

EXPONENTS

Rules:

$$a^m \cdot a^n = a^{m+n}$$

$$(a^m)^n = a^{mn}$$

$$\frac{a^m}{a^n} = a^{m-n}$$

Examples:

$$a^3 \cdot a^5 = a^{3+5} = a^8$$

$$(x^2)^4 = x^{2(4)}$$

$$(2x)^3 = 2^3 x^3 = 8x^3$$

$$\left(\frac{z^6}{z^4}\right)^2 = \frac{z^{6(2)}}{z^{4(2)}} = \frac{z^{12}}{z^8} = z^4$$

$$\frac{(x^5)^4}{(x^2)^3} = \frac{x^{5(4)}}{x^{2(3)}} = \frac{x^{20}}{x^6} = x^{20-6} = x^{14}$$

MULTIPLY EXPONENTS

1) $xy \cdot xy =$

2) $x \cdot xy =$

3) $xz \cdot z =$

4) $a^2 \cdot a^2b =$

5) $a^3b^2 \cdot a^2b^3 =$

6) $x^2y^3z \cdot y^4z^2 =$

7) $2m^2n \cdot m^3n^2 =$

8) $(ab^3)(5a^3b^2) =$

9) $3a^4b^3 \cdot 5a^2b^2 =$

10) $3x^2y^3 \cdot 2xy^3 =$

11) $3a^2b(4ab) =$

12) $7x^4y^2(3xy^4) =$

13) $8x^2(2xy^4) =$

14) $5ab^3(2a^5b^2) =$

15) $2a(3a^2b)(2b^2) =$

16) $m^2n^2 \cdot 2mn \cdot 3n^4 =$

17) $3z^2y(2xz^3)(4y) =$

18) $7a^3b^2 \cdot 8a^5 \cdot ab^2 =$

19) $2x^2y(3y^2z^3)(x^2z) =$

20) $x^3y^5z^2 \cdot y^5z^3 \cdot z =$

21) $m^2n(mn^3)(2m^3n^4) =$

POWER TO A POWER

$$1) (x^2)^3 = \quad 2) (x^3)^2 = \quad 3) (y^5)^2 = \quad 4) (y^3)^7 =$$

$$5) (xy)^2 = \quad 6) (x^3y^2)^3 = \quad 7) (x^2yz^3)^4 = \quad 8) (2m)^2 =$$

$$9) (3m^2n)^3 = \quad 10) 3(m^5n^2)^4 = \quad 11) (x^2y^3)^2(xy)^3 =$$

$$12) (3y^4)^2 = \quad 13) (x^3yz^2)^3 = \quad 14) (ab^3c^8)^4 =$$

$$15) 5(x^2y)^3 = \quad 16) 2(a^3b^2)^3 = \quad 17) 4(2xy^5)^3 =$$

$$18) 3(3a^4b^4)^2 = \quad 19) 5(4mn^7)^3 = \quad 20) (x^2y^5z^2)^4 =$$

$$21) (2a^3b^2)^5 = \quad 22) (3m^2n^4)^2 = \quad 23) 2(3z^2y)(x^2y^3) =$$

$$24) 3(2x^4)^2(w^4x^2)^2 = \quad 25) (x^2y^3)^2(y^4z^3) =$$

$$27) (wxy)^3(x^2)(w^4)(y^3)^2 =$$

DIVISION

