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A Puzzle by David Pleacher

A game of *Scrabble* was played by two calculus students, and peculiarly enough, in the first half of the game, every word was a math word. The game was played on a regulation *Scrabble* board using the standard rules for *Scrabble*. The following abbreviations are used on the board: TWS = Triple Word Score; DWS = Double Word Score; TLS = Triple Letter Score; and DLS = Double Letter Score. The chart below gives the frequency and the value of the Letter tiles:

Tile	Frequency	Value		Tile	Frequency	Value
A	9	1		N	6	1
B	2	3		O	8	1
C	2	3		P	2	3
D	4	2		Q	1	10
E	12	1		R	6	1
F	2	4		S	4	1
G	3	2		T	6	1
H	2	4		U	4	1
I	9	1		V	2	4
J	1	8		W	2	4
K	1	5		X	1	8
L	4	1		Y	2	4
M	2	3		Z	1	10
				Blank	2	0

Play alternated between the two calculus students until all the tiles were played. You must determine each word played, correct placement on the board, and the score at the end of the game. You are given a clue for each word played. The correct placement of the first letter of each word has been given to you. Remember that no more than SEVEN additional letters may be placed at one time. In this game, blanks were played only after all tiles of a particular letter were played (the two blanks were played in move #10 and move #18).

Fill in the chart below:

Score		Clues
Player 1	Player 2	
_____	X	1. The formula $(f \cdot g)' = f' \cdot g + f \cdot g'$ is called the _____ rule. Word begins at (5, 8).
X	_____	2. The function $f(x) = \frac{1}{4x^2 - 36}$ has two _____ asymptotes. Word begins at (10, 13).
_____	X	3. The line perpendicular to the tangent line at a point is called the _____ to a curve at that point. Word begins at (5, 6).
X	_____	4. Give the value of x where the function $f(x) = x^3 - 3x^2 - 24x$ has a relative minimum. Word begins at (7, 9).
_____	X	5. $\lim_{x \rightarrow 5} \left(\frac{5x^2 - 22x - 15}{x^2 - 8x + 15} \right) =$ _____. Word begins at (7, 9).
X	_____	6. The slope of a curve is the same as the slope of a _____ line to the curve at that point. Word begins at (3, 4).
_____	X	7. What is the x-coordinate of the point of inflection of the graph of $y = \frac{1}{3}x^3 - 9x^2 + 24$? Word begins at (5, 6).
X	_____	8. If $f(x) = \tan(2x) - 8x$, Then $f'\left(\frac{\pi}{6}\right) =$ _____. Word begins at (9, 12).
_____	X	9. The function $f(x) = x^{\frac{2}{3}}$ has a vertical tangent and a vertical _____ at (0, 0). Word begins at (5, 11).
X	_____	10. A function is said to be _____ upward on an interval if $f''(x) > 0$ at each point in the interval and _____ downward on an interval if $f''(x) < 0$ at each point in the interval. Word begins at (2, 11).

Score		Clues
Player 1	Player 2	
_____	X	11. The volume of a _____ is given by $V = \frac{1}{3} \pi r^2 h$. Word begins at (2, 11).
X	_____	12. What is the average value of $y = \frac{270}{13} x^2 \sqrt{x^3 + 1}$ on the interval $[0, 2]$? Word begins at (3, 7).
_____	X	13. If $x^2 - xy = 89$, Then when $x = 1$, $\frac{dy}{dx} =$ _____ Word begins at (5, 6).
X	_____	14. If $f(-x) = -f(x)$ for all x , then $f(x)$ is called a(n) _____ function. Word begins at (12, 12).
_____	X	15. Finding the volume of a solid of revolution rotated about the y-axis using the formula $V = \int_{y=c}^d \pi (f(y))^2 dy$ is called the _____ Method. Word begins at (12, 10).
X	_____	16. If $f(x) > g(x)$ for all $a < x < b$, Then $\int_{x=a}^b (f(x) - g(x)) dx$ finds the _____ between the two curves. Word begins at (6, 14).
_____	X	17. A dormitory room or suite housing four residents (also, a math prefix for four). Word begins at (4, 14).
X	_____	18. To record by making a mark. Word begins at (1, 1).
_____	X	19. To enjoy. Word begins at (15, 12).
X	_____	20. The feeling of happiness. Word begins at (1, 3).
_____	X	21. First person plural pronoun. Word begins at (1, 8).
X	_____	22. An adverb, meaning in what manner or to what degree, as in "_____ will you solve this puzzle?" Word begins at (1, 10).

