Evaluate Polynomial Expressions

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9.4 Evaluate Polynomial Expressions

Last Modified: Aug 23, 2023

[Figure 1]

Mr. Travis is taking his Social Studies class on a tour of downtown. He has created a scavenger hunt for the students as they travel around the city. The scavenger hunt is made up of all different types of architecture and landmarks as well as problems that will need to be solved. Mr. Travis asked the bus to drop the students off in front of the Town Hall. In the square across from the town hall is a plaza with three cubes in it.

One of the problems on the sheet read "Before you is a cube. Use the formula $A = 6s^2$ to find the surface area of a cube whose side measures 8 feet."

Can you solve this problem?

In this concept, you will learn to evaluate polynomial expressions.

Evaluating Polynomials

A **polynomial** is an algebraic expression that shows the sum of monomials.

In order to solve algebraic expressions, you need to use the order of operations, commonly called PEMDAS. The diagram below shows the order of arithmetic operations performed

using PEMDAS.
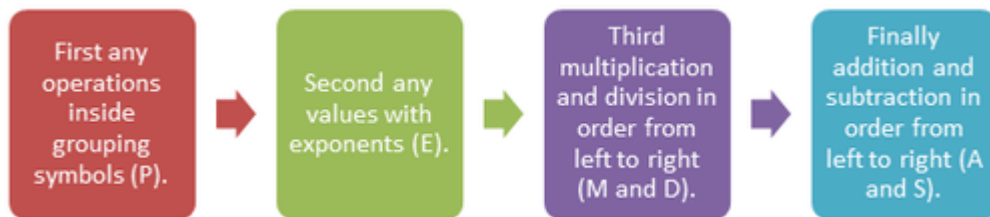
[Figure 2]

When you consider expressions, you can evaluate an expression for a given value. In other words, you can find the total value if you know the value that corresponds to the variable. You can replace the variable(s) with the given value and then use the order of operations to calculate the total value.

Let's look at an example.

Evaluate $x^2 + 3x - 10$ for $x = 5$

First, replace the variables with the given value of x.

$$(5)^2 + 3(5) - 10$$

Next, find the total value using the order of operations.

$$(5)^2 + 3(5) - 10$$
$$25 + 3(5) - 10 \qquad \text{There is no group so start with the exponent.}$$
$$25 + 15 - 10 \qquad \text{Complete the multiplication.}$$
$$40 - 10 \qquad \text{Perform the addition and subtraction from left to right.}$$
$$30$$

The answer is 30.

Examples

Example 1

Earlier, you were given a problem about the cube. You have been asked to find the surface area of a cube that has a side length of 8 feet.

First, substitute the side length into the formula for the surface area.

$$
\begin{aligned}
A &= 6s^2 \\
A &= 6(8)^2
\end{aligned}
$$

Next, use PEMDAS to solve for the surface area.

$$
\begin{aligned}
A &= 6(8)^2 && \text{First evaluate the exponent } 8^2 = 8 \times 8 = 64. \\
A &= 6(\textcolor{red}{64}) && \text{Perform the multiplication.} \\
A &= 384
\end{aligned}
$$

The answer is 384.

The surface area of the cube is 384 ft^2.

Example 2

Evaluate $4x^2 + 2x + 15$ for $x = 3$

First, replace the variables with the given value of x.

$$
4(3)^2 + 2(3) + 15
$$

Next, find the total value using the order of operations.

$$
\begin{aligned}
& 4(3)^2 + 2(3) + 15 \\
& 4(\textcolor{blue}{9}) + 2(3) + 15 && \text{There is no group so start with the } \textcolor{red}{\text{exponent}}. \\
& \textcolor{blue}{36 + 6} + 15 && \text{Complete the } \textcolor{blue}{\text{multiplication.}} \\
& 42 + 15 && \text{Perform the addition from left to right.} \\
& 57
\end{aligned}
$$

The answer is 57.

Example 3

Evaluate $x^2 + 5x - 1$ for $x = 3$

First, replace the variables with the given value of x.

$$(3)^2 + 5(3) - 1$$

Next, find the total value using the order of operations.

$(3)^2 + 5(3) - 1$

$(9) + 5(3) - 1$ There is no group so start with the exponent.

$9 + 15 - 1$ Complete the multiplication.

$24 - 1$ Perform the addition and subtraction from left to right.

23

The answer is 23.

Example 4

Evaluate $x^2 + 4x - 9$ for $x = 2$

First, replace the variables with the given value of x.

$$(2)^2 + 4(2) - 9$$

Next, find the total value using the order of operations.

$(2)^2 + 4(2) - 9$

$(4) + 4(2) - 9$ There is no group so start with the exponent.

$4 + 8 - 9$ Complete the multiplication.

$12 - 9$ Perform the addition and subtraction from left to right.

3

The answer is 3.

Example 5

Evaluate $2x^2 + 2x + 5$ for $x = 3$

First, replace the variables with the given value of x.

$$2(3)^2 + 2(3) + 5$$

Next, find the total value using the order of operations.

$(3)^2 + 2(3) + 5$

$2(9) + 2(3) + 5$ There is no group so start with the **exponent**.

$18 + 6 + 5$ Complete the **multiplication**.

$24 + 5$ Addition from left to right.
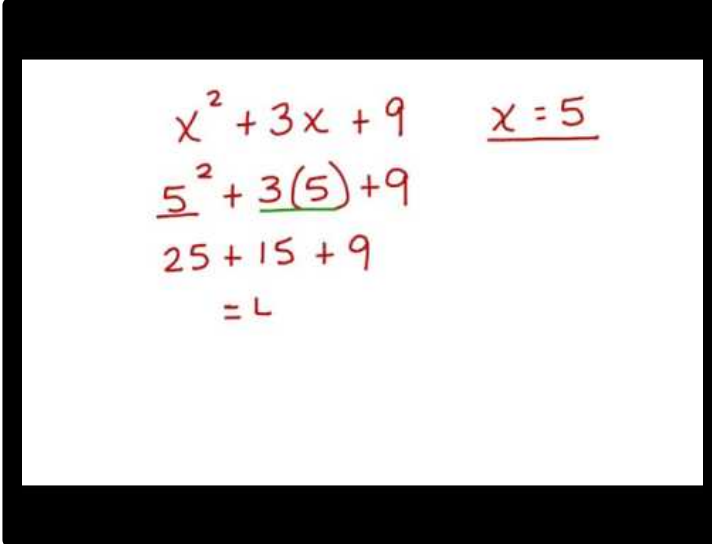
29

The answer is 29.

Review

Evaluate the following expressions for the given value.

1. $7x^3$ for $x = 2$

2. $6x^2$ for $x = 3$

3. $4x^3$ for $x = 2$

4. $8x^2$ for $x = 2$

5. $10xy$ for $x = 2, y = 3$

6. $7x^2 + 4x$ for $x = 2$

7. $6x^2 + 5x$ for $x = 2$

8. $3x^2 + 8x$ for $x = 3$

9. $7x^2 + 4x - 2$ for $x = 2$

10. $9x^2 + 5x - 3$ for $x = 3$

11. $5x^2 + 5x - 2$ for $x = 2$

12. $12x^2 + 8x + 11$ for $x = 2$

13. $6y^2 - 2y - 8$ for $y - 6$

14. $3(x - 7) + 5(x + 1)$ for $x = 10$

15. $-2y^3 + 6(y - 4) + y$ for $y = -3$

Review (Answers)

To see the review answers, return to the Table of Contents and select 'Other Versions' or 'Resources'.

Resources

https://flexbooks.ck12.org/flx/render/embeddedobject/182357

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1.0 REFERENCES

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