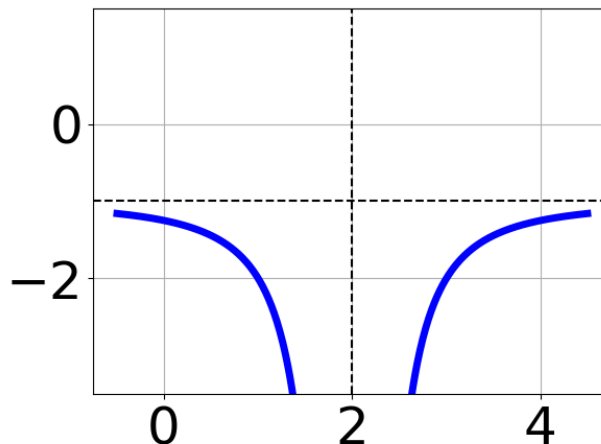


This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found [here](#).

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.*

1. Choose the equation of the function graphed below.



The solution is  $f(x) = \frac{-1}{(x-2)^2} - 1$ , which is option C.

A.  $f(x) = \frac{1}{(x+2)^2} - 1$

Corresponds to using the general form  $f(x) = \frac{a}{(x+h)^2} + k$  and the opposite leading coefficient.

B.  $f(x) = \frac{1}{x+2} - 1$

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

C.  $f(x) = \frac{-1}{(x-2)^2} - 1$

This is the correct option.

D.  $f(x) = \frac{-1}{x-2} - 1$

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

E. None of the above

This corresponds to believing the vertex of the graph was not correct.

**General Comment:** 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.

---

2. Determine the domain of the function below.

$$f(x) = \frac{6}{18x^2 - 33x + 15}$$

The solution is All Real numbers except  $x = 0.833$  and  $x = 1.000$ ., which is option B.

- A. All Real numbers except  $x = a$ , where  $a \in [8.96, 9.38]$

All Real numbers except  $x = 9.000$ , which corresponds to removing a distractor value from the denominator.

- B. All Real numbers except  $x = a$  and  $x = b$ , where  $a \in [0.55, 0.95]$  and  $b \in [0.97, 1.34]$

All Real numbers except  $x = 0.833$  and  $x = 1.000$ , which is the correct option.

- C. All Real numbers except  $x = a$ , where  $a \in [0.55, 0.95]$

All Real numbers except  $x = 0.833$ , which corresponds to removing only 1 value from the denominator.

- D. All Real numbers except  $x = a$  and  $x = b$ , where  $a \in [8.96, 9.38]$  and  $b \in [29.96, 30.21]$

All Real numbers except  $x = 9.000$  and  $x = 30.000$ , which corresponds to not factoring the denominator correctly.

- E. All Real numbers.

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

**General Comment:** Recall that dividing by zero is not a real number. Therefore the domain is all real numbers **except** those that make the denominator 0.

---

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

$$\frac{-6x}{-3x + 3} + \frac{-3x^2}{-18x^2 - 3x + 21} = \frac{-3}{6x + 7}$$

The solution is There are two solutions:  $x = 0.158$  and  $x = -1.465$ , which is option D.

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

- B.  $x \in [-1.17, -0.67]$

- C.  $x \in [-1.48, -1.27]$

- D.  $x_1 \in [0.08, 0.17]$  and  $x_2 \in [-5.1, -1.4]$

\*  $x = 0.158$  and  $x = -1.465$ , which is the correct option.

- E.  $x_1 \in [0.08, 0.17]$  and  $x_2 \in [-0.9, 3.5]$

**General Comment:** 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!

---

4. Determine the domain of the function below.

$$f(x) = \frac{3}{18x^2 + 45x + 18}$$

The solution is All Real numbers except  $x = -2.000$  and  $x = -0.500$ ., which is option D.

- A. All Real numbers except  $x = a$  and  $x = b$ , where  $a \in [-19, -14]$  and  $b \in [-19, -14]$

All Real numbers except  $x = -18.000$  and  $x = -18.000$ , which corresponds to not factoring the denominator correctly.

- B. All Real numbers except  $x = a$ , where  $a \in [-2, -1]$

All Real numbers except  $x = -2.000$ , which corresponds to removing only 1 value from the denominator.

- C. All Real numbers except  $x = a$ , where  $a \in [-19, -14]$

All Real numbers except  $x = -18.000$ , which corresponds to removing a distractor value from the denominator.

- D. All Real numbers except  $x = a$  and  $x = b$ , where  $a \in [-2, -1]$  and  $b \in [-1.5, 5.5]$

All Real numbers except  $x = -2.000$  and  $x = -0.500$ , which is the correct option.

