

no calculator

6.8 – Orders of Operations

6.8 The student will evaluate whole number numerical expressions, using the order of operations.

Understanding the Standard:

- The order of operations is a convention that defines the computation order to follow in simplifying an expression.
- The order of operations is as follows:
 - 1st - Complete all operations within **grouping symbols***. If there are grouping symbols within other grouping symbols, do the innermost operation first.
 - 2nd - Evaluate all **exponential** expressions.
 - 3rd - **Multiply and/or divide in order from left to right.**
 - 4th - **Add and/or subtract in order from left to right.**
- Parentheses **()**, brackets **[]**, braces **{ }**, and the division bar **—** as in $\frac{3+4}{5+6}$ should be treated as grouping symbols.
- The power of a number represents repeated multiplication of the number (e.g., $8^3 = 8 \cdot 8 \cdot 8$). The base is the number that is multiplied, and the exponent represents the number of times the base is used as a factor. In the example, 8 is the base, and 3 is the exponent.
- Any number, except 0, raised to the zero power is 1. Zero to the zero power is undefined.

Grouping symbols →

6.8 – Order of Operations

P arentheses	P	P lease
E xponents	E	E xcuse
M ultiply/ D ivide	M/D from left to right	M y D ear
A dd/ S ubtract	A/S from left to right	A unt S ally

1st Do the operations inside of parentheses or other grouping symbols.

If there are parentheses inside brackets, work from the inside to the outside.

()	Parentheses
{ }	Braces
[]	Brackets
 abs 	Absolute Value Bars
—	Fraction Bar

2nd Do the parts that use exponents or roots.

3rd Do all multiplication and division at the same time, from left to right.

4th Do all addition and subtraction at the same time, from left to right.

Essential Understandings:

What is the significance of the order of operations?

The order of operations prescribes the order to use to simplify expressions containing more than one operation. It ensures there is only one correct answer.

Essential Knowledge & Skills:

The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to

- Simplify expressions by using the order of operations in a demonstrated step-by-step approach. The expressions should be limited to positive values and not include braces { } or absolute value | |.
- Find the value of numerical expressions, using order of operations, mental mathematics, and appropriate tools. Exponents are limited to positive values.

Released SOL questions:

No calculator.

What is the value of $7^2 - 4 + 5$?

A 50

B 40

C 15

D 14

$$\begin{array}{r} \overline{49} - 4 + 5 \\ 45 + 5 \\ 50 \end{array}$$

What is the value of $6 + 3 \cdot 2$?

A 36

B 18

C 12

D 11

$$\begin{array}{r} \overline{6+6} \\ 12 \end{array}$$

Practice: Simplify each expression.

1.) $(20 \div 5 \times 8 \div 2 \times 4) \div (25 - 16 + 11 - 7 + 3)$

2.) $(42 + 18 - 54) \times \sqrt{100} \div (9^2 - 11 \times 6) \times (36 - 34 + 1^4)$

3.) $(26 - 5^2 + \sqrt{16}) \times (70 \div 7 + 4 - 2^3) \div (4^2 - 6)$

4.) $8 \times 6 + 33 \div 11 - 7 \times 6 + 6^2 \div 2 - 63 \div 9 \times 2$

5.) $92 - (48 \div 8 \times 5 \div 3 - 2)^2 + 16 \div 4 \times 5 \div 2 \times 7 - 4 \times (20 + \sqrt{4})$

6.) $77 \div (7 \times 8 - 5 \times 9) \times 4 - 48 \div 2^2$

7.) $(20 - 9 + 28 - 17 + 7 - 24)^2 \div (99 \div 33 + 2)$

8.) $(4^2 - 3^2) \times (\sqrt{36} + \sqrt{144}) \div (5^2 - 2^2)$

9.) $(8 \times 3 - 5 \times 4 + 6^2 - 1^7 + 11 \times 2 + 2) \div \sqrt{49}$

10.) $(5 \times 12 \div 10 \times 7 + 31 \times 3) \div (88 \div 11 \times 3 - 75 \div 5)$

11.) $(64 - 11 \times 3 + 52 \div 4 - 72 \div 8 + 3 \times 7) \div (13 - 4 + 5 - 7)$

12.) $84 \div (5^2 + 4 - 15) + 6 \times 2 + 3 \times 2 - 48 \div (11 + 15 - 23) - 72 \div (12)$

Extra
Credit
for 6 problems
correct
w/ work