

# Exponents Review ~ Developing

Name: KEY

**Base and Exponent**

Identify the base and exponent.

1) $8^3$ Base = <u>8</u> Exponent = <u>3</u>	2) $(-5)^4$ Base = <u>-5</u> Exponent = <u>4</u>	3) $(-4)^6$ Base = <u>-4</u> Exponent = <u>6</u>
4) $3^5$ Base = <u>3</u> Exponent = <u>5</u>	5) $7^5$ Base = <u>7</u> Exponent = <u>5</u>	6) $6^4$ Base = <u>6</u> Exponent = <u>4</u>
7) $(-1)^3$ Base = <u>-1</u> Exponent = <u>3</u>	8) $(-9)^7$ Base = <u>-9</u> Exponent = <u>7</u>	9) $2^8$ Base = <u>2</u> Exponent = <u>8</u>
10) $9^2$ Base = <u>9</u> Exponent = <u>2</u>	11) $4^9$ Base = <u>4</u> Exponent = <u>9</u>	12) $(-2)^8$ Base = <u>-2</u> Exponent = <u>8</u>
13) $(-7)^4$ Base = <u>-7</u> Exponent = <u>4</u>	14) $8^2$ Base = <u>8</u> Exponent = <u>2</u>	15) $2^6$ Base = <u>2</u> Exponent = <u>6</u>
16) $5^7$ Base = <u>5</u> Exponent = <u>7</u>	17) $(-7)^2$ Base = <u>-7</u> Exponent = <u>2</u>	18) $(-6)^9$ Base = <u>-6</u> Exponent = <u>9</u>
19) $9^3$ Base = <u>9</u> Exponent = <u>3</u>	20) $3^8$ Base = <u>3</u> Exponent = <u>8</u>	21) $(-4)^0$ Base = <u>-4</u> Exponent = <u>0</u>

Name: \_\_\_\_\_

Exponents

(A) Rewrite in expanded form:

1)  $23^7$

=  $23 \times 23 \times 23 \times 23 \times 23 \times 23 \times 23$

2)  $3^8$

=  $3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$

3)  $5^9$

=  $5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5$

4)  $18^6$

=  $18 \times 18 \times 18 \times 18 \times 18 \times 18$

(B) Rewrite in exponent form:

1)  $4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4$

=  $4^7$

2)  $22 \times 22 \times 22 \times 22 \times 22 \times 22$

=  $22^6$

3)  $9 \times 9 \times 9 \times 9$

=  $9^4$

4)  $17 \times 17 \times 17 \times 17 \times 17$

=  $17^5$

(C) Rewrite in standard form:

1)  $2^{10}$

=  $1024$

2)  $11^3$

=  $1331$

3)  $4^4$

=  $256$

4)  $13^2$

=  $169$

5)  $5^4$

=  $625$

6)  $9^3$

=  $729$

7)  $8^3$

=  $512$

8)  $15^2$

=  $225$

9)  $1^9$

=  $1$

10)  $6^4$

=  $1296$

Name: \_\_\_\_\_

Evaluate the Expressions

1) $3^6 + 2^9$ $= 729 + 512$ $= 1241$	2) $2^{10} - 4^3$ $= 1024 - 64$ $= 960$	3) $10^3 + 13^2$ $= 1000 + 169$ $= 1169$
4) $8^2 + 3^4$ $= 64 + 81$ $= 145$	5) $4^5 + 5^2$ $= 1024 + 25$ $= 1049$	6) $4^2 \times 12^2$ $= 16 \times 144$ $= 2304$
7) $3^7 \div 3^4$ $= 2187 \div 81$ $= 27$	8) $8^4 \div 2^4$ $= 4096 \div 16$ $= 256$	9) $9^2 \times 2^5$ $= 81 \times 32$ $= 2592$
10) $6^4 + 7^2$ $= 1296 + 49$ $= 1345$	11) $2^2 \times 3^4$ $= 4 \times 81$ $= 324$	12) $8^3 - 5^2$ $= 512 - 25$ $= 487$
13) $12^5 \div 8^3$ $= 248832 \div 512$ $= 486$	14) $3^4 \times 4^2$ $= 81 \times 16$ $= 1296$	15) $6^9 \div 3^9$ $= 10077696 \div 19683$ $= 512$
16) $9^5 \div 3^7$ $= 59049 \div 2187$ $= 27$	17) $4^3 \times 4^2$ $= 64 \times 16$ $= 1024$	18) $5^5 - 3^7$ $= 3125 - 2187$ $= 938$
19) $10^3 - 8^2$ $= 1000 - 64$ $= 936$	20) $11^3 - 9^3$ $= 1331 - 729$ $= 602$	21) $7^3 - 14^2$ $= 343 - 196$ $= 147$

