

Intermediate Algebra
Skill-Builder # AE - 2
Applying Exponent Rules Involving Products and Powers

Following are the exponent rules for products and powers.

$$a^n \cdot a^m = a^{n+m} \quad (1)$$

$$(a^n)^m = a^{nm} \quad (2)$$

$$(ab)^n = a^n b^n \quad (3)$$

Examples

The following show how rule (1) is used:

1. $2^2 \cdot 2^3 = 2^{2+3} = 2^5 = 32$

2. $x^2 \cdot x^4 \cdot x^8 = x^{2+4+8} = x^{14}$

3. $x^3 \cdot x^2 \cdot y^4 \cdot y \cdot z \cdot z = x^{3+2} \cdot y^{4+1} \cdot z^{1+1} = x^5 y^5 z^2$

4. $a^3 b c^3 \cdot a b^4 c^6 = a^3 a \cdot b b^4 \cdot c^3 c^6 = a^4 b^5 c^9$

The following show how rule (2) is used:

5. $(2^2)^3 = 2^{2 \cdot 3} = 2^6 = 64$

6. $(c^4)^9 = c^{4 \cdot 9} = c^{36}$

7. $(n^2)^5 (p^4)^4 = n^{2 \cdot 5} p^{4 \cdot 4} = n^{10} p^{16}$

The following show how rule (3) is used:

8. $(2x)^5 = 2^5 x^5 = 32x^5$

9. $(3abx)^4 = 3^4 a^4 b^4 x^4 = 81a^4 b^4 x^4$

The following show how rules (1) - (3) are used in one problem:

10. $2x^4 y (3xy^3)^2 = 2x^4 y \cdot 3^2 x^2 (y^3)^2$
 $= 2x^4 y \cdot 9x^2 y^6$
 $= 2 \cdot 9 \cdot x^4 x^2 \cdot y y^6$
 $= 18x^6 y^7$

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Simplify.

1. $3^2 \cdot 3 \cdot 3^9$ (Leave answer in exponential form.)

2. $4^2 \cdot 4 \cdot 4 \cdot 4^4$ (Leave answer in exponential form.)

3. $x \cdot x^2 \cdot x^3$

4. $y^7 \cdot y^3 \cdot y$

5. $2a \cdot 2^3 a^2 \cdot 2a^3$

6. $-b^3 \cdot 5b^2 \cdot 2b^4$

7. $(t^5)^6$

8. $(m^2)^{10}$

9. $(x^3)^3 (y^2)^5$

10. $(y^4)^3 (w^5)^7$

11. $(a^2)^4 (a^3)^2$

12. $(p^7)^3 (p^2)^9$

13. $(5ab)^2$

14. $(3xy)^3$

15. $(2xy)^3 (3xy)^2$

16. $(3mnp)^3 (mn)^4$

17. $(6w^2x^5)^2$

18. $(-2n^5pw^4)^3$

19. $(3x^3y)^2 (2xy^5)^3$

20. $(2a^3b^5)^3 (2a^6b)^4$

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Answers

1. 3^{12}
2. 4^8
3. x^6
4. y^{11}
5. $32a^6$
6. $-10b^9$
7. t^{30}
8. m^{20}
9. x^9y^{10}
10. $y^{12}w^{35}$
11. a^{14}
12. p^{32}
13. $25a^2b^2$
14. $27x^3y^3$
15. $72x^5y^5$
16. $27m^7n^7p^3$
17. $36w^4x^{10}$
18. $-8n^{15}p^3w^{12}$
19. $72x^9y^{17}$
20. $128a^{33}b^{19}$

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