

EXPONENTS

A DEFINITIONS

A.1 WRITING REPEATED MULTIPLICATION IN EXPONENT FORM

Ex 1: Write in exponent form:

$$2 \times 2 \times 2 = \boxed{2^3}$$

Answer: $\overbrace{2 \times 2 \times 2}^{3 \text{ factors}} = 2^3$

Ex 2: Write in exponent form:

$$3 \times 3 \times 3 \times 3 = \boxed{3^4}$$

Answer: $\overbrace{3 \times 3 \times 3 \times 3}^{4 \text{ factors}} = 3^4$

Ex 3: Write in exponent form:

$$5 \times 5 = \boxed{5^2}$$

Answer: $\overbrace{5 \times 5}^{2 \text{ factors}} = 5^2$

Ex 4: Write in exponent form:

$$7 \times 7 \times 7 = \boxed{7^3}$$

Answer: $\overbrace{7 \times 7 \times 7}^{3 \text{ factors}} = 7^3$

Ex 5: Write in exponent form:

$$10 \times 10 \times 10 \times 10 \times 10 = \boxed{10^5}$$

Answer: $\overbrace{10 \times 10 \times 10 \times 10 \times 10}^{5 \text{ factors}} = 10^5$

A.2 WRITING IN EXPONENT FORM FROM VERBAL EXPRESSIONS

Ex 6: Write in exponent form:

$$2 \text{ raised to the power } 3 = \boxed{2^3}$$

Answer: 2 raised to the power of 3 = 2^3

Ex 7: Write in exponent form:

$$5 \text{ raised to the power } 2 = \boxed{5^2}$$

Answer: 5 raised to the power of 2 = 5^2

Ex 8: Write in exponent form:

$$7 \text{ raised to the power } 4 = \boxed{7^4}$$

Answer: 7 raised to the power of 4 = 7^4

Ex 9: Write in exponent form:

$$10 \text{ raised to the power } 5 = \boxed{10^5}$$

Answer: 10 raised to the power of 5 = 10^5

A.3 CALCULATING POWERS

Ex 10: Evaluate the power:

$$2^3 = \boxed{8}$$

Answer:

$$2^3 = 2 \times 2 \times 2 \\ = 8$$

Ex 11: Evaluate the power:

$$5^2 = \boxed{25}$$

Answer:

$$5^2 = 5 \times 5 \\ = 25$$

Ex 12: Evaluate the power:

$$3^4 = \boxed{81}$$

Answer:

$$3^4 = 3 \times 3 \times 3 \times 3 \\ = 81$$

Ex 13: Evaluate the power:

$$10^3 = \boxed{1000}$$

Answer:

$$10^3 = 10 \times 10 \times 10 \\ = 1000$$

A.4 EXPRESSING NUMBERS IN EXPONENT FORM

Ex 14: Write in exponent form:

$$8 = \boxed{2^3}$$

Answer:

$$8 = 2 \times 2 \times 2 \\ = 2^3$$

Ex 15: Write in exponent form:

$$27 = \boxed{3^3}$$

Answer:

$$27 = 3 \times 3 \times 3 \\ = 3^3$$

Ex 16: Write in exponent form:

$$16 = \boxed{2^4}$$

Answer:

$$16 = 2 \times 2 \times 2 \times 2 \\ = 2^4$$

Ex 17: Write in exponent form:

$$100 = \boxed{10^2}$$

Answer:

$$100 = 10 \times 10 \\ = 10^2$$

A.5 INTERPRETING POWERS

MCQ 18: Determine if the following statement is True or False:

$$2^3 = 2 + 2 + 2$$

- ☐ True
☒ False

Answer:

- The expression 2^3 represents $2 \times 2 \times 2$, not $2 + 2 + 2$.
- Therefore, the statement $2^3 = 2 + 2 + 2$ is **False**.

MCQ 19: Determine if the following statement is True or False:

$$3^2 = 2 \times 2 \times 2$$

- ☐ True
☒ False

Answer:

- The expression 3^2 represents 3×3 , not $2 \times 2 \times 2$.
- Therefore, the statement $3^2 = 2 \times 2 \times 2$ is **False**.

MCQ 20: Determine if the following statement is True or False:

$$4^3 = 4 \times 4 \times 4$$

- ☒ True
☐ False

Answer:

- The expression 4^3 represents $4 \times 4 \times 4$.
- Therefore, the statement $4^3 = 4 \times 4 \times 4$ is **True**.

MCQ 21: Determine if the following statement is True or False:

$$3 \times 4 = 4 + 4 + 4$$

- ☒ True
☐ False

Answer:

- The expression 3×4 represents 3 groups of 4, which is $4 + 4 + 4$.
- Therefore, the statement $3 \times 4 = 4 + 4 + 4$ is **True**.

