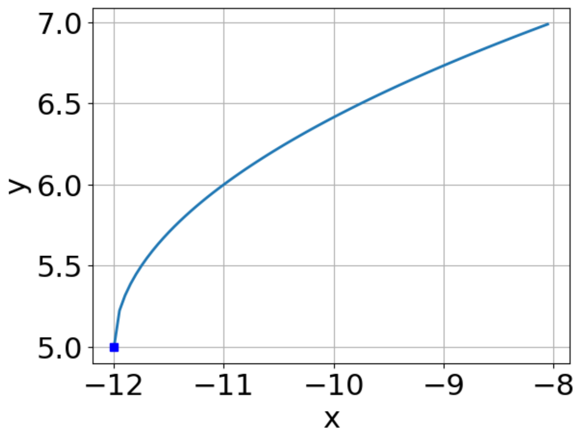
The solution is



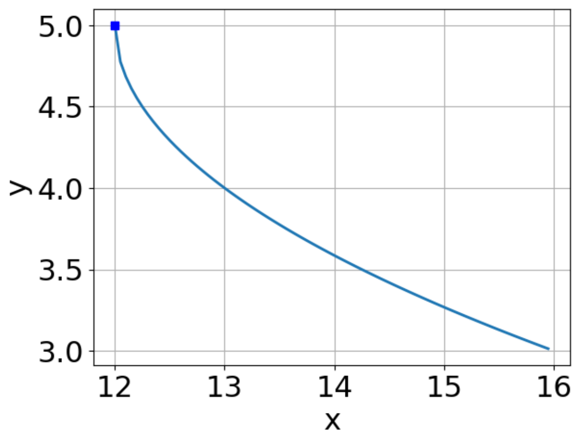
A. This is the correct option.



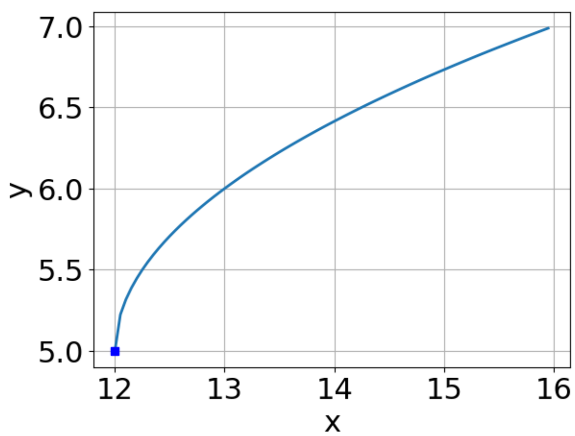
B. Corresponds to switching the coefficient and having the correct vertex.



C. Corresponds to the correct coefficient and switching the x-value of the vertex.



D. Corresponds to switching the coefficient AND switching the x-value of the vertex.



General Comments: Remember that the general form of a radical equation is $f(x) = a\sqrt[b]{x-h}+k$, where a is the leading coefficient (and in this case, we assume is either 1 or -1), b is the root degree (in this case, either 2 or 3), and (h, k) is the vertex.

24. Solve the radical equation below. Then, choose the interval(s) that the solution(s) belongs to.

$$\sqrt{-9x-6} - \sqrt{3x-7} = 0$$

The solution is All solutions lead to invalid or complex values in the equation.

A. All solutions lead to invalid or complex values in the equation.

   * This is the correct option.

B. $x \in [0.05, 0.28]$

C. $x_1 \in [0.05, 0.28]$ and $x_2 \in [-1, 7]$

D. $x \in [-0.45, 0.05]$

E. $x_1 \in [0.05, 0.28]$ and $x_2 \in [10, 15]$

General Comments: Remember that the general form of a radical equation is $f(x) = a\sqrt[b]{x-h} + k$, where a is the leading coefficient (and in this case, we assume is either 1 or -1), b is the root degree (in this case, either 2 or 3), and (h, k) is the vertex.