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### Exponent Rules

Use product rule to rewrite each expression as single positive exponent.

1) $5^8 \times 5^5$ $= 5^{8+5}$ $= 5^{13}$	2) $18^4 \times 18^3$ $= 18^{4+3}$ $= 18^7$	3) $13^6 \times 13^5$ $= 13^{6+5}$ $= 13^{11}$
4) $16^3 \times 16^6$ $= 16^{3+6}$ $= 16^9$	5) $12^7 \times 12^3$ $= 12^{7+3}$ $= 12^{10}$	6) $9^9 \times 9^2$ $= 9^{9+2}$ $= 9^{11}$

Use quotient rule to rewrite each expression as single positive exponent.

1) $4^8 \div 4^5$ $= 4^{8-5}$ $= 4^3$	2) $19^7 \div 19^6$ $= 19^{7-6}$ $= 19^1 = 19$	3) $7^5 \div 7^4$ $= 7^{5-4}$ $= 7^1 = 7$
4) $10^3 \div 10^1$ $= 10^{3-1}$ $= 10^2$	5) $12^{15} \div 12^8$ $= 12^{15-8}$ $= 12^7$	6) $9^8 \div 9^8$ $= 9^{8-8}$ $= 9^0$

Use power rule to rewrite each expression as single positive exponent.

1) $(15^9)^7$ $= 15^{9 \times 7}$ $= 15^{63}$	2) $(7^3)^6$ $= 7^{3 \times 6}$ $= 7^{18}$	3) $(17^4)^7$ $= 17^{4 \times 7}$ $= 17^{28}$
4) $(3^5)^4$ $= 3^{5 \times 4}$ $= 3^{20}$	5) $(2^8)^8$ $= 2^{8 \times 8}$ $= 2^{64}$	6) $(5^3)^2$ $= 5^{3 \times 2}$ $= 5^6$

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**Exponent Rules**

Use laws of exponents and simplify. Write your answers in positive exponents.

1) $\frac{p^8}{p^6}$ $= p^{8-6}$ $= p^2$	2) $c^6 \cdot c^5$ $= c^{6+5}$ $= c^{11}$	3) $(h^9)^{10}$ $= h^{9 \times 10}$ $= h^{90}$
4) $(y^2)^9$ $= y^{2 \times 9}$ $= y^{18}$	5) $w^4 \cdot w^7$ $= w^{4+7}$ $= w^{11}$	6) $\frac{a^{10}}{a^2}$ $= a^{10-2}$ $= a^8$
7) $(b^{10})^8$ $= b^{10 \times 8}$ $= b^{80}$	8) $n^2 \cdot n^{10}$ $= n^{2+10}$ $= n^{12}$	9) $(p^4)^6$ $= p^{4 \times 6}$ $= p^{24}$
10) $r^4 \cdot r^3$ $= r^{4+3}$ $= r^7$	11) $(s^7)^5$ $= s^{7 \times 5}$ $= s^{35}$	12) $\frac{k^5}{k}$ $= k^{5-1}$ $= k^4$
13) $\frac{w^9}{w^3}$ $= w^{9-3}$ $= w^6$	14) $u^7 \cdot u^6$ $= u^{7+6}$ $= u^{13}$	15) $\frac{z^7}{z^6}$ $= z^{7-6}$ $= z^1 = z$

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Exponent Rules

Use laws of exponents and simplify. Write your answers in positive exponents.