MCQ 22: Determine if the following statement is True or False:

$$3^2 = 2 \times 2 \times 2$$

- ☐ True
☒ False

Answer:

- The expression 3^2 means 3×3 , which equals 9.
- The expression $2 \times 2 \times 2$ means multiplying 2 three times, which equals 8.
- Therefore, the statement $3^2 = 2 \times 2 \times 2$ is **False**.

A.6 EVALUATING EXPRESSIONS WITH POWERS

Ex 23: Evaluate the expression:

$$2^3 \times 3^2 = \boxed{72}$$

Answer:

$$\begin{aligned} 2^3 \times 3^2 &= (2 \times 2 \times 2) \times (3 \times 3) \\ &= 8 \times 9 \\ &= 72 \end{aligned}$$

Ex 24: Evaluate the expression:

$$3^2 \times 10^2 = \boxed{900}$$

Answer:

$$\begin{aligned} 3^2 \times 10^2 &= (3 \times 3) \times (10 \times 10) \\ &= 9 \times 100 \\ &= 900 \end{aligned}$$

Ex 25: Evaluate the expression:

$$6 \times 10^3 = \boxed{6000}$$

Answer:

$$\begin{aligned} 6 \times 10^3 &= 6 \times (10 \times 10 \times 10) \\ &= 6 \times 1000 \\ &= 6000 \end{aligned}$$

Ex 26: Evaluate the expression:

$$2.5 \times 10^2 = \boxed{250}$$

Answer:

$$\begin{aligned} 2.5 \times 10^2 &= 2.5 \times (10 \times 10) \\ &= 2.5 \times 100 \\ &= 250 \end{aligned}$$

A.7 CHECKING EQUALITY BETWEEN PRODUCTS AND POWERS

MCQ 27: Determine if the following statement is True or False:

$$2 \times 2 \times 3 \times 3 = 2^4$$

- ☐ True
☒ False

Answer:

- The expression $2 \times 2 \times 3 \times 3$ is equal to $2^2 \times 3^2 = 4 \times 9 = 36$.
- The expression $2^4 = 2 \times 2 \times 2 \times 2 = 16$.
- Therefore, the statement $2 \times 2 \times 3 \times 3 = 2^4$ is **False**.

MCQ 28: Determine if the following statement is True or False:

$$2 \times 2 \times 2 = 3^2$$

- ☐ True
☒ False

Answer:

- $2 \times 2 \times 2 = 8$
- $3^2 = 3 \times 3 = 9$
- Therefore, the statement $2 \times 2 \times 2 = 3^2$ is **False**.

MCQ 29: Determine if the following statement is True or False:

$$2 \times 3 \times 2 \times 3 = 2^2 \times 3^2$$

- ☒ True
- ☐ False

Answer:

$$\begin{aligned}
 2 \times 3 \times 2 \times 3 &= (2 \times 2) \times (3 \times 3) \\
 &= 2^2 \times 3^2
 \end{aligned}$$

Therefore, the statement $2 \times 3 \times 2 \times 3 = 2^2 \times 3^2$ is **True**.

MCQ 30: Determine if the following statement is True or False:

$$5 \times 5 \times 5 \times 4 = 5^3 \times 2^2$$

- ☒ True
- ☐ False

Answer:

$$\begin{aligned}
 5 \times 5 \times 5 \times 4 &= (5 \times 5 \times 5) \times 4 \\
 &= 5^3 \times 4 \\
 &= 5^3 \times (2 \times 2) \\
 &= 5^3 \times 2^2
 \end{aligned}$$

Therefore, the statement $5 \times 5 \times 5 \times 4 = 5^3 \times 2^2$ is **True**.

B ORDER OF OPERATIONS

B.1 EVALUATING EXPRESSIONS WITH EXPONENTS IN 2 STEPS

Ex 31: Evaluate this expression:

$$2 \times 5^2 = \boxed{50}$$

Answer:

$$\begin{aligned}
 2 \times 5^2 &= 2 \times 5^2 \quad (\text{exponent: } 5^2 = 25) \\
 &= 2 \times 25 \quad (\text{multiplication: } 2 \times 25 = 50) \\
 &= 50
 \end{aligned}$$

Ex 32: Evaluate this expression:

$$2^3 - 1 = \boxed{7}$$

Answer:

$$\begin{aligned}
 2^3 - 1 &= 2^3 - 1 \quad (\text{exponent: } 2^3 = 8) \\
 &= 8 - 1 \quad (\text{subtraction: } 8 - 1 = 7) \\
 &= 7
 \end{aligned}$$

Ex 33: Evaluate this expression:

$$(2 + 1)^2 = \boxed{9}$$

Answer:

$$\begin{aligned}
 (2 + 1)^2 &= (2 + 1)^2 \quad (\text{parentheses: } 2 + 1 = 3) \\
 &= 3^2 \quad (\text{exponent: } 3^2 = 9) \\
 &= 9
 \end{aligned}$$

