

Assessing Mathematical Reasoning through Engaging Group Tasks

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Construct a Number

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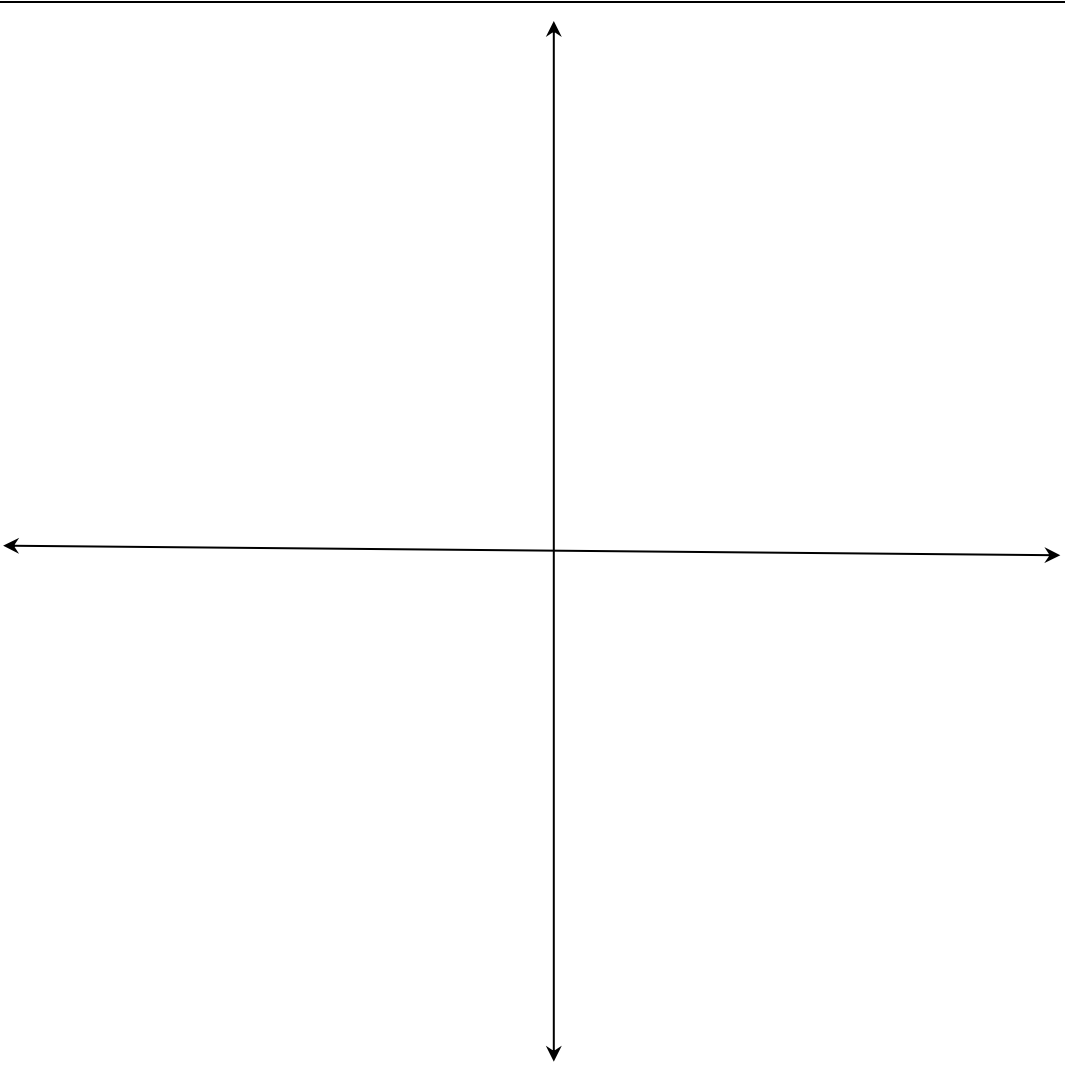
Task: Construct a number N with the given properties