1) $\frac{x^4}{x^3} =$

2) $\frac{x^8}{x^5} =$

3) $\frac{x^2}{x} =$

4) $\frac{y^5}{y^3} =$

5) $\frac{z^7}{z^4} =$

6) $\frac{z^4}{z^2} =$

7) $\frac{x^3y^4}{x^2} =$

8) $\frac{x^4y^2}{x^4} =$

9) $\frac{y^7z^3}{y^5} =$

10) $\frac{m^3n^5}{m^2} =$

11) $\frac{3m^3}{6m^2} =$

12) $\frac{25z^6}{5z^3} =$

13) $\frac{8z^4}{2z^2} =$

14) $\frac{21x^4y^3}{7xy^2} =$

15) $\frac{15x^3yz^5}{3x^3z^3} =$

16) $\frac{9m^3n^2}{18m^2} =$

17) $\frac{6m^5}{8m^2} =$

18) $\frac{5x^3y^5}{10xy^4} =$

19) $\frac{10y^8}{8y^3} =$

20) $\frac{21x^5y^3z^7}{24x^3y^2z^5} =$

MIXED REVIEW

1) $\frac{2x(3x)}{4x} =$

2) $\frac{x^3y^4(xy^2)}{x^2y^3} =$

3) $\frac{(2x)^3(x^2y)}{6x^2} =$

4) $\frac{4x(3xy)^5}{(2x^2y)^3} =$

5) $\frac{(8m^2n^5)2m^6}{6m^3n^3} =$

6) $\left(\frac{2x}{3y}\right)^2 =$

7) $\frac{(3x^8y)(4x^2)(2y^5)}{(2x^2)^3} =$

8) $\frac{(4xy^3)^2(x^2y)^3}{9x^2(x^3y^4)} =$

9) $\frac{(5m^4n^5)^2(2n^2)^2}{(2mn)^3(3m^2n)} =$

10) $\frac{(m^3n^4)^2(m^5)^3}{(m^2n)^3(mn)^2} =$

11) $\frac{2(2y^2)^3}{5(x^2y)^2} =$

12) $\frac{(2m^3)(6m^2)}{4m^4} =$

13) $\frac{5(2mn^3)^2(mn)^3}{18(m^3n)(n^2)^2} =$

14) $2x^2y\left(\frac{3}{5}xy^3\right)\left(\frac{1}{x^3y}\right) =$

$$15) \frac{1}{3}a^2b^4 \cdot \frac{2}{5}ab^2 =$$

$$16) \frac{(2x)^2}{x} \cdot \left(\frac{1}{2}x\right)^3 =$$

$$17) \left(\frac{8x^3y^5z}{3xy^2}\right)^2 \left(\frac{3xy^2z^2}{2z}\right)^3 =$$

$$18) \left(\frac{x^4y^2z}{2y}\right)^3 \left(\frac{3xy^2z^2}{y^2}\right)^3 =$$

$$19) \frac{5x^4}{z^2} \cdot \frac{3z^8}{2y^2} \cdot \frac{x^3}{6y^3} =$$

$$20) \left(\frac{2}{3}x^3y^2\right) \left(\frac{1}{5}y^2x^2\right) \left(\frac{1}{x^3y^4}\right) =$$

