2.6-Combinations of Functions and Composite Functions

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Obj 1: Find the domain of a function.

* Division by zero.
* Take a square root or even root of a negative #

To find the domain of a function, we need to exclude from the domain the real values of x that cause division by zero or taking the square root of a negative number.

E.g. $g(x) = \dfrac{5x}{x^2 - 49}$. Find the domain of g?

Step 1: $x^2 - 49 = 0$

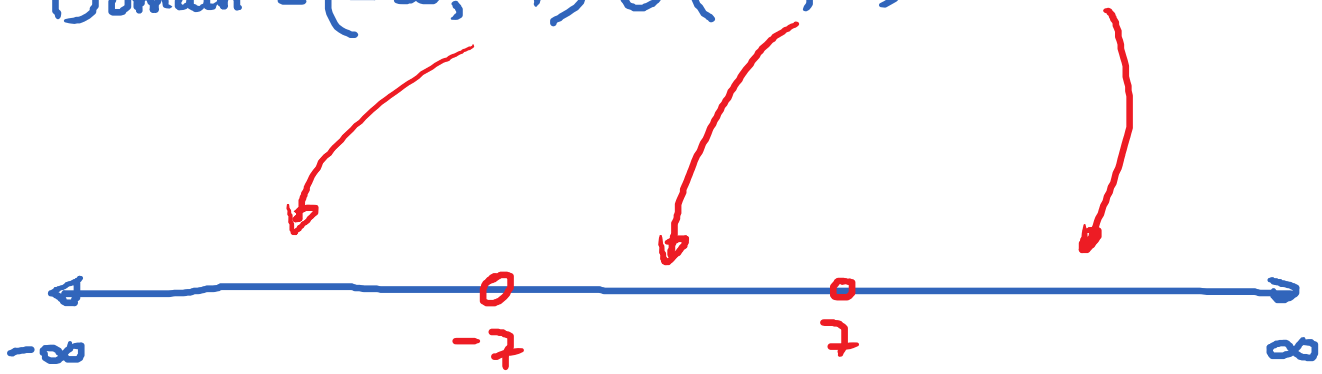
$x^2 = 49$

$x = \pm 7$

Step 2: Domain is all real numbers except for $x = 7$ and $x = -7$.

In interval notation:

$$\text{Domain} = (-\infty, -7) \cup (-7, 7) \cup (7, \infty)$$



Ex. $$f(x) = \frac{5x - 10}{x^3 - 5x^2 + 6x}$$

Find the domain of f. Use interval notation to express your answer.

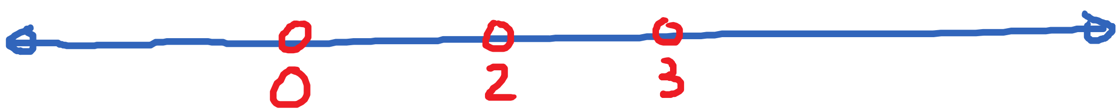
Step 1: $x^3 - 5x^2 + 6x = 0 \rightarrow$ Solve for x

$$x(\underbrace{x^2 - 5x + 6}) = 0$$

$$x(x-2)(x-3) = 0$$

$$x = 0 \quad \text{or} \quad x = 2 \quad \text{or} \quad x = 3$$

Step 2:



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Domain $= (-\infty, 0) \cup (0,2) \cup (2,3) \cup (3,\infty)$

<u>Key:</u> To find the domain of $f(x) = \dfrac{p(x)}{q(x)}$.

<u>Step 1:</u> Set denominator $q(x) = 0$.

<u>Step 2:</u> Solve for x in $q(x) = 0$.

Exclude those from the domain.

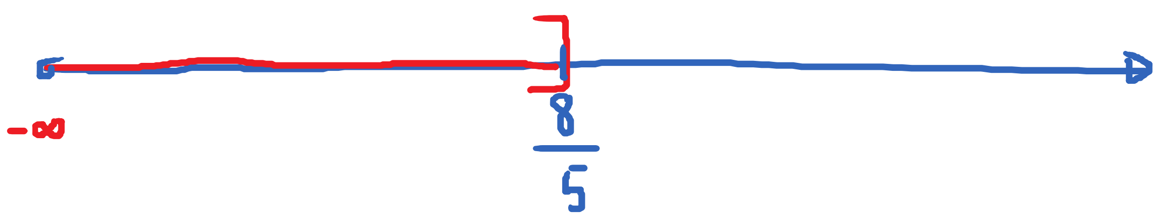
<u>E.g.</u> $h(x) = \sqrt{\boxed{8-5x}}$. Find the domain of h.

want it to be ≥ 0

To find the domain: Require: $\boxed{8 - 5x \geq 0}$

$\rightarrow \quad \dfrac{-\cancel{5}x}{-\cancel{5}} \geq \dfrac{-8}{-5} \quad \rightarrow \quad \boxed{x \leq \dfrac{8}{5}}$

In interval notation:



$$D = \left(-\infty, \frac{8}{5}\right]$$

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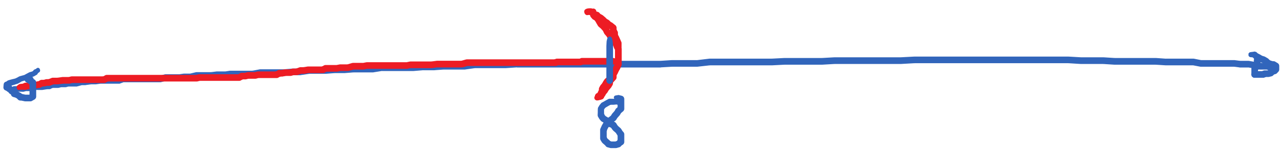
E.g. $u(x) = \dfrac{5x}{\sqrt{24-3x}}$. Find the domain of u.

want it to be > 0

To find domain: $24 - 3x > 0$

$$\frac{-3x}{-3} < \frac{-24}{-3}$$

$$x < 8$$



$D = (-\infty, 8)$

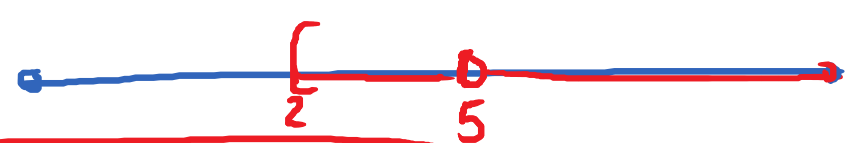
E.g. $f(x) = \dfrac{\sqrt{x-2}}{x-5}$. Find the domain of f.

$\boxed{x \neq 5}$

to be ≥ 0

$x - 2 \geq 0 \rightarrow \boxed{x \geq 2}$

In interval notation:



$$\boxed{D = [2, 5) \cup (5, \infty)}$$