1) $(n^6)^5$ $= n^{6 \times 5}$ $= n^{30}$	2) $s^4 \cdot s^{10}$ $= s^{4+10}$ $= s^{14}$	3) $\frac{b^7}{b^5}$ $= b^{7-5}$ $= b^2$
4) $(k^{10})^7$ $= k^{10 \times 7}$ $= k^{70}$	5) $\frac{y^8}{y^8}$ $= y^{8-8}$ $= y^0$	6) $(z^4)^9$ $= z^{4 \times 9}$ $= z^{36}$
7) $\frac{m^9}{m^4}$ $= m^{9-4}$ $= m^5$	8) $r^{10} \cdot r^6$ $= r^{10+6}$ $= r^{16}$	9) $g^9 \cdot g^2$ $= g^{9+2}$ $= g^{11}$
10) $\frac{r^{10}}{r^5}$ $= r^{10-5}$ $= r^5$	11) $(p^3)^8$ $= p^{3 \times 8}$ $= p^{24}$	12) $h^4 \cdot h^5$ $= h^{4+5}$ $= h^9$
13) $(d^4)^6$ $= d^{4 \times 6}$ $= d^{24}$	14) $q^8 \cdot q^2$ $= q^{8+2}$ $= q^{10}$	15) $\frac{l^6}{l^4}$ $= l^{6-4}$ $= l^2$

# Exponents Review ~ Proficient

Name: \_\_\_\_\_

## Base and Exponent

Identify the base and exponent.

1) $8^3$ Base = <u>8</u> Exponent = <u>3</u>	2) $(-5)^4$ Base = <u>-5</u> Exponent = <u>4</u>	3) $(-4)^6$ Base = <u>-4</u> Exponent = <u>6</u>
4) $-3^5$ Base = <u>3</u> Exponent = <u>5</u>	5) $7^5$ Base = <u>7</u> Exponent = <u>5</u>	6) $6^4$ Base = <u>6</u> Exponent = <u>4</u>
7) $(-1)^3$ Base = <u>-1</u> Exponent = <u>3</u>	8) $-(-9)^7$ Base = <u>-9</u> Exponent = <u>7</u>	9) $2^8$ Base = <u>2</u> Exponent = <u>8</u>
10) $9^2$ Base = <u>9</u> Exponent = <u>2</u>	11) $4^9$ Base = <u>4</u> Exponent = <u>9</u>	12) $(-2)^8$ Base = <u>-2</u> Exponent = <u>8</u>
13) $(-7)^4$ Base = <u>-7</u> Exponent = <u>4</u>	14) $8^2$ Base = <u>8</u> Exponent = <u>2</u>	15) $-2^6$ Base = <u>2</u> Exponent = <u>6</u>
16) $5^7$ Base = <u>5</u> Exponent = <u>7</u>	17) $(-7)^2$ Base = <u>-7</u> Exponent = <u>2</u>	18) $-(-6)^9$ Base = <u>-6</u> Exponent = <u>9</u>
19) $-9^3$ Base = <u>9</u> Exponent = <u>3</u>	20) $3^8$ Base = <u>3</u> Exponent = <u>8</u>	21) $(-4)^0$ Base = <u>-4</u> Exponent = <u>0</u>

Name: \_\_\_\_\_

Exponents

(A) Rewrite in expanded form:

1)  $(-12)^4$

=  $(-12)(-12)(-12)(-12)$

2)  $2^9$

=  $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

3)  $(-24)^3$

=  $(-24)(-24)(-24)$

4)  $-7^8$

=  $-7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7$

(B) Rewrite in exponent form:

1)  $18 \times 18 \times 18$

=  $18^3$

2)  $(-3) \times (-3) \times (-3) \times (-3) \times (-3)$

=  $(-3)^5$

3)  $-(23 \times 23 \times 23 \times 23)$

=  $-23^4$

4)  $(-8) \times (-8) \times (-8) \times (-8)$

=  $(-8)^4$

(C) Rewrite in standard form:

1)  $(-5)^4$

=  $625$

2)  $12^2$

=  $144$

3)  $-(-8)^3 = -(-512)$

=  $512$

4)  $(-1)^7$

=  $-1$

5)  $(-10)^3$

=  $-1000$

6)  $-9^3$

=  $-729$

7)  $13^2$

=  $169$

8)  $(-14)^2$

=  $196$

9)  $-2^6$

=  $-64$

10)  $7^3$

=  $343$



Name : \_\_\_\_\_

## Parentheses in PEMDAS

Solve.