---

25. Solve the radical equation below. Then, choose the interval(s) that the solution(s) belongs to.

$$\sqrt{-9x^2+16} - \sqrt{18x} = 0$$

The solution is that there are 2 many solutions and they are $[-8/3, 2/3]$

A. $x \in [0.1, 1.4]$

B. $x \in [-3.3, -0.8]$

C. $x_1 \in [-3.3, -0.8]$ and $x_2 \in [-4, 2]$

   * This is the correct option.

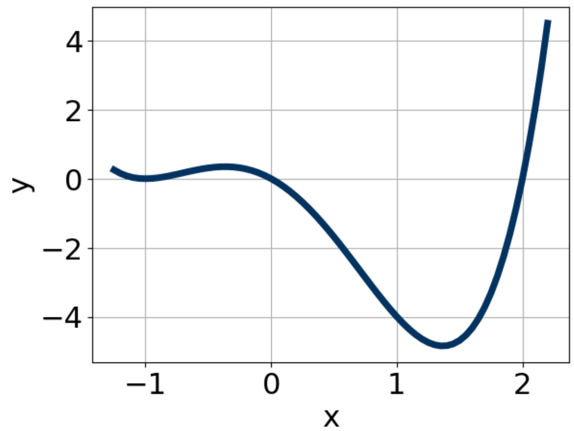
D. All solutions lead to invalid or complex values in the equation.

E. $x_1 \in [1.1, 3]$ and $x_2 \in [-4, 2]$

General Comments: Remember that the general form of a radical equation is $f(x) = a\sqrt[b]{x-h} + k$, where a is the leading coefficient (and in this case, we assume is either 1 or -1), b is the root degree (in this case, either 2 or 3), and (h, k) is the vertex.

This is the Answer Key for Module 6 Version A.

26. Which of the following equations *could* be of the graph presented below?



The solution is $(x+1)^2(x-2)x$

A. $(x+1)^2(x-2)x$

B. $-(x+1)^2(x-2)x^2$

C. $-(x+1)^2(x-2)x$

D. $(x+1)^2(x-2)^2x$

E. $(x+1)(x-2)^2x$

General Comments: Draw the x-axis to determine which zeros are touching (and so have even multiplicity) or cross (and have odd multiplicity)

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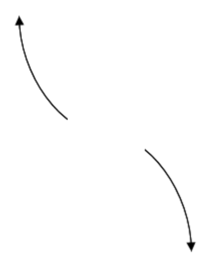
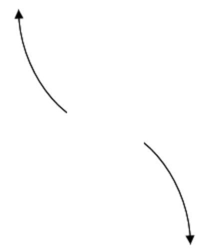
27. Choose the end behavior of the polynomial below.

$$f(x) = -9(x-6)^4(x+6)^9(x+5)^5(x-5)^7$$

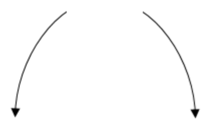
The solution is



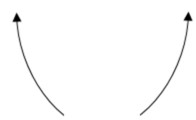
A. Negative leading coefficient, sum of degrees is odd.



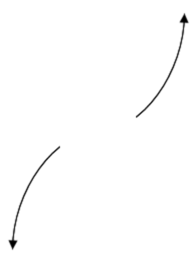
B. Negative leading coefficient, sum of degrees is even.



C. Positive leading coefficient, sum of degrees is even.



D. Positive leading coefficient, sum of degrees is odd.



General Comments: Remember that end behavior is determined by the leading coefficient AND the sum of the multiplicities.

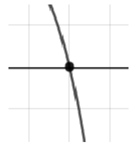
---

28. Describe the zero behavior of the zero 6 of the polynomial below.

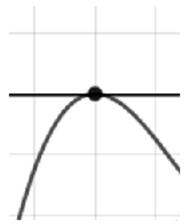
$$f(x) = -9(x-6)^4(x+6)^9(x+5)^5(x-5)^7$$

The solution is

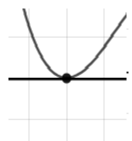
A. The function is above the x-axis, then passes through.