1.	N is a multiple of 11	
2.	The tens digit of N is even	
3.	The sum of the digits of N is 17	
4.	$N^2 < 10^6$	
5.	M is the number obtained by reversing the digits of N . $M > N$	
6.	The remainder when N is divided by 5 is even	
7.	$\sqrt{N} > 27$	

Construct a Function (Algebra 1)

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Task: Construct a function $f(x)$ with the given properties

1.	$f(x)$ is linear	
2.	$f(x)$ intersects $x + y = 1$ for $x < 0$	
3.	$f(8) < 8$	
4.	$f(x)$ takes a maximum value	
5.	$\frac{f(4) - f(1)}{4 - 1} > 2$	
6.	$f(x)$ has domain $[-5, \infty)$	
7.	There exists an $a > 1$ such that $f(a) = 0$	

Construct a Quadrilateral

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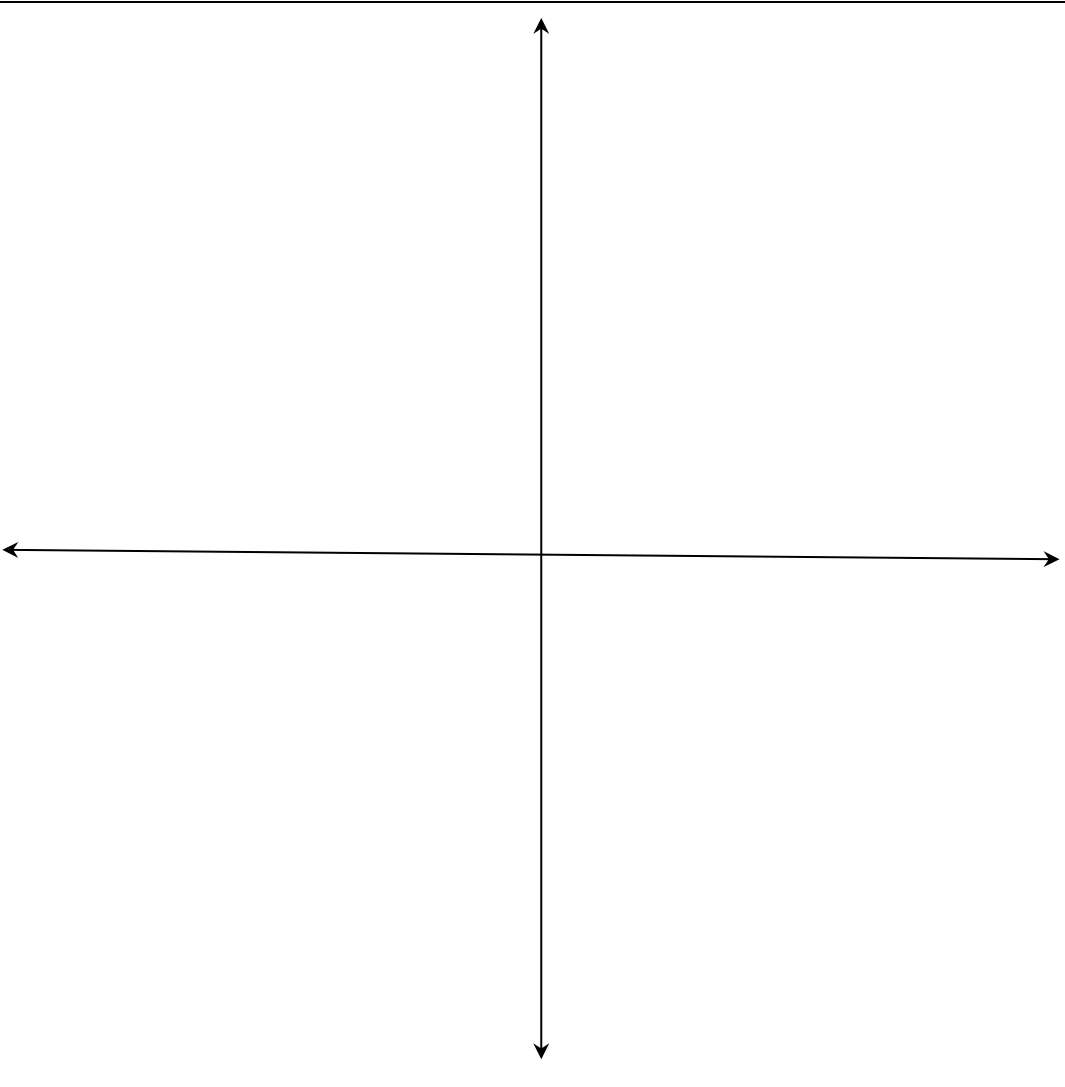
Task: Construct a quadrilateral $ABCD$ with the given properties

