

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. Determine the domain of the function below.

$$f(x) = \frac{4}{25x^2 - 36}$$

The solution is All Real numbers except  $x = -1.200$  and  $x = 1.200$ ., which is option C.

- A. All Real numbers.

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

- B. All Real numbers except  $x = a$  and  $x = b$ , where  $a \in [-30, -29]$  and  $b \in [28, 31]$

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

- C. All Real numbers except  $x = a$  and  $x = b$ , where  $a \in [-2.2, -0.2]$  and  $b \in [0.2, 3.2]$

All Real numbers except  $x = -1.200$  and  $x = 1.200$ , which is the correct option.

- D. All Real numbers except  $x = a$ , where  $a \in [-2.2, -0.2]$

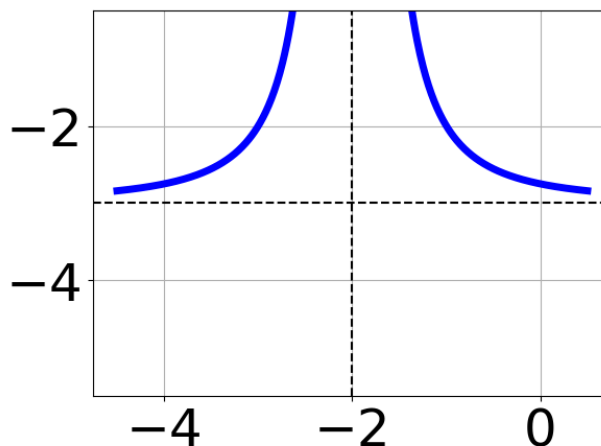
All Real numbers except  $x = -1.200$ , which corresponds to removing only 1 value from the denominator.

- E. All Real numbers except  $x = a$ , where  $a \in [-30, -29]$

All Real numbers except  $x = -30.000$ , which corresponds to removing a distractor value from the denominator.

**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.

2. Choose the equation of the function graphed below.



The solution is None of the above as it should be  $f(x) = \frac{1}{(x+2)^2} - 3$ , which is option E.

A.  $f(x) = \frac{-1}{x+2} - 3$

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

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

C.  $f(x) = \frac{1}{x-2} - 3$

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

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

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.

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

$$\frac{-4x}{-6x+5} + \frac{-6x^2}{-30x^2+x+20} = \frac{-2}{5x+4}$$

The solution is There are two solutions:  $x = 0.283$  and  $x = -1.360$ , which is option D.

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

B.  $x \in [-1.41, -1.22]$

C.  $x_1 \in [0.19, 0.87]$  and  $x_2 \in [-0.9, 1.7]$

D.  $x_1 \in [0.19, 0.87]$  and  $x_2 \in [-4.7, -0.5]$

\*  $x = 0.283$  and  $x = -1.360$ , which is the correct option.

E.  $x \in [-0.9, -0.56]$

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

$$\frac{40}{20x - 35} + 1 = \frac{40}{20x - 35}$$

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

A.  $x \in [0.75, 4.75]$

$x = 1.750$ , 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.  $x_1 \in [0.75, 2.75]$  and  $x_2 \in [0.75, 4.75]$

$x = 1.750$  and  $x = 1.750$ , which corresponds to getting the correct solution and believing there should be a second solution to the equation.

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

\* $x = 1.750$  leads to dividing by 0 in the original equation and thus is not a valid solution, which is the correct option.

D.  $x \in [-1.75, -0.75]$

$x = -1.750$ , which corresponds to not distributing the factor  $20x - 35$  correctly when trying to eliminate the fraction.

E.  $x_1 \in [-1.75, -0.75]$  and  $x_2 \in [0.75, 4.75]$

$x = -1.750$  and  $x = 1.750$ , which corresponds to getting the correct solution and believing there should be a second solution to the equation.