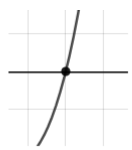
B. The function is below the x-axis, then touches.



C. The function is above the x-axis, then touches.



D. The function is below the x-axis, then passes through.



General Comments: You will need to sketch the entire graph, then zoom in on the zero the question asks about.

---

29. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $ax^3 + bx^2 + cx + d$.

$$\frac{6}{5}, \frac{-7}{3}, \text{ and } -5$$

The solution is $15x^3 + 92x^2 + 43x - 210$

A. $a \in [9, 17], b \in [81, 95], c \in [39, 48], \text{ and } d \in [207, 216]$

Distractor 2: This corresponds to having everything correct except the sign of the last term.

B. $a \in [9, 17], b \in [81, 95], c \in [39, 48], \text{ and } d \in [-214, -206]$

* This is the correct solution

C. $a \in [9, 17], b \in [-94, -86], c \in [39, 48], \text{ and } d \in [207, 216]$

Distractor 1: This corresponds to multiplying $(x + z_1)(x + z_2)(x + z_3)$

D. $a \in [9, 17], b \in [120, 135], c \in [300, 311], \text{ and } d \in [207, 216]$

Distractor 3: This corresponds to using $(x + z_1)$ for the first term.

E. $a \in [9, 17], b \in [52, 62], c \in [-134, -124], \text{ and } d \in [-214, -206]$

Distractor 4: This corresponds to using $(x + z_1)(x + z_2)$ for the first two terms.

General Comments: To construct the lowest-degree polynomial, you want to multiply out $(5x - 6)(3x - -7)(1x - -5)$

---

30. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $x^3 + bx^2 + cx + d$.

$$3i \text{ and } 2$$

The solution is $x^3 - 2x^2 + 9x - 18$

A. $b \in [1.96, 3.14], c \in [-10.3, -5.2], \text{ and } d \in [13, 22]$

   Distractor 4: This distractor corresponds to negatives for each of the coefficients in the solution.

B. $b \in [-0.43, 1.18], c \in [-5.3, -3.7], \text{ and } d \in [5, 9]$

   Distractor 3: This distractor corresponds to using b from the complex and the other zero to make a quadratic.

C. $b \in [-0.43, 1.18], c \in [-3.8, 0.6], \text{ and } d \in [-5, 4]$

   Distractor 2: This distractor corresponds to using a from the complex and the other zero to make a quadratic.

D. $b \in [-2.57, -0.67], c \in [8.2, 13], \text{ and } d \in [-21, -11]$

   * This is the correct solution

E. $b \in [1.96, 3.14], c \in [8.2, 13], \text{ and } d \in [13, 22]$

   Distractor 1: This distractor corresponds to using (x+z) for zeros.

General Comments: Remember that the conjugate of $a + bi$ is $a - bi$. Since these zeros always come in pairs, we need to multiply out $(x - 3i)(x + 3i)(x - 2)$

This is the Answer Key for Module 7 Version A.

31. Determine the domain of the function below.

$$\frac{3}{18x^2 - 24x - 24}$$

The solution is All Real numbers except $x = a$ and $x = b,$ where $a \in [-4, 0]$ and $b \in [0, 4]$

A. All Real numbers except $x = a,$ where $a \in [-4, 0]$

This corresponds to removing only 1 value from the denominator.

B. All Real numbers except $x = a,$ where $a \in [-26, -22]$

This corresponds to removing a distractor value from the denominator.

C. All Real numbers except $x = a$ and $x = b,$ where $a \in [-26, -22]$ and $b \in [17, 20]$

This corresponds to not factoring the denominator correctly.

D. All Real numbers.

This corresponds to thinking the denominator has complex roots or that rational functions have a domain of all Real numbers.