- E. All Real numbers.

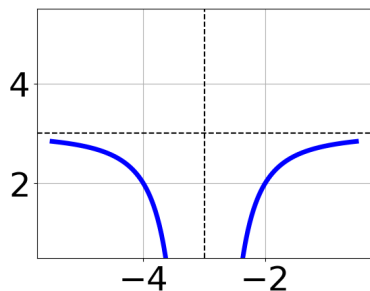
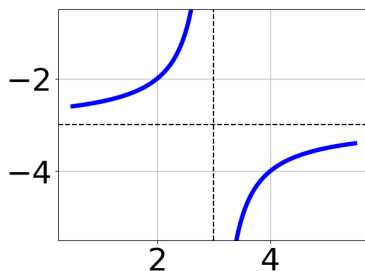
This corresponds to thinking the denominator has complex roots or that rational functions have a domain of all Real numbers.

**General Comment:** Recall that dividing by zero is not a real number. Therefore the domain is all real numbers **except** those that make the denominator 0.

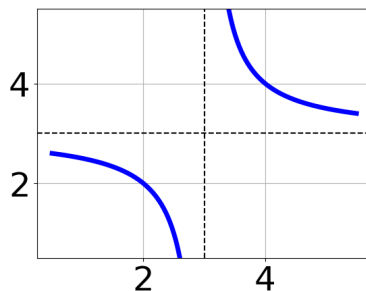
5. Choose the graph of the equation below.

$$f(x) = \frac{-1}{x-3} - 3$$

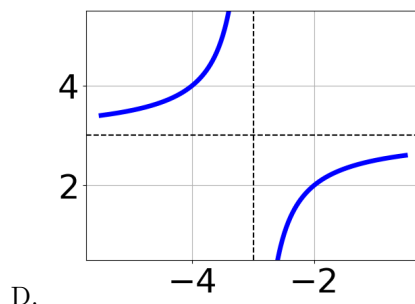
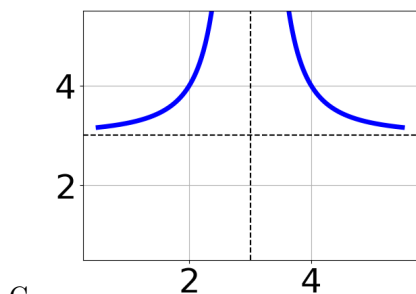
The solution is the graph below, which is option E.



A.



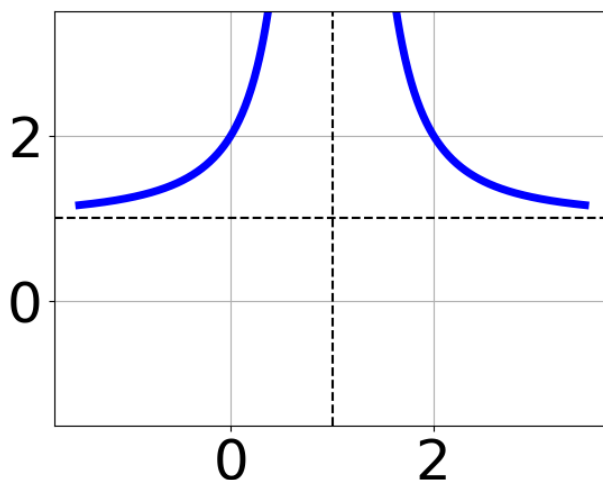
B.



E. None of the above.

**General Comment:** 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.

6. Choose the equation of the function graphed below.



The solution is None of the above as it should be  $f(x) = \frac{1}{(x-1)^2} + 1$ , which is option E.

A.  $f(x) = \frac{-1}{x-1} + 1$

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

B.  $f(x) = \frac{-1}{(x-1)^2} + 1$

Corresponds to using the general form  $f(x) = \frac{a}{(x-h)^2} + k$  and the opposite leading coefficient.

C.  $f(x) = \frac{1}{x+1} + 1$

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

D.  $f(x) = \frac{1}{(x+1)^2} + 1$

The  $x$ -value of the equation does not match the graph.