$$1) (83 - 38) \div 3^2$$
$$= 45 \div 9$$

$$\text{Ans} = \boxed{5}$$

$$2) (36 \div 9)^3 - 87$$
$$= 4^3 - 87$$
$$= 64 - 87$$

$$\text{Ans} = \boxed{-23}$$

$$3) (7^2 + 41) \div 3 - 94$$
$$= (49 + 41) \div 3 - 94$$
$$= 90 \div 3 - 94$$
$$= 30 - 94$$

$$\text{Ans} = \boxed{-64}$$

$$4) (14 \times 5) + 2^5$$
$$= 70 + 32$$

$$\text{Ans} = \boxed{102}$$

$$5) 3^2 + (26 - 9) \times 2$$
$$= 9 + 17 \times 2$$
$$= 9 + 34$$

$$\text{Ans} = \boxed{43}$$

$$6) 7 + 66 \div (2^4 - 5)$$
$$= 7 + 66 \div (16 - 5)$$
$$= 7 + 66 \div 11$$
$$= 7 + 6$$

$$\text{Ans} = \boxed{13}$$

$$7) (64 + 24) \div 2^3$$
$$= 88 \div 8$$

$$\text{Ans} = \boxed{11}$$

$$8) (55 - 45)^2 \div 4$$
$$= 10^2 \div 4$$
$$= 100 \div 4$$

$$\text{Ans} = \boxed{25}$$

$$9) 14 + 75 - (31 \times 3^2)$$
$$= 14 + 75 - (31 \times 9)$$
$$= 14 + 75 - 279$$
$$= 89 - 279$$

$$\text{Ans} = \boxed{-190}$$

$$10) 3^3 + 77 \div (27 - 16)$$
$$= 27 + 77 \div 11$$
$$= 27 + 7$$

$$\text{Ans} = \boxed{34}$$

Name: \_\_\_\_\_

Exponential Rules

Use laws of exponents to rewrite each expression as single positive exponent:

1) $\frac{18^4 \times 18^5}{18^6}$ $= 18^{4+5-6}$ $= 18^3$	2) $((-9)^3)^4 \times (-9)^6$ $= (-9)^{3 \times 4 + 6}$ $= (-9)^{18}$	3) $(11^4)^3 \div (11^6)^2$ $= 11^{4 \times 3 - 6 \times 2}$ $= 11^0$
4) $((-7)^4)^8 \div (-7)^9$ $= (-7)^{4 \times 8 - 9}$ $= (-7)^{23}$	5) $\frac{13^7 \times 13^8}{13^8}$ $= 13^{7+8-8}$ $= 13^7$	6) $((-13)^2)^6 \times (-13)^7$ $= (-13)^{2 \times 6 + 7}$ $= (-13)^{19}$
7) $(8^5)^7 \div 8^9$ $= 8^{5 \times 7 - 9}$ $= 8^{26}$	8) $19^6 \times (19^4)^5$ $= 19^{6+4 \times 5}$ $= 19^{26}$	9) $\frac{20^{10} \times 20^8}{20^9}$ $= 20^{10+8-9}$ $= 20^9$
10) $(3^8)^3 \times 3^5 \times 3^4$ $= 3^{8 \times 3 + 5 + 4}$ $= 3^{33}$	11) $\frac{3^{15}}{3^4 \times 3^{10}}$ $= 3^{15 - (4+10)}$ $= 3^1 = 3$	12) $(6^5)^{12} \div (6^7)^8$ $= 6^{5 \times 12 - 7 \times 8}$ $= 6^4$
13) $\frac{(-5)^{25}}{(-5)^6 \times (-5)^4}$ $= (-5)^{25 - (6+4)}$ $= (-5)^{15}$	14) $6^7 \times (6^5)^3 \times 6^9$ $= 6^{7+5 \times 3+9}$ $= 6^{31}$	15) $(-5)^7 \div ((-5)^4)^0$ $= (-5)^{7-4 \times 0}$ $= (-5)^7$

Name: \_\_\_\_\_

**Exponent Rules**

Use laws of exponents and simplify. Write your answers in exponents.

