1.2 ORDER OF OPERATIONS

PART A

1) Evaluate each of the following.

a) $10-5+4$

b) $6+2\times4$

c) $6\div3+3\times4$

d) $12-(6+2)$

e) $20-4^2+5(3)$

f) $(2+3)^2$

g) $(4+6\div2)^3$

h) $3\left(3^2-2\times4\right)$

i) $10+(9-7)^4$

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

k) $3\left(20+8\div4-2\right)-6^2$

l) $\left(5-2^2+2\right)^3\div3$

m) $10^2+2(6-3)^2$

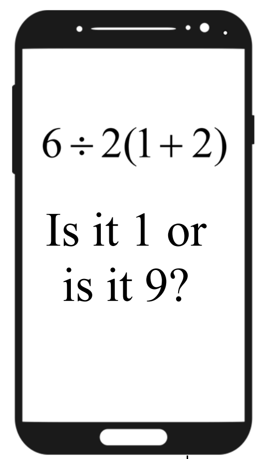
n) $2(3+1)^2-4(3-10\div5)^4$

o) $\left[5+3(8-2\times3)\right]^2$

p) $2\left[\left(15-3^2\right)+\left(30-25\right)^2\right]$

2) Evaluate $\left(\left(2^2\right)^2\right)^2$.

3) Questions like the one shown on the right often appear on social media, along with many comments supporting each of the two options.



a) Show that the given expression is equal to 9 if it is evaluated using the standard order of operations (BEDMAS).
b) Explain how one might arrive at a value of 1 for this expression.
c) Suggest a way to rewrite the given expression such that using the standard order of operations results in a value of 1.

ANSWERS

1) a) 9 b) 14 c) 14 d) 4 e) 19 f) 25 g) 343 h) 3 i) 26 j) 17 k) 24 l) 9 m) 118 n) 28 o) 121 p) 62 **2)** 256

3) a) After evaluating the contents of the brackets, the division is completed before the multiplication, as the division appears first from left to right.

$$\begin{aligned}&6\div2(1+2)\\&=6\div2(3)\\&=3(3)\\&=9\end{aligned}$$

b) If the multiplication is completed before the division, the result will be 1.

$$\begin{aligned}&6\div2(1+2)\\&=6\div2(3)\\&=6\div6\\&=1\end{aligned}$$

c) Answers may vary. Two possibilities are $(6\div2)(1+2)$ and $\dfrac{6}{2(2+1)}$.

Note: It is quite possible that the intended interpretation of the given expression is $\dfrac{6}{2(2+1)}$*, but it could not be represented using such notation due to early typesetting/printing limitations. In practice, the context of the problem would most likely indicate how such an expression should be interpreted.*

PART B

4) Use your knowledge of integer multiplication to evaluate the following powers.

a) $(3)^2$ b) $(-3)^2$ c) $(-4)^2$ d) $(2)^3$ e) $(-2)^3$ f) $(-2)^4$

5) If n represents a natural number (1, 2, 3, 4, …), when will $(-3)^n$ give a positive result and when will it give a negative result?

6) Evaluate each of the following.

a) $11+(-6)-4$

b) $6+(-3)\times 2$

c) $-4(3)+5(-2)$

d) $-7-(2-5)$

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

f) $(5-9)^2$

g) $(-7+8\div 2)^3$

h) $-4\left(2^2-2\times 5\right)$

i) $10-(10-12)^4$

j) $(5-6)^2+(5-6)^3$

k) $2\left[-20+(-9)\div(-3)-2\right]+5^2$

l) $\left[5-2^2+(-3)\right]^3\div(-4)$

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

n) $\left[(5-6)^3(8-6)^2\right]^3$

o) $\left[-5-2(8-4\times 3)\right]^2$

p) $-2\left[\left(11-2^2\right)+\left(20-25\right)^2\right]$

7) Is -3^2 the same as $(-3)^2$? Explain.

8) Evaluate $20+\left(-2^4\right)+\left(-2\right)^4$.

ANSWERS

4) a) 9 b) 9 c) 16 d) 8 e) −8 f) 16

5) If n is an even number, the result will be positive. If n is an odd number, the result will be negative.

6) a) 1 b) 0 c) −22 d) −4 e) 19 f) 16 g) −27 h) 24
i) −6 j) 0 k) −13 l) 2 m) 14 n) −64 o) 9 p) −64

7) No. For -3^2, the exponent applies only to the base of 3 (not -3). We can think of this expression as *the negative of* 3^2 or *the opposite of* 3^2. Therefore, $-3^2=-(3\times 3)=-9$.

The base of the power $(-3)^2$, however, is -3. Therefore, $(-3)^2=(-3)\times(-3)=9$.

8) 20