E. All Real numbers except $x = a$ and $x = b,$ where $a \in [-4, 0]$ and $b \in [0, 4]$

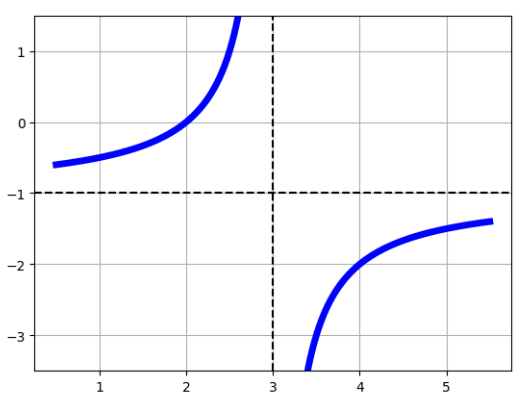
This is the correct option!

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

---

32. Choose the equation of the function graphed below.

Graph of the function $f(x) = \dfrac{-1}{x-3} - 1$



The solution is $\dfrac{-1}{x-3} - 1$

A. $\dfrac{-1}{x-3} - 1$

This is the correct option.

B. $\dfrac{1}{x+3} - 1$

Corresponds to using the general form $f(x) = \dfrac{a}{x+h} + k$ and the opposite leading coefficient.

C. $\frac{1}{(x+3)^2} - 1$

Corresponds to thinking the graph was a shifted version of $\frac{1}{x^2}$, using the general form $f(x) = \frac{a}{x+h} + k$, and the opposite leading coefficient.

D. $\frac{-1}{(x-3)^2} - 1$

Corresponds to thinking the graph was a shifted version of $\frac{1}{x^2}$.

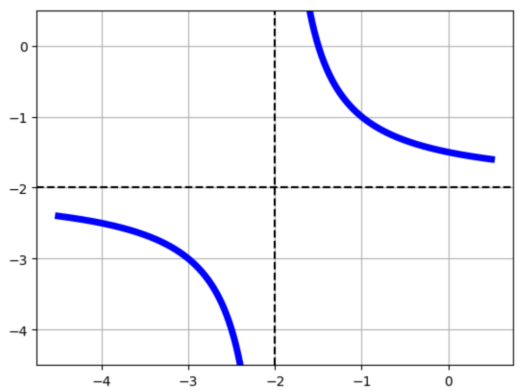
General Comments: Remember that the general form of a basic rational equation is $f(x) = \frac{a}{(x-h)^n} + k$, where a is the leading coefficient (and in this case, we assume is either 1 or -1), n is the degree (in this case, either 1 or 2), and (h, k) is the intersection of the asymptotes.

---

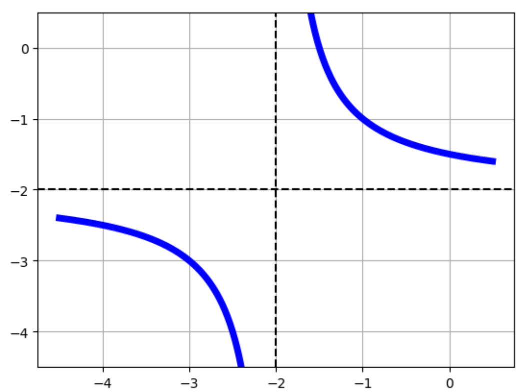
33. Choose the graph of the equation below.