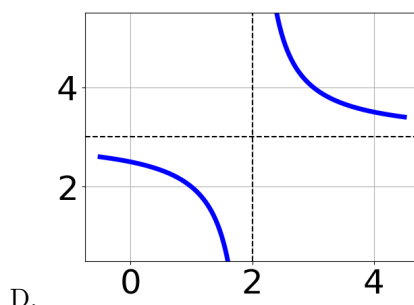
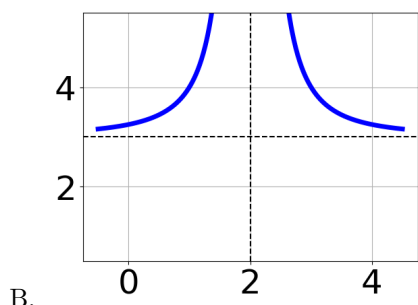
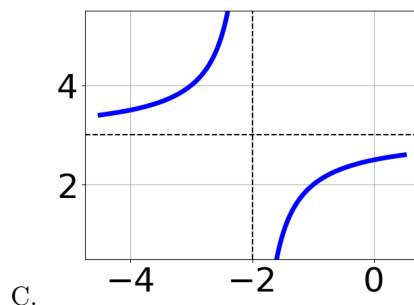
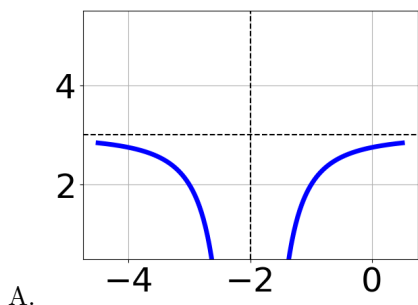
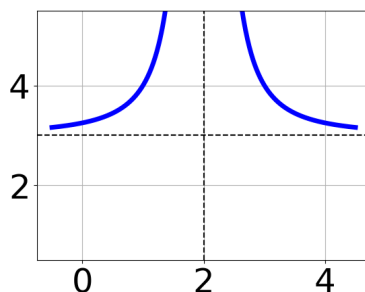
**General Comment:** Distractors are different based on the number of solutions. Remember that after solving, we need to make sure our solution does not make the original equation divide by zero!

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5. Choose the graph of the equation below.

$$f(x) = \frac{1}{(x - 2)^2} + 3$$

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.

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

$$\frac{-7}{5x-9} + -6 = \frac{-2}{-30x+54}$$

The solution is  $x = 1.556$ , which is option D.

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

This corresponds to thinking  $x = 1.556$  leads to dividing by zero in the original equation, which it does not.

B.  $x_1 \in [-3.04, 0.96]$  and  $x_2 \in [1.47, 1.59]$

$x = -2.044$  and  $x = 1.556$ , which corresponds to getting the correct solution and believing there should be a second solution to the equation.

C.  $x \in [-3.04, 0.96]$

$x = -2.044$ , which corresponds to not distributing the factor  $5x - 9$  correctly when trying to eliminate the fraction.

D.  $x \in [0.56, 3.56]$

\*  $x = 1.556$ , which is the correct option.

E.  $x_1 \in [0.56, 2.56]$  and  $x_2 \in [1.57, 1.92]$

$x = 1.556$  and  $x = 1.633$ , 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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7. Determine the domain of the function below.

$$f(x) = \frac{3}{36x^2 + 48x + 15}$$

The solution is All Real numbers except  $x = -0.833$  and  $x = -0.500$ ., which is option D.

A. All Real numbers except  $x = a$  and  $x = b$ , where  $a \in [-30.12, -29.31]$  and  $b \in [-18.17, -17.5]$

All Real numbers except  $x = -30.000$  and  $x = -18.000$ , which corresponds to not factoring the denominator correctly.

B. All Real numbers except  $x = a$ , where  $a \in [-30.12, -29.31]$

All Real numbers except  $x = -30.000$ , which corresponds to removing a distractor value from the denominator.

C. All Real numbers except  $x = a$ , where  $a \in [-0.86, -0.54]$

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  $a \in [-0.86, -0.54]$  and  $b \in [-0.73, 0.03]$

All Real numbers except  $x = -0.833$  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.