<p>1) <math>\left(\frac{x^7 y^3}{x^2 y^1}\right)^4 = (x^5 y^2)^4</math>  <math>= x^{20} y^8</math></p>	<p>2) <math>(a^3 b)^4 (a b^6)^2</math>  <math>= a^{12} b^4 \times a^2 b^{12}</math>  <math>= a^{14} b^{16}</math></p>	<p>3) <math>\left(\frac{8m^5 n^7}{2mn^5}\right)^3</math>  <math>= (4m^4 n^2)^3</math>  <math>= 4^3 m^{12} n^6</math>  <math>= 64m^{12} n^6</math></p>
<p>4) <math>(5p^3 q^2)(2p^4 q)^2</math>  <math>= (5p^3 q^2)(4p^8 q^2)</math>  <math>= 20p^{11} q^4</math></p>	<p>5) <math>\frac{(8k^{-5})(2k^3)}{4k^6}</math>  <math>= \frac{16k^8}{4k^6}</math>  <math>= 4k^2</math></p>	<p>6) <math>(b^3 c^7)^2 (b^3 c^2)^3</math>  <math>= b^6 c^{14} \times b^9 c^6</math>  <math>= b^{15} c^{20}</math></p>
<p>7) <math>\left(\frac{6lm^8}{3l^2 m^6}\right)^2</math>  <math>= (2m^2)^2</math>  <math>= 4m^4</math></p>	<p>8) <math>\left(\frac{2r^{-5} s^6}{r^3 s^4}\right)(3r^9 s^4)</math>  <math>= (2r^2 s^2)(3r^9 s^4)</math>  <math>= 6r^{11} s^6</math></p>	<p>9) <math>(u^3 v^6)\left(\frac{9u^5 v^2}{3u^6 v^8}\right)</math>  <math>= (u^3 v^6)(3u^{-1} v^{-6})</math>  <math>= 3u^2 v^0 = 3u^2</math></p>
<p>10) <math>\frac{8v^{15} w^6}{(2v^3 w^2)(v^6 w)}</math>  <math>= \frac{8v^{15} w^6}{2v^9 w^3}</math>  <math>= 4v^6 w^3</math></p>	<p>11) <math>\left(\frac{3s^{12} t^7}{6s^3 t^5}\right)^4</math>  <math>= \left(\frac{1}{2} s^9 t^2\right)^4</math>  <math>= \frac{1}{2^4} s^{36} t^8 = \frac{1}{16} s^{36} t^8</math></p>	<p>12) <math>(3l^2 m^3)(2m^{-5})^2 (lm^4)^3</math>  <math>= (3l^2 m^3)(4m^{10})(l^3 m^{12})</math>  <math>= 12l^5 m^{25}</math></p>
<p>13) <math>(4u^2 v)^3 (u^{-5} v^6)^2 (u^8 w^9)^0</math>  <math>= (4^3 u^6 v^3)(u^{-10} v^{12})(1)</math>  <math>= 64u^{-4} v^{15}</math></p>	<p>14) <math>\left(\frac{6x^3 y^5}{2xy^2 z^8}\right)^5</math>  <math>= (3x^2 y^3)^5</math>  <math>= 3^5 x^{10} y^{15}</math>  <math>= 243x^{10} y^{15}</math></p>	<p>15) <math>\frac{(2a^3 b)(6b^5 c^{17})}{4c^9}</math>  <math>= \frac{12a^3 b^6 c^{17}}{4c^9}</math>  <math>= 3a^3 b^6 c^8</math></p>

Name: \_\_\_\_\_

**Exponent Rules**

Use laws of exponents and simplify. Write your answers in \_\_\_\_\_ exponents.