$$\frac{1}{x+2} - 2$$

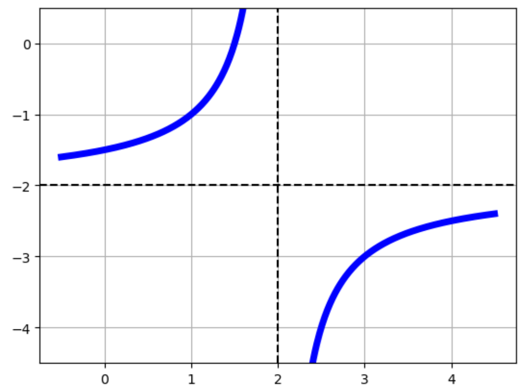
The solution is



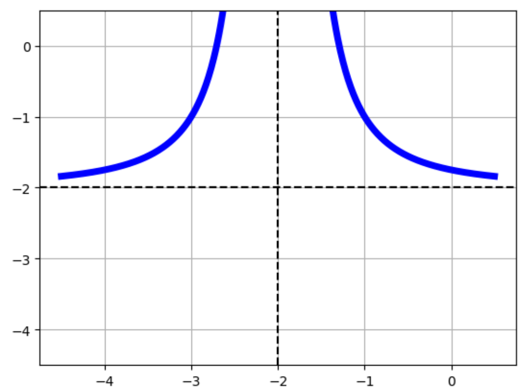
Pictures were imported out of order. This will be fixed in future keys.



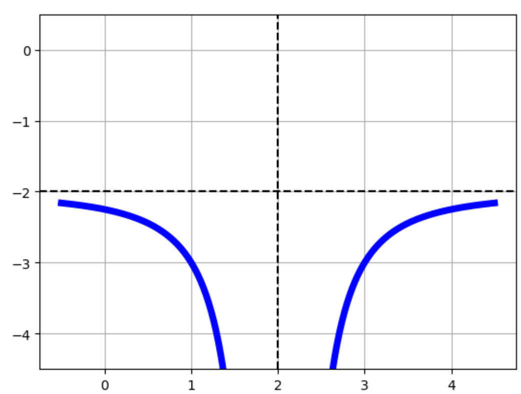
A.



B.



C.



D.

General Comments: Remember that the general form of a basic rational equation is $f(x) = \frac{a}{(x-h)^n} + k$, where a is the leading coefficient (and in this case, we assume is either 1 or -1), n is the degree (in this case, either 1 or 2), and (h, k) is the intersection of the asymptotes.

---

34. Solve the rational equation below. Then, choose the interval(s) that the solution(s) belongs to.

$$\frac{-5}{5 * x - 6} - -9 = \frac{7}{-30 * x + 36}$$

The solution is 1.28518518519

A. $x_1 \in [-1.83, -0.96]$ and $x_2 \in [-1, 3]$

B. $x_1 \in [1.36, 1.95]$ and $x_2 \in [-1, 3]$

C. All solutions lead to invalid or complex values in the equation.

D. $x \in [-1.83, -0.96]$

E. $x \in [0.88, 1.46]$

General Comments: Distractors are different based on the number of solutions. Remember that after solving, we need to make sure our solution does not make the original equation divide by zero!

---

35. Solve the rational equation below. Then, choose the interval(s) that the solution(s) belongs to.

$$7 * x/(-5 * x + 4) - 4 * x * *2/(20 * x * *2 - 6 * x - 8) = -3/(-4 * x - 2)$$

The solution is $[-29/64 + sqrt(2377)/64, -sqrt(2377)/64 - 29/64]$

A. $x \in [-1.08, -0.69]$

B. $x_1 \in [0.14, 0.37]$ and $x_2 \in [-0.3, 2.9]$

C. $x \in [-1.45, -1.17]$

D. $x_1 \in [0.14, 0.37]$ and $x_2 \in [-1.7, -0.6]$

E. All solutions lead to invalid or complex values in the equation.

General Comments: Distractors are different based on the number of solutions. Remember that after solving, we need to make sure our solution does not make the original equation divide by zero!

This is the Answer Key for Module 8 Version A.

36. Which of the following intervals describes the Domain of the function below?

$$f(x) = \log_2(x+9) + 5$$

The solution is $(-9, \infty)$

A. $(-\infty, a), a \in [8, 10.1]$

Distractor 2: This corresponds to using negative of the horizontal shift. Remember: the general for is a*log(x-h)+k.

B. $[a, \infty), a \in [-6.1, -3.2]$

Distractor 3: This corresponds to using the negative vertical shift AND including the endpoint.

C. $(a, \infty), a \in [-9.3, -8.8]$

* This is the solution.