1.	$AB = AD$	
2.	$\overline{AB} \parallel \overline{CD}$	
3.	$AB + AD < BC + DC$	
4.	$\overline{AC} \perp \overline{BD}$	
5.	$\triangle ADC$ is isosceles	
6.	$m\angle A < m\angle C$	
7.	No interior angle of $ABCD$ is right	

Construct a Function (Algebra 2)

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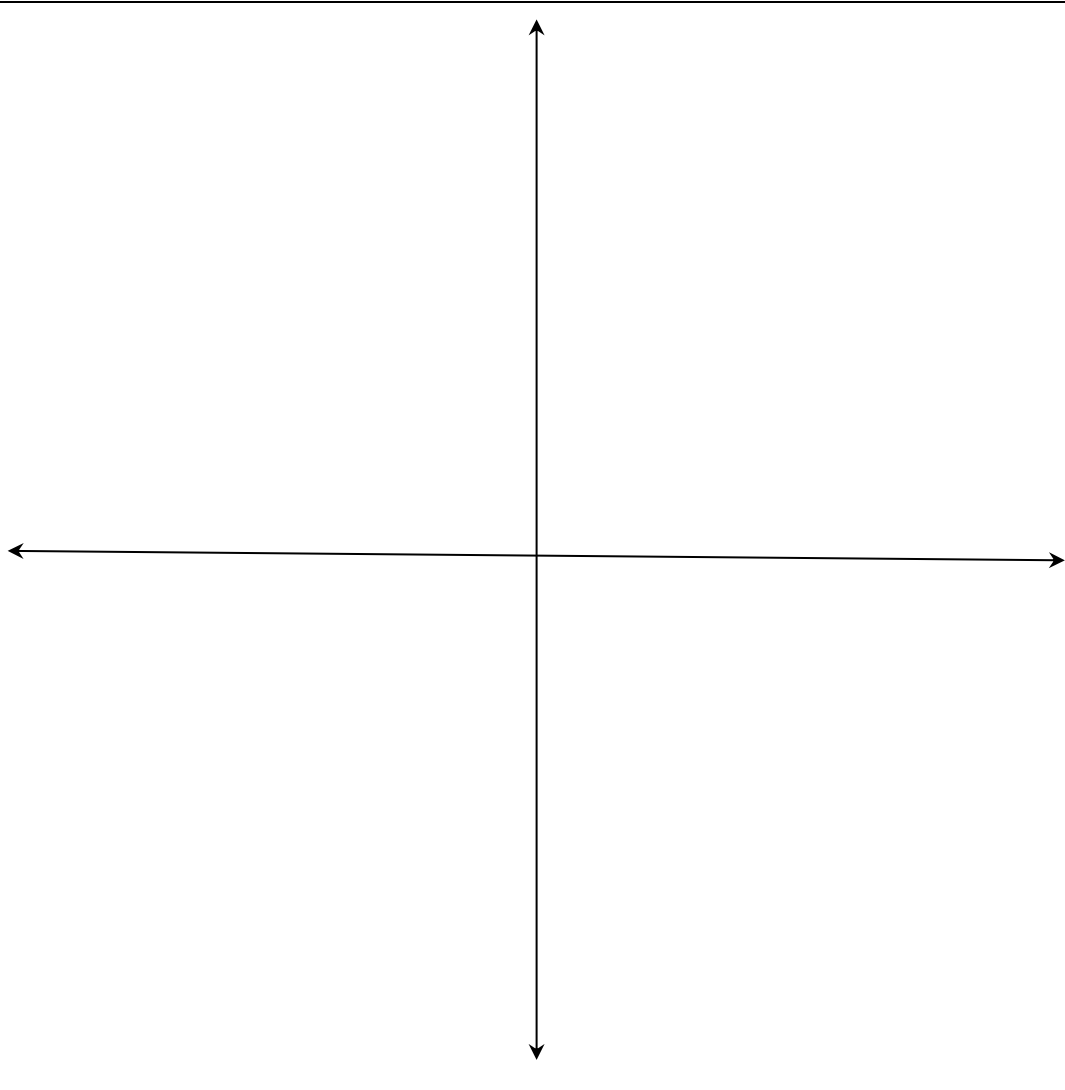
Task: Construct a function $f(x)$ with the given properties

