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Keystrokes

5.6 Use the Location Principle

TEKS *a.1, a.5, a.6*

QUESTION **How can you use the Location Principle to identify zeros of a polynomial function?**

You can use the following result, called the *Location Principle*, to help you find zeros of polynomial functions:

> If f is a polynomial function and a and b are two numbers such that $f(a) < 0$ and $f(b) > 0$, then f has at least one real zero between a and b.

EXAMPLE **Find zeros of a polynomial function**

Find all real zeros of $f(x) = 6x^3 + 5x^2 - 17x - 6$.

STEP 1 *Enter values for x*

Enter "x" into cell A1. Enter "0" into cell A2. Type "=A2+1" into cell A3. Select cells A3 through A7, and use the *fill down* command to fill in values of x.

	A	B
1	*x*	
2	0	
3	1	
4	2	
5	3	
6	4	
7	5	

STEP 2 *Enter values for f(x)*

Enter "$f(x)$" into cell B1. Enter "=6*A2^3+5*A2^2−17*A2−6" into cell B2. Select cells B2 through B7, and use the *fill down* command to fill in the values of $f(x)$.

	A	B
1	*x*	*f(x)*
2	0	−6
3	1	−12
4	2	28
5	3	150
6	4	390
7	5	784

STEP 3 *Use Location Principle*

The spreadsheet in Step 2 shows that $f(1) < 0$ and $f(2) > 0$. So, by the Location Principle, f has a zero between 1 and 2. The rational zero theorem shows that the only possible *rational* zero between 1 and 2 is $\frac{3}{2}$. Synthetic division confirms that $\frac{3}{2}$ is a zero and that f can be factored as:

$$f(x) = \left(x - \frac{3}{2}\right)(6x^2 + 14x + 4) = (2x - 3)(3x^2 + 7x + 2) = (2x - 3)(3x + 1)(x + 2)$$

▸ The zeros of f are $\frac{3}{2}$, $-\frac{1}{3}$, and -2.

PRACTICE

Find all real zeros of the function.

1. $f(x) = 6x^3 - 10x^2 - 6x + 10$
2. $f(x) = 24x^4 - 38x^3 - 191x^2 - 157x - 28$
3. $f(x) = 36x^3 + 109x^2 - 341x + 70$
4. $f(x) = 12x^4 + 25x^3 - 160x^2 - 305x - 132$