Name: _____ Date: _____ Block: _____

STEM - Math 8

Unit 1 – Integers

Lesson 5 – Order of Operations

Goals:
- Perform the Order of Operations on integers.

Warm – up:
Do you remember what BEDMAS stands for?

- In a mathematical expression with many operations, the outcome will differ according to the order in which the calculations are done.
- The order of operations is a rule used to determine the correct sequence of calculations in a mathematical expression.

+ − ÷ × → answer

Brackets:
According to the order of operations, calculations inside brackets MUST be completed first.

Compare:

$2 \times 3 + 4$ → $6 + 4$ → 10

V.S.

$10 \neq 14$

$2 \times (3 + 4)$ → 2×7 → 14

(-2)

Exponents:
- When the same number is multiplied a repeated number of times, we write it in a condensed way which is **exponential form.**

shortened

For Example:

Repeated multiplication	Exponential Form	In Words:	Standard Form
$3 \cdot 3 \cdot 3 \cdot 3$	3^4 (base: 3, exponent: 4)	three to the power of four	81
$(-2) \cdot (-2) \cdot (-2) \cdot (-2) \cdot (-2)$	$(-2)^5$	negative two to the power of five	-32

9 · 3
27 · 3
81

Note: any number raised to the power of zero is defined as 1 (ex $3^0 = 1$; $4^0 = 1$; $55365^0 = 1$.)
- However, 0^0 is UNDEFINED!

except zero

Order of Operations:
1. Calculate all operations in brackets first.
2. Simplify all exponent expressions
3. Do multiplication and division as they occur, working from left to right.
4. Do addition and subtraction as they occur, working from left to right.

To remember the order of operations, the acronym BEDMAS is used.

1. **B** – Brackets
2. **E** – Exponents
3. **D** – Division
   M – Multiplication
4. **A** – Addition
   S – Subtraction

Ex: Evaluate:

a. $32 \div 4 \times 8 \div 2$

$8 \times 8 \div 2$

$64 \div 2$

32

b. $(-2)^3 \cdot (3)^2 + 10$

$(-8)(9) + 10$

$-72 + 10$

-62

c. $6 \cdot (-2)^2 - 3 + 5 \cdot (-2)$

$6 \cdot 4 - 3 + 5 \cdot (-2)$

$24 - 3 + 5 \cdot (-2)$

$24 - 3 + (-10)$

$21 + (-10) = 11$

d. $-3^2(6-2) + 2(5+3)$

$-3^2(4) + 2(8)$

$-9(4) + 2(8)$

$-36 + 16$

-20

* $-3^2 \neq (-3)^2$

$-(3 \cdot 3)$ $(-3)(-3)$

$-9 \neq 9$

e. $(-2)^2(2^3 - 9) + 2$

$(-2)^2(8-9) + 2$

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

$(+4)(-1) + 2$

$-4 + 2 = -2$

$8 + (-9)$

28

$\times 28$

f. $2[(2+3)^2 + (3^3+1)^2]$

$2[(5)^2 + (27+1)^2]$

$2[(5)^2 + (28)^2]$

$2[25 + 784]$

$2[809] = 1618$

[ ] outside brackets

( ) inside brackets

* inside brackets first

Assignment – No Calculator:

Level 1:

1. Evaluate. Circle the part you do first then find the answer.

a. $4 + 2 \cdot 3 =$ 10

b. $(4+2) \cdot 3 =$ 18

c. $(10-2) \cdot 3 =$ 24

d. $(-12) + (-4) \times 8 =$ -44

e. $12 \div 4 - 3 =$ 0

f. $(-12) \div 3 - 5 =$ -9

g. $3 - 21 \div 7 =$ 0

h. $24 \div 8 + 5 - 2 =$ 6

i. $2 \cdot 3^2 =$ 18

j. $13 \times (-5) \div 2 =$ -32.5

k. $(-11) \times (-4 + 2) =$ 22

l. $(3^2 - 19) \div (-2) =$ 5

Level 2:

2. Simplify. Write out the repeated multiplication before evaluating.

a. $(-1)^3 =$ -1

$(-1) \times (-1) \times (-1)$
$= -1$

b. $(-1)^5 =$ -1

c. $(-1)^2 = =$ 1

d. $(-2)^3 =$ -8

e. $(-2)^4 =$ 16

f. $(-2)^2 =$ 4

3. What is the pattern between even exponents of a negative integer?

$(-x)^{even} = +$

4. What is the pattern between odd exponents of a negative integer?

$(-x)^{odd} = (-)$

5. Write each number in terms of a power.

a. $2 \times 2 \times 2 \times 2$

2^4

b. $(-4) \cdot (-4) \cdot (-4) \cdot (-4) \cdot (-4)$

$(-4)^5$

c. $2 \cdot 5 \cdot 2 \cdot 2 \cdot 5$

$2^3 \cdot 5^2$

d. $7 \times 7 \times 7$

7^3

e. $-(-2) \cdot (-2) \cdot (-2) \cdot (-2)$

$-(-2)^4$

f. $7 \cdot 7 \cdot 7 \cdot 2 \cdot 2$

$(7^3)(2^2)$

6. Evaluate. Box your final answer.

a. $2 \cdot 4^2 + 3^2$

41

b. $8^0 \cdot 5 - 3^2$

-4

c. $3^2 \cdot 5 - 2^3 \div 4$

43

d. $64 \div (12 - 2^2)$

8

e. $3(6-4)^2$

12

f. $(5-12)^2 \div 7$

7

g. $50 - 10 \times (7+2)$

-40

h. $12 \div (6-3) \times 4$

16

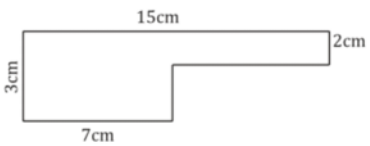
i. $\frac{(72 \div (3-5) \times 4)}{(-5-4)}$

16

7. A concert has adult tickets for $15 and child tickets for $10. Marcus bought 4 adult ticket and 3 child tickets. How much money did he spend?

$15 x 4 + $10 x 3 = $90

8. Find the area of the shaded region. Show your work. Area of a rectangle is: $A = l \times w$



(3 x 7) + [(15 - 7) x 2] = 37cm^2

Level 3:

9. Insert brackets to make the expression correct.

a. $(-5+2)\cdot 3^2 = -27$ * -27

b. $5\cdot(3-3)\cdot 6 = 0$

c. $(-4^2)-(3\cdot 2^2) = -20$

d. $(8-28)\div 4\times 7 = -35$

10. Evaluate.

a. $-3^2[4-(-6)]$

-90

b. $(-2)[-6-(-4)]$

4

c. $\frac{-14+(-2)^2}{6-(-2)}$

-1.25

d. $\frac{-2^3[(-3)^2-(-1)^3]}{-4+(-6)}$

8

e. $\frac{5^2+3}{2}-\frac{(-4)^2}{8}$

2

f. $\frac{4\cdot 2^2+(-2)}{14+3(-4)}$

7

11. A scuba diver took 24 minutes to reach the ocean floor off Vancouver Island. Her rate of descent was -8m/min. After every 4 minutes she paused for 1 minute to prevent nitrogen buildup. How deep was the ocean floor?