1.	$f(-5) = f(0) = f(3) \neq 0$	
2.	$f(2)$ is a relative minimum	
3.	$f(4)$ is a relative maximum	
4.	$f(4) < f(2)$	
5.	$f(x) > 0$ on $[3,5]$	
6.	There is a value c in $[3,5]$ such that $f(c) > f(4)$	
7.	For all a, b in $[3,5]$, $b > a \Rightarrow f(b) < f(a)$	
8.	$\frac{f(-3) - f(3)}{-3 - 3} < 0$	
9.	$f(4) < \frac{f(-3) - f(3)}{-3 - 3}$	
10.	Let $g(x) = f(x - 2) + 3$, $g(1)$ is a double root	

Construct a Function (Precalculus)

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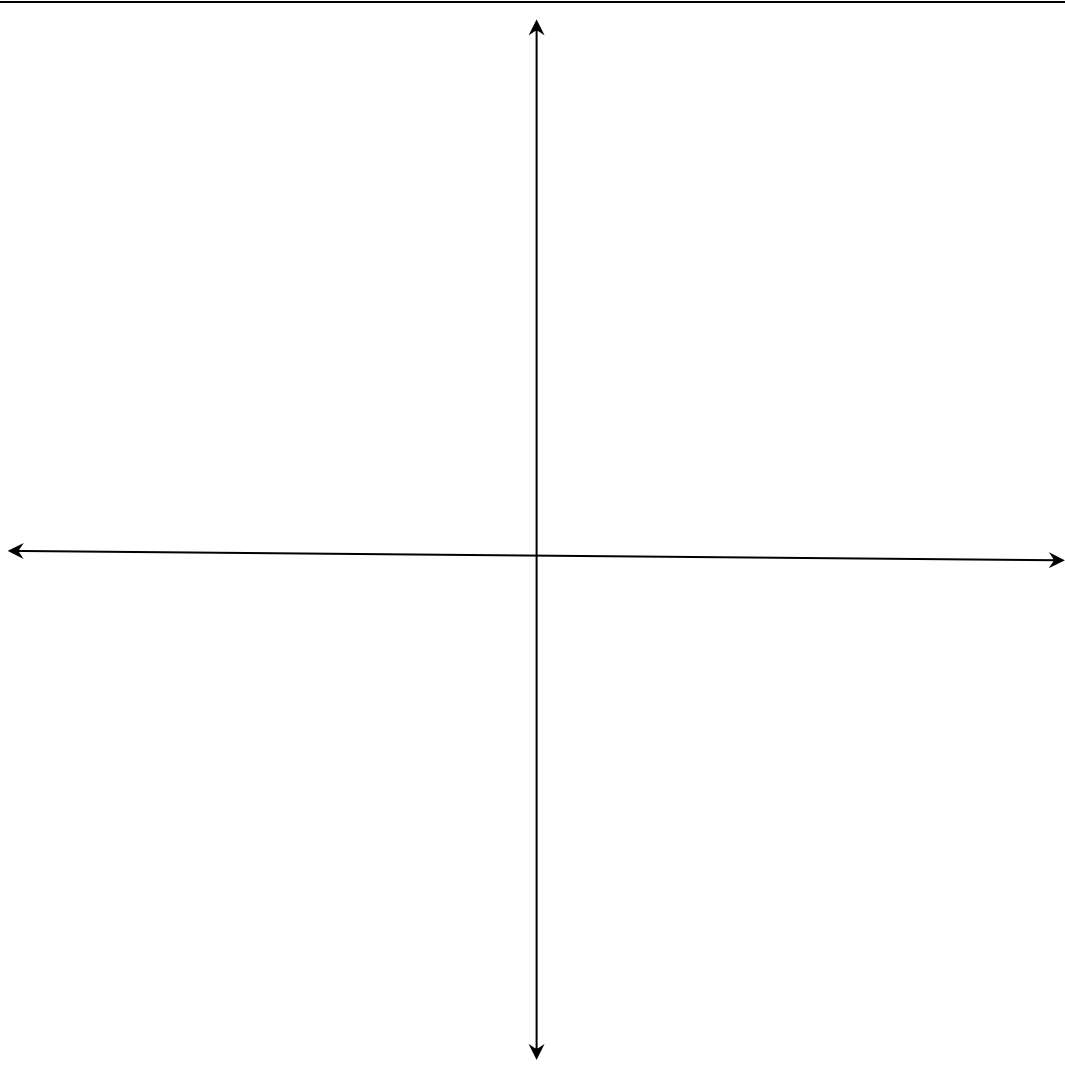
Task: Construct a function $f(x)$ with the given properties