MULTIPLY EXPONENTS - SOLUTIONS

1) $xy \cdot xy = x^2y^2$

2) $x \cdot xy = x^2y$

3) $xz \cdot z = xz^2$

4) $a^2 \cdot a^2b = a^4b$

5) $a^3b^2 \cdot a^2b^3 = a^5b^5$

6) $x^2y^3z \cdot y^4z^2 = x^2y^7z^3$

7) $2m^2n \cdot m^3n^2 = 2m^5n^3$

8) $(ab^3)(5a^3b^2) = 5a^6b^5$

9) $3a^4b^3 \cdot 5a^2b^2 = 15a^6b^5$

10) $3x^2y^3 \cdot 2xy^3 = 6x^3y^6$

11) $3a^2b(4ab) = 12a^3b^2$

12) $7x^4y^2(3xy^4) = 21x^5y^6$

13) $8x^2(2xy^4) = 16x^3y^4$

14) $5ab^3(2a^5b^2) = 10a^6b^5$

15) $2a(3a^2b)(2b^2) = 12a^3b^3$

16) $m^2n^2 \cdot 2mn \cdot 3n^4 = 6m^3n^7$

17) $3z^2y(2xz^3)(4y) = 24z^5xy^2$

18) $7a^3b^2 \cdot 8a^5 \cdot ab^2 = 56a^9b^4$

19) $2x^2y(3y^2z^3)(x^2z) = 6x^4y^3z^4$

20) $x^3y^5z^2 \cdot y^5z^3 \cdot z = x^3y^{10}z^6$

21) $m^2n(mn^3)(2m^3n^4) = 2m^6n^8$

POWER TO A POWER - SOLUTIONS

1) $(x^2)^3 = x^6$

2) $(x^3)^2 = x^6$

3) $(y^5)^2 = y^{10}$

4) $(y^3)^7 = y^{21}$

5) $(xy)^2 = x^2y^2$

6) $(x^3y^2)^3 = x^9y^6$

7) $(x^2yz^3)^4 = x^8y^4z^{12}$

8) $(2m)^2 = 2^2m^2 = 4m^2$

9) $(3m^2n)^3 = 3^3m^6n^3 = 9m^6n^3$

10) $3(m^5n^2)^4 = 3m^9n^6$

11) $(x^2y^3)^2(xy)^3 = (x^4y^6)(x^3y^3) = x^7y^9$

12) $(3y^4)^2 = 3^2y^8 = 9y^8$

13) $(x^3yz^2)^3 = x^9yz^6$

14) $(ab^3c^8)^4 = a^4b^{12}c^{32}$

15) $5(x^2y)^3 = 5x^6y^3$

16) $2(a^3b^2)^3 = 2a^9b^6$

17) $4(2xy^5)^3 = 4(2^3x^3y^{15}) = 4(8x^3y^{15}) = 32x^3y^{15}$

18) $3(3a^4b^4)^2 = 3(3^2a^8b^8) = 3(9a^8b^8) = 27a^8b^8$

19) $5(4mn^7)^3 = 5(4^3m^3n^{21}) = 5(64 m^3n^{21}) = 320m^3n^{21}$

20) $(x^2y^5z^2)^4 = x^8y^{20}z^8$

21) $(2a^3b^2)^5 = 2^5a^{15}b^{10} = 32a^{15}b^{10}$

22) $(3m^2n^4)^2 = 3^2m^4n^8 = 9m^4n^8$

23) $2(3z^2y)(x^2y^3) = 2(3x^2z^2y^4) = 6 x^2z^2y^4$

24) $3(2x^4)^2(w^4x^2)^2 = 3(2^2x^8)(w^8x^4) = 3(4)x^{12}w^6 = 12x^{12}w^6$

25) $(x^2y^3)^2(y^4z^3) = (x^4y^6)(y^4z^3) = x^4y^{10}z^3$

27) $(wxy)^3(x^2)(w^4)(y^3)^2 = (w^3x^3y^3)(x^2w)(y^6) = w^4x^6y^9$

DIVISION - SOLUTIONS

$$1) \frac{x^4}{x^3} = x^1 \quad 2) \frac{x^8}{x^5} = x^3 \quad 3) \frac{x^2}{x} = x \quad 4) \frac{y^5}{y^3} = y^2$$

$$5) \frac{z^7}{z^4} = z^3 \quad 6) \frac{z^4}{z^2} = z^2 \quad 7) \frac{x^3y^4}{x^2} = xy^4 \quad 8) \frac{x^4y^2}{x^4} = y^2$$

$$9) \frac{y^7z^3}{y^5} = y^2z^3 \quad 10) \frac{m^3n^5}{m^2} = mn^5 \quad 11) \frac{3m^3}{6m^2} = \frac{1}{2}m$$

$$12) \frac{25z^6}{5z^3} = 5z^3 \quad 13) \frac{8z^4}{2z^2} = 4z^2 \quad 14) \frac{21x^4y^3}{7xy^2} = 3x^3y$$

$$15) \frac{15x^3yz^5}{3x^3z^3} = 5yz^2 \quad 16) \frac{9m^3n^2}{18m^2} = \frac{1}{2}mn^2$$

$$17) \frac{6m^5}{8m^2} = \frac{3}{4}m^3 \quad 18) \frac{5x^3y^5}{10xy^4} = \frac{1}{2}x^2y$$

$$19) \frac{10y^8}{8y^3} = \frac{5}{4}y^5 \quad 20) \frac{21x^5y^3z^7}{24x^3y^2z^5} = \frac{7}{8}x^2yz^2$$