D. $(-\infty, a], a \in [3.2, 7.1]$

Distractor 1: This corresponds to using the vertical shift when shifting the Domain AND including the endpoint.

E. $(-\infty, \infty)$

Distractor 4: This corresponds to thinking of the Range of the log function (or the domain of the exponential function).

General Comments: The domain of a basic logarithmic function is $(0, \infty)$ and the Range is $(-\infty, \infty)$. We can use shifts when finding the Domain, but the Range will always be all Real numbers.

---

37. Which of the following intervals describes the Domain of the function below?

$$f(x) = e^{x+6} - 9$$

The solution is $(-\infty, \infty)$

A. $(a, \infty), a \in [8, 15]$

Distractor 2: This corresponds to using the negative vertical shift AND flipping the Range interval.

B. $(-\infty, a), a \in [-12, -8]$

Distractor 3: This corresponds to using the correct vertical shift *if we wanted the Range* AND including the endpoint.

C. $(-\infty, a], a \in [-12, -8]$

Distractor 4: This corresponds to using the correct vertical shift *if we wanted the Range*.

D. $[a, \infty), a \in [8, 15]$

Distractor 1: This corresponds to using the negative vertical shift AND flipping the Range interval AND including the endpoint.

E. $(-\infty, \infty)$

* This is the solution.

General Comments: Domain of a basic exponential function is $(-\infty, \infty)$ while the Range is $(0, \infty)$. We can shift these intervals [and even flip when $a < 0$!] to find the new Domain/Range.

---

38. Solve the equation for x and choose the interval that contains the solution (if it exists).

$$\log_2(3x+8)+6=3$$

The solution is $x=-2.625$

A. $x \in [4.62, 5.96]$

Corresponds to reversing the base and exponent when converting and reversing the value with x.

B. $x \in [-0.48, 0.23]$

Corresponds to ignoring the vertical shift when converting to exponential form.

C. $x \in [0.11, 0.47]$

Corresponds to reversing the base and exponent when converting.

D. $x \in [-3.09, -2.47]$

* This is the solution!

E. There is no Real solution to the equation.

Corresponds to believing a negative coefficient within the log equation means there is no Real solution.

General Comments: First, get the equation in the form $\log_b(cx+d)=a$. Then, convert to $b^a=cx+d$ and solve.

---

39. Solve the equation for x and choose the interval that contains x (if it exists).

$$11=\ln\sqrt{\frac{20}{e^x}}$$

The solution is $x=-19.004000$

A. $x \in [13, 21]$

Distractor 1: This corresponds to getting the negative of the solution.

B. $x \in [-13, -8]$

Distractor 2: This corresponds to leaving 1/2 in front of the log.

C. $x \in [-21, -17]$

* This is the real solution

D. $x \in [5, 12]$

Distractor 3: This corresponds to leaving 1/2 in front of the log AND getting the negative of the solution.

E. There is no solution to the equation.

This corresponds to believing the exponential functional cannot be solved.

General comments: After using the properties of logarithmic functions to break up the right-hand side, use $\ln(e)=1$ to reduce the question to a linear function to solve. You can put $\ln(20)$ into a calculator if you are having trouble.

---

40. Solve the equation for x and choose the interval that contains the solution (if it exists).

$$2^{4x-5}=\left(\frac{1}{25}\right)^{2x+3}$$

The solution is $x = -0.672$

A. $x \in [-1.2, -0.4]$

   * This is the solution!

B. $x \in [-19.2, -18.4]$

   Correponds to ignoring that the bases are different.

C. $x \in [0.6, 2.9]$

   Corresponds to getting the negative of the actual solution.

D. $x \in [21, 23.5]$

   Corresponds to ignoring that the basses are different and reversing that solution.

E. There is no Real solution to the equation.

   Corresponds to believing there is no solution since the bases are not powers of each other.

General Comments: This question was written so that the bases could not be written the same. You will need to take the log of both sides.
