For example, find the value of $6w^2 + 2w - 20$ when $w = 1$:

$$6(1)^2 + 2(1) - 20$$
$$= 6(1) + 2(1) - 20$$
$$= \mathbf{6 + 2 - 20}$$
$$= \mathbf{8 + (-20)}$$
$$= -12$$

Notice that when $w = 1$, the next-to-last step is just the original polynomial without its variables. In other words, that step is just the coefficients and the constant of the polynomial: **6 + 2 − 20**.

Because the replacement value for w is 1, the multiplicative identity, it is as if the variables "melt away" and we can find the sum of the numerical parts of the polynomial. In other words, when the variable is replaced by 1, the variables can be eliminated.

Example 1: Find the value of each polynomial when the variable is 1.

a) $5p^3 + 3p$ b) $y^2 - 8y$ c) $3x^2 - x + 4$

Procedure: To replace the variable with 1 means that the variable(s) can be eliminated. The result is the sum of the coefficients and the constant of the polynomial. If there is no visible coefficient, then the coefficient is 1 (or -1).

Answer:

a) $5p^3 + 3p$, $p = 1$

$5 + 3$

$= 8$

b) $1y^2 - 8y$, $y = 1$

$1 - 8$

$= -7$

c) $3x^2 - 1x + 4$, $x = 1$

$3 - 1 + 4$

$= 6$

You Try It 1 Find the value of each polynomial when the variable is 1. Use Example 1 as a guide.

a) $2x^3 + 3x$ b) $w^2 - 6$ c) $6c^3 + c - 4$ d) $-3p^2 + 2p - 5$

When a product is complete, we can check to see if the constants and coefficient of the result are correct by replacing the variable with 1 in each polynomial in the product. Again, this check does not indicate whether the exponents are correct.

For example, in the product $(3w - 5)(2w + 4) = \underline{6w^2 + 2w - 20}$, we can choose $w = 1$ for each variable. If the product is correct, then each side of the equal sign will be the same value:

Original Expression	$\stackrel{?}{=}$	Result	
$(3w - 5)(2w + 4)$	$\stackrel{?}{=}$	$6w^2 + 2w - 20$,	Replace w with 1, as in Example 1.
$(3 - 5)(2 + 4)$	$\stackrel{?}{=}$	$6 + 2 - 20$	Evaluate each part separately.
$(-2)(6)$	$\stackrel{?}{=}$	-12	
-12	$=$	-12 ✓ True	

Because $-12 = -12$, we can be confident that the coefficients and constant of $6w^2 + 2w - 20$ are correct. Now mentally verify that the exponents of the answer, $6w^2 + 2w - 20$, are also correct.

This checking process is one that you can do in your head or as scratch work. It is intended only as a quick way to verify that the simplification of two polynomials is correct.

If we multiply two polynomials and this checking technique shows that the product is not correct, then we should either search for our mistake or start the multiplication over from the beginning.

Example 2: Replace each variable with 1 in the product to determine whether the coefficients and constants in the multiplication are correct.

a) $3y^4(6y^2 - 4y) = \underline{18y^6 - 12y^5}$ b) $(4x - 3)(2x + 6) = \underline{8x^2 - 18}$

Procedure: To replace the variable with 1 means that the variables can be eliminated. Evaluate each side of the equal sign to determine if the multiplication is correct.

Answer:

Original Expression	$\stackrel{?}{=}$	Result
a) $3y^4(6y^2 - 4y)$	$\stackrel{?}{=}$	$18y^6 - 12y^5$
$3 \cdot (6 - 4)$	$\stackrel{?}{=}$	$18 - 12$
$3 \cdot (2)$	$\stackrel{?}{=}$	6
6	$=$	6

True, this multiplication is *likely* correct .

Original Expression	$\stackrel{?}{=}$	Result
b) $(4x - 3)(2x + 6)$	$\stackrel{?}{=}$	$8x^2 - 18$
$(4 - 3)(2 + 6)$	$\stackrel{?}{=}$	$8 - 18$
$(1)(8)$	$\stackrel{?}{=}$	-10
8	$\neq$	-10

False, this multiplication is *not* correct.