MIXED REVIEW - SOLUTIONS

$$1) \frac{2x(3x)}{4x} = \frac{6x^2}{4x} = \frac{3}{2}x$$

$$2) \frac{x^3y^4(xy^2)}{x^2y^3} = \frac{x^4y^6}{x^2y^3} = x^2y^3$$

$$3) \frac{(2x)^3(x^2y)}{6x^2} = \frac{8x^3(x^2y)}{6x^2} = \frac{4}{3}x^3y$$

$$4) \frac{4x(3xy)^5}{(2x^2y)^3} = \frac{4x(9x^5y^2)}{8x^6y} = \frac{36x^6y^2}{8x^6y} = \frac{9}{2}y$$

$$5) \frac{(8m^2n^5)2m^6}{6m^3n^3} = \frac{16m^8n^5}{6m^3n^3} = 3m^5n^2$$

$$6) \left(\frac{2x}{3y}\right)^2 = \frac{4x^2}{9y^2}$$

$$7) \frac{(3x^8y)(4x^2)(2y^5)}{(2x^2)^3} = \frac{24x^{10}y^6}{8x^6} = 3x^4y^6$$

$$8) \frac{(4xy^3)^2(x^2y)^3}{9x^2(x^3y^4)} = \frac{16x^2y^6(x^6y^3)}{9x^5y^4} = \frac{16}{9}x^3y^5$$

9)

$$\frac{(5m^4n^5)^2(2n^2)^2}{(2mn)^3(3m^2n)} = \frac{25m^8n^{10}(4n^4)}{8m^3n^3(3m^2n)} = \frac{100m^8n^{14}}{24m^5n^4} = \frac{35}{6}m^3n^{10}$$

$$10) \frac{(m^3n^4)^2 (m^5)^3}{(m^2n)^3 (mn)^2} = \frac{m^6n^8(m^{15})}{m^6n^3(m^2n^2)} = m^{13}n^3$$

$$11) \frac{2(2x^2y^2)^3}{5(x^2y)^2} = \frac{2(8x^6y^6)}{5(x^4y^2)} = \frac{16x^6y^6}{5x^4y^2} = \frac{16}{5}x^2y^4$$

$$12) \frac{(2m^3)(6m^2)}{4m^4} = \frac{12m^6}{4m^4} = 3m^2$$

13)

$$\frac{5(2mn^3)^2 (mn)^3}{18(m^3n)(n^2)^2} = \frac{5(4m^2n^6)(m^3n^3)}{18(m^3n^5)} = \frac{20m^5n^9}{18m^3n^5} = \frac{10}{9}m^2n^4$$

$$14) 2x^2y\left(\frac{3}{5}xy^3\right)\left(\frac{1}{x^3y}\right) = \frac{6x^3y^4}{x^3y} = 6y^3$$

$$15) \frac{1}{3}a^2b^4 \cdot \frac{2}{5}ab^2 = \frac{2}{15}a^3b^6$$

$$16) \frac{(2x)^2}{x} \cdot \left(\frac{1}{2}x\right)^3 = \frac{4x^5}{2x} = 2x^4$$

$$17) \left(\frac{8x^3y^5z}{3xy^2} \right)^2 \left(\frac{3xy^2z^2}{2z} \right)^3 = \frac{64x^6y^2(9x^3y^6z^6)}{9x^2y^4z} = 64x^7y^4z^5$$

18)

$$\left(\frac{x^4y^2z}{2y} \right)^3 \left(\frac{3xy^2z^2}{y^2} \right)^3 = \frac{x^{12}y^6z^3(27x^3y^6z^6)}{8y^3y^6} = \frac{27}{8}x^{13}y^4z^6$$

$$19) \frac{5x^4}{z^2} \cdot \frac{73z^8y^7}{2y^2} \cdot \frac{x^3}{6y^3} = \frac{15x^7y^7z^8}{12y^5z^2} = \frac{5}{4}x^7y^2z^6$$

$$20) \left(\frac{2}{3}x^3y^2 \right) \left(\frac{1}{5}y^2x^2 \right) \left(\frac{1}{x^3y^4} \right) = \frac{2x^5y^4}{15x^3y^4} = \frac{2}{15}x^2$$