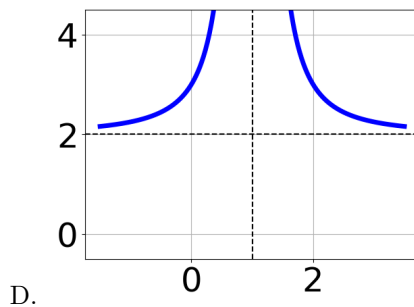
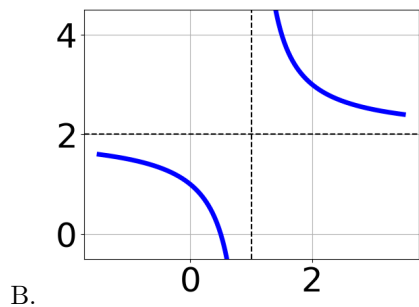
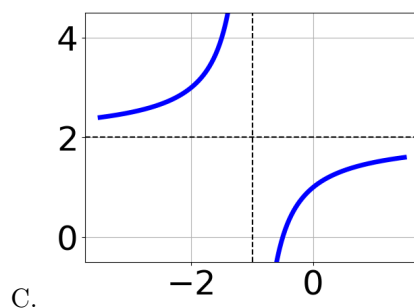
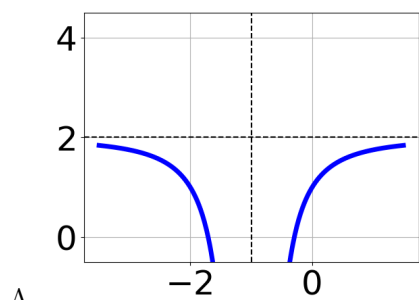
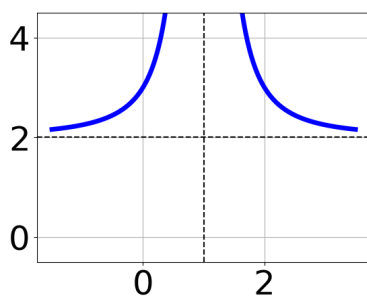
**General Comment:** Recall that dividing by zero is not a real number. Therefore the domain is all real numbers **except** those that make the denominator 0.

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8. Choose the graph of the equation below.

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

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

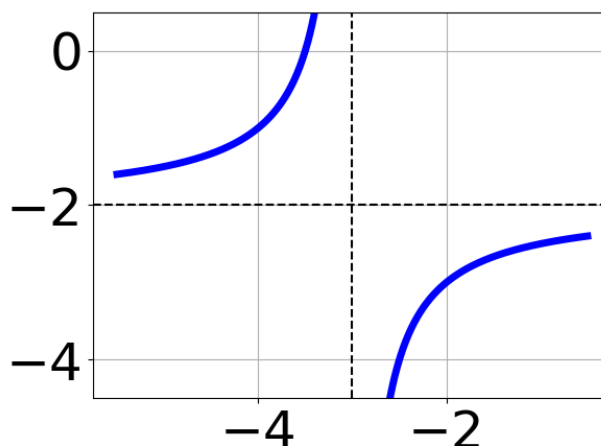


E. None of the above.

**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.

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9. Choose the equation of the function graphed below.



The solution is None of the above as it should be  $f(x) = \frac{-1}{x+3} - 2$ , which is option E.

A.  $f(x) = \frac{1}{(x-3)^2} - 4$

Corresponds to thinking the graph was a shifted version of  $\frac{1}{x^2}$ , using the general form  $f(x) = \frac{a}{x+h} + k$ , the opposite leading coefficient, AND not noticing the  $y$ -value was wrong.

B.  $f(x) = \frac{-1}{x+3} - 4$

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

C.  $f(x) = \frac{-1}{(x+3)^2} - 4$

Corresponds to thinking the graph was a shifted version of  $\frac{1}{x^2}$  not noticing the  $y$ -value was wrong.

D.  $f(x) = \frac{1}{x-3} - 4$

Corresponds to using the general form  $f(x) = \frac{a}{x+h} + k$ , the opposite leading coefficient AND not noticing the  $y$ -value was wrong.

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.

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

$$\frac{-2x}{2x-7} + \frac{-3x^2}{-10x^2+25x+35} = \frac{-3}{-5x-5}$$

The solution is There are two solutions:  $x = 0.932$  and  $x = -3.218$ , which is option E.

A.  $x \in [-1.69, 0.55]$

- B.  $x_1 \in [0.01, 1.5]$  and  $x_2 \in [0.5, 4.5]$
- C. All solutions lead to invalid or complex values in the equation.
- D.  $x \in [-3.37, -1.37]$
- E.  $x_1 \in [0.01, 1.5]$  and  $x_2 \in [-6.22, 2.78]$

\*  $x = 0.932$  and  $x = -3.218$ , which is the correct option.

**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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