1.	$f(x)$ is increasing on $(-2,3)$	
2.	$\lim_{x \rightarrow \infty} f(x) = 10$	
3.	$f(x)$ has three real roots	
4.	$f(x) > x$ on $[6,8]$	
5.	$f(x)$ is decreasing on $(3, \infty)$	
6.	The graph $y = f(x)$ has no y-intercept	
7.	There exist no real numbers a and b such that $\frac{f(b) - f(a)}{b - a} = 0$	
8.	The range of $f(x)$ is $[10, \infty)$	

Construct a Function (Calculus)

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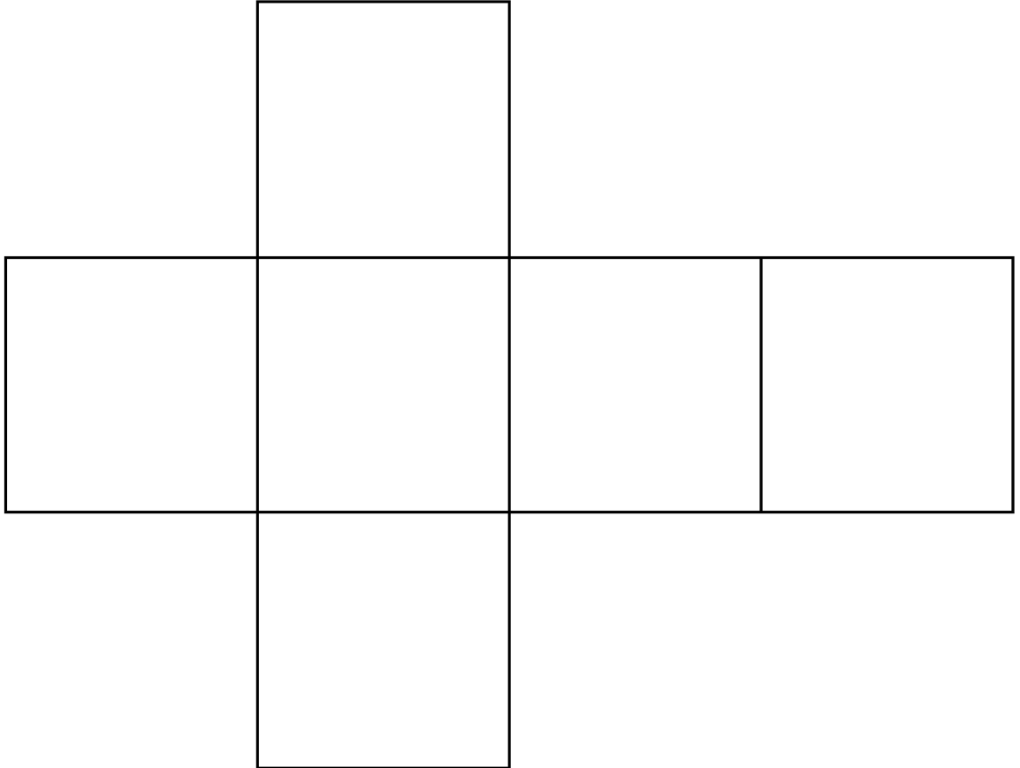
Task: Construct a function $f(x)$ with the given properties