Score		Clues
Player 1	Player 2	
_____	X	23. A gesture, usually showing respect, made by bending forward at the waist. Word begins at (3, 12).
X	_____	24. A type of airplane that does not use propellers. Word begins at (1, 3).
_____	X	25. Intelligent, as in "You must be _____ to solve this puzzle!" Word begins at (14, 10).
X	_____	26. To open the mouth wide. Word begins at (12, 6).
_____	X	27. Intention, purpose, or design. Word begins at (13, 6).
X	_____	28. A mixture of particles and gases that is the result of urban air pollution. Word begins at (12, 4).
_____	X	29. Not in danger. In baseball, not out. Word begins at (12, 4).
X	_____	30. A structure built by a spider. Word begins at (1, 8).
_____	X	31. Ego. Word begins at (7, 15).
X	_____	32. A conjunction preceding the hypothesis in a conditional statement. Word begins at (11, 2).
_____	X	33. The third-person singular personal pronoun used to refer to a non-human entity. Word begins at (9, 10).
X	_____	34. A unit of weight equal to 2,000 pounds. Word begins at (5, 2).
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_____	_____	TOTAL SCORE

The Initial Playing Board

15	TWS			DLS				TWS				DLS			TWS	
14		DWS				TLS				TLS					DWS	
13			DWS					DLS		DLS				DWS		
12	DLS			DWS					DLS				DWS			DLS
11					DWS							DWS				
10		TLS					TLS				TLS					TLS
9			DLS					DLS		DLS				DLS		
8	TWS			DLS					DWS				DLS			TWS
7			DLS					DLS		DLS				DLS		
6		TLS					TLS				TLS					TLS
5					DWS							DWS				
4	DLS				DWS				DLS				DWS			DLS
3			DWS					DLS		DLS				DWS		
2		DWS					TLS				TLS				DWS	
1	TWS			DLS					TWS				DLS			TWS
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

ANSWER KEY

Player #1		Move	Player #2	
<u>Points</u>	<u>Word</u>		<u>Points</u>	<u>Word</u>
24	PRODUCT	1		
		2	17	VERTICAL
10	NORMAL	3		
		4	12	FOUR
12	FOURTEEN	5		
		6	18	TANGENT
8	NINE	7		
		8	26	ZERO
16	CUSP	9		
		10	11	CONCAVE
5	CONE	11		
		12	32	SIXTY
9	NINETY	13		
		14	5	ODD
11	DISK	15		
		16	6	AREA
14	QUAD	17		
		18	21	TALLY
9	LIKE	19		
		20	13	JOY
15	WE	21		
		22	14	HOW (and OW)
8	BOW	23		
		24	9	JET
21	SHARP	25		
		26	7	GAPE

Player #1		
<u>Points</u>	<u>Word</u>	<u>Move</u>
5	AIM	27
		28
8	SAFE	29
		30
3	ID	31
		32
2	IT	33
		34

180

TOTAL POINTS

Player #2		
<u>Points</u>	<u>Word</u>	
18	SMOG	
8	WEB	
5	IF	
5	TON	

227

The Solution

15						I									
14			Q	U	A	D									
13					R				V						
12		B			E			Z	E	R	O			L	
11		C	O	N	C	A	V	E		R		D		I	
10	H	O	W		U				I	T		D	I	S	
9		N			S		F			I			H	E	
8	W	E			P	R	O	D	U	C	T			A	
7	E		S				U			A				R	
6	B		I		N	O	R	M	A	L		G	A	P	
5			X		I		T						I		
4			T	A	N	G	E	N	T			S	M	O	
3	J	O	Y		E		E					A			
2	E				T	O	N				I	F			
1	t	A	L	L	Y							E			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Lower case letters indicate blanks.