E. None of the above

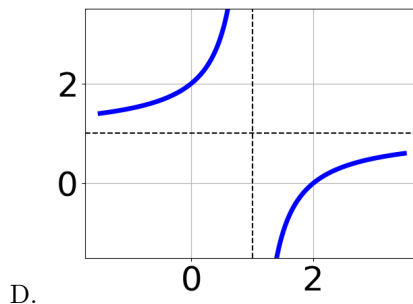
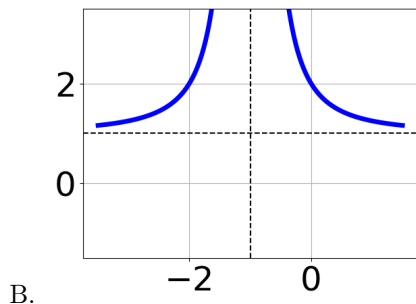
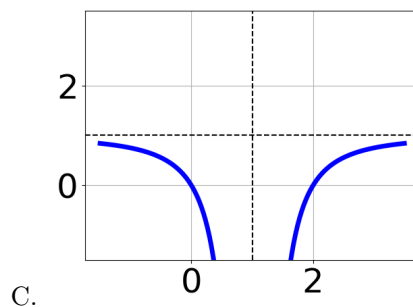
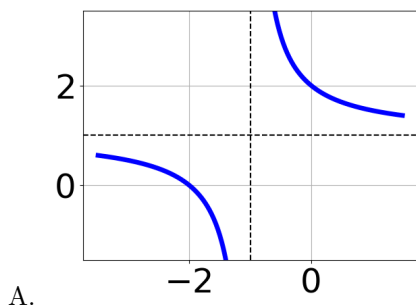
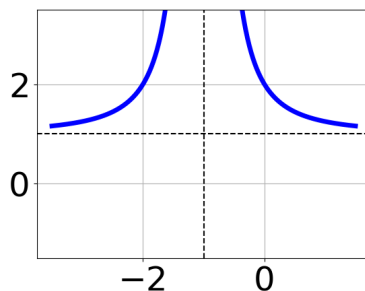
None of the equation options were the correct equation.

**General Comment:** 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.

7. Choose the graph of the equation below.

$$f(x) = \frac{1}{(x+1)^2} + 1$$

The solution is the graph below, which is option B.



E. None of the above.

**General Comment:** 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.

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

$$\frac{126}{126x + 28} + 1 = \frac{126}{126x + 28}$$

The solution is all solutions are invalid or lead to complex values in the equation., which is option D.

A.  $x \in [-0.22, 0.78]$

$x = -0.222$ , which corresponds to not checking if this value leads to dividing by 0 in the original equation and thus is not a valid solution.

B.  $x \in [0, 0.35]$

$x = 0.222$ , which corresponds to not distributing the factor  $126x + 28$  correctly when trying to eliminate the fraction.

C.  $x_1 \in [-0.43, 0.1]$  and  $x_2 \in [0.17, 0.33]$

$x = -0.222$  and  $x = 0.222$ , which corresponds to getting the correct solution and believing there should be a second solution to the equation.

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

\* $x = -0.222$  leads to dividing by 0 in the original equation and thus is not a valid solution, which is the correct option.

E.  $x_1 \in [-0.43, 0.1]$  and  $x_2 \in [-0.28, -0.06]$

$x = -0.222$  and  $x = -0.222$ , which corresponds to getting the correct solution and believing there should be a second solution to the equation.

**General Comment:** 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!

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

$$\frac{-7x}{5x - 7} + \frac{-2x^2}{-15x^2 + 56x - 49} = \frac{6}{-3x + 7}$$

The solution is There are two solutions:  $x = 0.626$  and  $x = 3.532$ , which is option A.

A.  $x_1 \in [0.28, 0.85]$  and  $x_2 \in [1.53, 5.53]$

\*  $x = 0.626$  and  $x = 3.532$ , which is the correct option.

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

C.  $x_1 \in [0.28, 0.85]$  and  $x_2 \in [-0.6, 2.4]$

D.  $x \in [2.72, 4.2]$

E.  $x \in [1.99, 3.46]$

**General Comment:** 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!

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

$$\frac{-7}{5x - 4} + 7 = \frac{6}{-10x + 8}$$

The solution is  $x = 0.914$ , which is option D.

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

This corresponds to thinking  $x = 0.914$  leads to dividing by zero in the original equation, which it does not.

- B.  $x_1 \in [0.91, 4.91]$  and  $x_2 \in [0.92, 1.53]$

$x = 0.914$  and  $x = 1.171$ , which corresponds to getting the correct solution and believing there should be a second solution to the equation.

- C.  $x_1 \in [-2.69, 0.31]$  and  $x_2 \in [0.8, 1.16]$

$x = -0.686$  and  $x = 0.914$ , which corresponds to getting the correct solution and believing there should be a second solution to the equation.

- D.  $x \in [0.91, 1.91]$

\*  $x = 0.914$ , which is the correct option.

- E.  $x \in [-2.69, 0.31]$

$x = -0.686$ , which corresponds to not distributing the factor  $5x - 4$  correctly when trying to eliminate the fraction.

**General Comment:** 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!

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