Ex 34: Evaluate this expression:

$$2^3 \div 4 = \boxed{2}$$

Answer:

$$\begin{aligned}
 2^3 \div 4 &= 2^3 \div 4 \quad (\text{exponent: } 2^3 = 8) \\
 &= 8 \div 4 \quad (\text{division: } 8 \div 4 = 2) \\
 &= 2
 \end{aligned}$$

Ex 35: Evaluate this expression:

$$(5 - 2)^2 = \boxed{9}$$

Answer:

$$\begin{aligned}
 (5 - 2)^2 &= (5 - 2)^2 \quad (\text{parentheses: } 5 - 2 = 3) \\
 &= 3^2 \quad (\text{exponent: } 3^2 = 9) \\
 &= 9
 \end{aligned}$$

B.2 EVALUATING EXPRESSIONS WITH EXPONENTS IN 3 STEPS

Ex 36: Evaluate this expression:

$$2^3 \times (8 - 6) = \boxed{16}$$

Answer:

$$\begin{aligned}
 2^3 \times (8 - 6) &= 2^3 \times (8 - 6) \quad (\text{parentheses: } 8 - 6 = 2) \\
 &= 2^3 \times 2 \quad (\text{exponent: } 2^3 = 8) \\
 &= 8 \times 2 \quad (\text{multiplication: } 8 \times 2 = 16) \\
 &= 16
 \end{aligned}$$

Ex 37: Evaluate this expression:

$$(2 + 1)^2 - 1 = \boxed{8}$$

Answer:

$$\begin{aligned}
 (2 + 1)^2 - 1 &= (2 + 1)^2 - 1 \quad (\text{parentheses: } 2 + 1 = 3) \\
 &= 3^2 - 1 \quad (\text{exponent: } 3^2 = 9) \\
 &= 9 - 1 \quad (\text{subtraction: } 9 - 1 = 8) \\
 &= 8
 \end{aligned}$$

Ex 38: Evaluate this expression:

$$(3^2 - 1) \times 4 = \boxed{32}$$

Answer:

$$\begin{aligned}
 (3^2 - 1) \times 4 &= (3^2 - 1) \times 4 \quad (\text{eval parenthesis: } 3^2 = 9) \\
 &= (9 - 1) \times 4 \quad (\text{eval parenthesis: } 9 - 1 = 8) \\
 &= 8 \times 4 \quad (\text{multiplication: } 8 \times 4 = 32) \\
 &= 32
 \end{aligned}$$

Ex 39: Evaluate this expression:

$$\frac{3^2 - 1}{2} = \boxed{4}$$

Answer:

$$\begin{aligned}\frac{3^2 - 1}{2} &= \frac{3^2 - 1}{2} && (\text{eval numerator: } 3^2 = 9) \\ &= \frac{9 - 1}{2} && (\text{eval numerator: } 9 - 1 = 8) \\ &= \frac{8}{2} && (\text{division: } 8 \div 2 = 4) \\ &= 4\end{aligned}$$


B.3 FINDING THE OPERATORS

Ex 40: 

$$3^3 \boxed{-} 2^2 = 23$$

Answer:


- $3^3 + 2^2 = 27 + 4 = 31$, so it's not true.
- $3^3 - 2^2 = 27 - 4 = 23$, so it's true.
- $3^3 \times 2^2 = 27 \times 4 = 108$, so it's not true.
- $3^3 \div 2^2 = 27 \div 4 = 6.75$, so it's not true.

Ex 41: 

$$2^4 \boxed{\times} 3^2 = 144$$

Answer:


- $2^4 + 3^2 = 16 + 9 = 25$, so it's not true.
- $2^4 - 3^2 = 16 - 9 = 7$, so it's not true.
- $2^4 \times 3^2 = 16 \times 9 = 144$, so it's true.
- $2^4 \div 3^2 = 16 \div 9 \approx 1.78$, so it's not true.

Ex 42: 

$$2^3 \boxed{\div} 4 = 2$$

Answer:

- $2^3 + 4 = 8 + 4 = 12$, so it's not true.
- $2^3 - 4 = 8 - 4 = 4$, so it's not true.
- $2^3 \times 4 = 8 \times 4 = 32$, so it's not true.
- $2^3 \div 4 = 8 \div 4 = 2$, so it's true.

Ex 43: 

$$(2 + 1)^2 \boxed{+} 1 = 10$$

Answer:

- $(2 + 1)^2 + 1 = 9 + 1 = 10$, so it's true.
- $(2 + 1)^2 - 1 = 9 - 1 = 8$, so it's not true.
- $(2 + 1)^2 \times 1 = 9 \times 1 = 9$, so it's not true.
- $(2 + 1)^2 \div 1 = 9 \div 1 = 9$, so it's not true.