1.	$\lim_{h \rightarrow 0} \frac{f(2+h) - f(2)}{h} = f'(5)$	
2.	$\forall b, a \text{ (for all b and a)}$ $b > a \Rightarrow f'(b) > f'(a)$	
3.	$f(x)$ is concave-up on its domain	
4.	$f(x)$ is not differentiable at $x = 4$	
5.	$\lim_{x \rightarrow \infty} f(x) = 3$	
6.	$\exists c, d \text{ (there exists c and d) such that}$ $\frac{f(d) - f(c)}{d - c} = 0$	

Construct a Die

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Task: Using positive integers, construct a fair, six-sided die with the given properties

1.	The probability of rolling an even number is not zero				
2.	The probability of the sum of two rolls being even is greater than $\frac{1}{2}$				
3.	The probability of rolling a number greater than 10 is 0				
4.	The probability of rolling the same number twice in a row is less than 20%				
5.	The probability of rolling a number greater than 4 is less than $\frac{1}{3}$				
6.	The average value of the faces is greater than the average value of the faces of a standard die				
7.	All sums of opposite faces of the die are odd				
8.	The probability that the sum of two rolls of the die is at least 12 is greater than $\frac{1}{6}$				

Construct a Function Peer Review Assessment

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Task: Identify which of the conditions were met. Explain your reasoning.

Condition	Correct/ Incorrect	Explanation
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

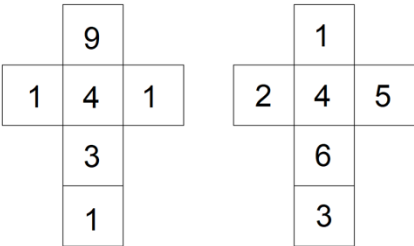
Summary Questions

What choices did this group make that were different from your own? How did it effect their function?

Identify the most interesting aspect of this group's function. What makes it interesting?

Construct a Die Assessment Ideas

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Level 1	Level 2	Level 3	Level 4
<p><i>What conditions do these dice satisfy?</i></p> 	<p><i>Given your solution, create a new condition that your die does [does not] satisfy.</i></p> <p><i>Given your solution, create a new condition about rolling the die twice that your die does [does not] satisfy.</i></p>	<p><i>Identify a set of conditions that are mutually exclusive. Justify your response.</i></p> <p><i>Construct a die that satisfies exactly one [two, etc] condition(s).</i></p>	<p><i>Create your own "Construct a Die" task with six conditions not all of which can be simultaneously satisfied.</i></p>

Other Assessment Ideas

Where did you start? Explain why.

If you could remove one condition, which one would it be? Why?