Objective 1 - Domain

Identify the domain after operating $(+, -, x, \div)$ *on functions.*

Link to section in online textbook.

First, watch this video to see how operations change the domain of two functions. This is the first time we are treating **functions** like **numbers** that we can add/subtract/multiply/divide.

Question 1 *First, determine the domain of each function below. Then, determine the resulting domain after operating* $(+, -, x, \div)$ *on the two functions.*

$$f(x) = -3\,x^2 + 6\,x - 4$$
$$g(x) = -2\,(5\,x - 3)(x - 1)$$

Domain of $f(x)$*:* $\boxed{(}\ \boxed{-\infty}, \boxed{+\infty}\ \boxed{)}$

Sample response: $(-\infty, \infty)$

Feedback(*`attempt`*): *Note: There are boxes for you to put either "(" or "[" based on whether you want to include the end points. This is why there are four boxes.*

Hint: *You are looking for the interval that describes the domain. If we do not need to remove numbers from the domain, the answer is* $(-\infty, \infty)$*. Otherwise, we need to restrict the domain like* $(3, \infty)$*.*

Domain of $g(x)$*:* $\boxed{(}\ \boxed{-\infty}, \boxed{+\infty}\ \boxed{)}$

Domain of $f(x) + g(x)$*:* $\boxed{(}\ \boxed{-\infty}, \boxed{+\infty}\ \boxed{)}$

Domain of $f(x) - g(x)$*:* $\boxed{(}\ \boxed{-\infty}, \boxed{+\infty}\ \boxed{)}$

Domain of $f(x) * g(x)$*:* $\boxed{(}\ \boxed{-\infty}, \boxed{+\infty}\ \boxed{)}$

Domain of $f(x) \div g(x)$*:*

$$\boxed{(}\ \boxed{-\infty}, \boxed{\frac{3}{5}}\ \boxed{)}$$

Learning outcomes:
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$\cup$

$(\ \frac{3}{5}\ ,\ 1\ )$

$\cup$

$(\ 1\ ,\ +\infty\ )$

Hint: *The denominator is already factored so you can focus on the new concept. How do we write the union of intervals when we have 2 points missing?*

Question 2 *First, determine the domain of each function below. Then, determine the resulting domain after operating $(+, -, \mathrm{x}, \div)$ on the two functions.*

$$f(x) = -6\,x^2 + 6\,x + 5$$
$$g(x) = \sqrt{3\,x + 4}$$

Domain of $f(x)$: $(\ -\infty\ ,\ +\infty\ )$

Feedback(attempt): *Note: There are boxes for you to put either "(" or "[" based on whether you want to include the end points. This is why there are four boxes.*

Hint: *You are looking for the interval that describes the domain. If we do not need to remove numbers from the domain, the answer is $(-\infty, \infty)$. Otherwise, we need to restrict the domain like $(3, \infty)$.*

Domain of $g(x)$: $[\ -1.333\ ,\ +\infty\ )$

Domain of $f(x) + g(x)$: $[\ -1.333\ ,\ +\infty\ )$

Domain of $f(x) - g(x)$: $[\ -1.333\ ,\ +\infty\ )$

Domain of $f(x) * g(x)$: $[\ -1.333\ ,\ +\infty\ )$

Domain of $f(x) \div g(x)$: $(\ -1.333\ ,\ +\infty\ )$

Hint: *The domain for division is* ***nearly*** *the same. Do we need to exclude something extra since the radical is in the denominator?*

Question 3 *First, determine the domain of each function below. Then, determine the resulting domain after operating $(+, -, x, \div)$ on the two functions.*

$$f(x) = 6\,x^2 + 3\,x + 6$$

$$g(x) = \frac{1}{6\,(x+1)}$$

Domain of $f(x)$: ($-\infty$, $+\infty$)

Hint: You are looking for the interval that describes the domain. If we do not need to remove numbers from the domain, the answer is $(-\infty, \infty)$. Otherwise, we need to restrict the domain like $(3, \infty)$.

Domain of $g(x)$:

($-\infty$, -1.0)
$\cup$
(-1.0 , $+\infty$)

Domain of $f(x) + g(x)$:

($-\infty$, -1.0)
$\cup$
(-1.0 , $+\infty$)

Domain of $f(x) - g(x)$:

($-\infty$, -1.0)
$\cup$
(-1.0 , $+\infty$)

Domain of $f(x) * g(x)$:

($-\infty$, -1.0)
$\cup$
(-1.0 , $+\infty$)

Domain of $f(x) \div g(x)$:

$$(\ -\infty\ ,\ -1.0\ )$$
$$\cup$$
$$(\ -1.0\ ,\ +\infty\ )$$

Hint: *You may be tempted to say that dividing by a rational will "fix" the domain. When looking at the entire function $f(x) \div g(x)$, we want to make sure our values are defined on each function separately AND the resulting function.*

Question 4 *First, determine the domain of each function below. Then, determine the resulting domain after operating $(+, -, x, \div)$ on the two functions.*

$$f(x) = \frac{1}{4\,(x+1)}$$
$$g(x) = \sqrt{-5\,x - 3}$$

Domain of $f(x)$:

$$(\ -\infty\ ,\ -1.0\ )$$
$$\cup$$
$$(\ -1.0\ ,\ +\infty\ )$$

Hint: You are looking for the interval that describes the domain. If we do not need to remove numbers from the domain, the answer is $(-\infty, \infty)$. Otherwise, we need to restrict the domain like $(3, \infty)$.

Domain of $g(x)$:

$$(\ -\infty\ ,\ -0.6\ ]$$

Domain of $f(x) + g(x)$:

$$(\ -\infty\ ,\ -1.0\ )$$
$$\cup$$
$$(\ -1.0\ ,\ -0.6\ ]$$

Domain of $f(x) - g(x)$:

$$(\ -\infty\ ,\ -1.0\ )$$
$$\cup$$

$$\boxed{(}\boxed{-1.0},\boxed{-0.6}\boxed{]}$$

Domain of $f(x) * g(x)$*:*

$$\boxed{(}\boxed{-\infty},\boxed{-1.0}\boxed{)}$$
$$\cup$$
$$\boxed{(}\boxed{-1.0},\boxed{-0.6}\boxed{]}$$

Domain of $f(x) \div g(x)$*:*

$$\boxed{(}\boxed{-\infty},\boxed{-1.0}\boxed{)}$$
$$\cup$$
$$\boxed{(}\boxed{-1.0},\boxed{-0.6}\boxed{)}$$

Problem 5 *Look back on the last 4 questions and see if you can spot a pattern. This pattern is our main takeaway for this objective:*

The resulting domain is the $\boxed{\textit{intersection}}$ *of the two parent domains. If we are looking at the special case of dividing, we also need to remove* $g(x) = \boxed{0}$ *from the* $\boxed{\textit{intersection}}$ *of the two parent domains.*

Feedback(*`correct`*): *In Calculus, you will learn new operations on functions. One of the most important things to keep in mind is the relationship between the domain of the "parent function(s)" and the resulting function.*
