

Evaluating Polynomials

There are two ways to evaluate polynomial functions:

1. direct substitution
2. synthetic substitution

Direct Substitution (i.e. "PLUG IN")

ex: Find the indicated polynomial value using direct substitution.

a) $f(x) = x^2 - 5x + 2$, $f(13) = ?$

$$\begin{aligned} f(13) &= 13^2 - 5 \cdot 13 + 2 \\ &= 169 - 65 + 2 = 106 \end{aligned}$$

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ex: Find the indicated polynomial value using direct substitution.

$$\text{b) } g(x) = x^3 + 4x^2 - 1, \quad g(6) = ?$$

$$g(6) = 6^3 + 4(6)^2 - 1$$

$$= 216 + 144$$

$$= 360$$

Synthetic Substitution - substitution using a chart of coefficients

*Before using synthetic substitution,
- the polynomial must be in standard form
- consider if all terms are present

ex: Find the indicated polynomial value using synthetic substitution.

a) $f(x) = x^2 - 5x + 2$, $f(13) = ?$

A handwritten synthetic substitution chart for the polynomial $f(x) = x^2 - 5x + 2$ at $x = 13$. The chart is structured as follows:

13		1	-5	2
		↓	↗ 13	↗ 104
		1	8	106

The final result, 106, is enclosed in a box.

ex: Find the indicated polynomial value using synthetic substitution.

b) $g(x) = x^3 + 4x^2 - 1$, $g(6) = ?$

6		4	0	-1	→	$x^3 + 4x^2 + 0x - 1$
		6	60	360		
		10	60	359		

$g(6) = 359$

ex: Find the indicated polynomial value using synthetic substitution.

c) $m(x) = 5x^4 + 2x - 8$, $m(-2) = ?$

$$\begin{array}{r|rrrrr} -2 & 5 & 0 & 0 & 2 & -8 \\ & \downarrow & -10 & 20 & -40 & +76 \\ \hline & 5 & -10 & 20 & -38 & \end{array}$$

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$m(-2) = 68$

ex: If $f(x) = 3x^2 + bx - 7$ and $f(2) = 15$ find the value of b .

$$(2x-7)^3 = (2x-7)(2x-7)(2x-7)$$

$$(2x-7)(4x^2 - 28x + 49)$$

$$8x^3 - 84x^2 + 294x - 343$$

$$\begin{array}{r} 4x^2 - 28x + 49 \\ \hline 2x \quad \left| \begin{array}{l} 8x^3 - 56x^2 + 98x \\ -28x^2 + 196x - 343 \end{array} \right. \end{array}$$