<p>1) <math>\left(\frac{p^7 q^2}{p^2 q}\right)^2</math>  <math>= (p^5 q)^2</math>  <math>= p^{10} q^2</math></p>	<p>2) <math>(a^2 b)^3 (ab^7)</math>  <math>= (a^6 b^3)(ab^7)</math>  <math>= a^7 b^{10}</math></p>	<p>3) <math>\left(\frac{-6u^5 v^2}{-2u^4 v^2}\right)^2</math>  <math>= (3uv)^2</math>  <math>= 3^2 u^2 v^2</math>  <math>= 9u^2 v^2</math></p>
<p>4) <math>(-8m^3 n^2)(2m^5 n^3)</math>  <math>= (-8m^3 n^2)(2^3 m^{15} n^3)</math>  <math>= -64m^{18} n^5</math></p>	<p>5) <math>\frac{(5r^2)(2r^6)}{7r^5}</math>  <math>= \frac{10r^8}{7r^5}</math>  <math>= \frac{10}{7} r^3 = 1\frac{3}{7} r^3</math></p>	<p>6) <math>\left(\frac{-3x^2 y^3}{x^4 y^2}\right)(-2x^8 y^2)</math>  <math>= (-3x^{-2} y^3)(-2x^8 y^2)</math>  <math>= 6x^6 y^5</math></p>
<p>7) <math>\left(\frac{-9m^7 n^{13}}{3m^4 n^5}\right)^2</math>  <math>= (-3m^3 n^8)^2</math>  <math>= (-3)^2 m^6 n^{16}</math>  <math>= 9m^6 n^{16}</math></p>	<p>8) <math>(s^4 t^2)^3 (s^5 t^3)^2</math>  <math>= (s^{12} t^6)(s^{10} t^6)</math>  <math>= s^{22} t^{12}</math></p>	<p>9) <math>(-8r^3 s^5)\left(\frac{r^7 s^5}{2r^4 s^7}\right)</math>  <math>= (-8r^3 s^5)\left(\frac{1}{2} r^3 s^{-2}\right)</math>  <math>= -4r^6 s^3</math></p>
<p>10) <math>\frac{6l^7 m^3}{(l^5 m)(2lm)}</math>  <math>= \frac{6l^7 m^3}{2l^6 m^2}</math>  <math>= 3lm</math></p>	<p>11) <math>\left(\frac{-4b^{12} c^3}{-8b^4 c^0}\right)^3</math>  <math>= \left(\frac{1}{2} b^8 c^3\right)^3</math>  <math>= \frac{1^3}{2^3} b^{24} c^9</math>  <math>= \frac{1}{8} b^{24} c^9</math></p>	<p>12) <math>(-5a^2 b^4)(2bc^3)^2(-3c^4)^3</math>  <math>= (-5a^2 b^4)(4b^2 c^6)(-27c^{12})</math>  <math>= 540a^2 b^6 c^{18}</math>  <math>\uparrow (-5)(4)(-27) = (-5)(-108) = 540</math></p>
<p>13) <math>\frac{(4l^3 m^2)(2m^3 n^5)}{8n}</math>  <math>= \frac{8l^3 m^5 n^5}{8n}</math>  <math>= l^3 m^5 n^4</math></p>	<p>14) <math>\left(\frac{9p^2 q^{-3}}{27pq^3 r^{-2}}\right)^0</math>  <math>= 1</math></p>	<p>15) <math>(-8x^2 y)(y^3 z^2)^2 (2x^3 y^2)^3</math>  <math>= (-8x^2 y)(y^6 z^4)(8x^9 y^6)</math>  <math>= -64x^{11} y^{13} z^4</math></p>

# Exponents Review ~ Extending

Name: KEY

## Base and Exponent

Identify the base and exponent.

1) $\left(\frac{2}{3}\right)^2$ Base = <u><math>\frac{2}{3}</math></u> Exponent = <u>2</u>	2) $6^4$ Base = <u>6</u> Exponent = <u>4</u>	3) $-(-9)^3$ Base = <u>-9</u> Exponent = <u>3</u>
4) $\left(-\frac{5}{8}\right)^0$ Base = <u><math>-\frac{5}{8}</math></u> Exponent = <u>0</u>	5) $\left(\frac{8}{9}\right)^4$ Base = <u><math>\frac{8}{9}</math></u> Exponent = <u>4</u>	6) $\left(-\frac{1}{6}\right)^6$ Base = <u><math>-\frac{1}{6}</math></u> Exponent = <u>6</u>
7) $-5^7$ Base = <u>5</u> Exponent = <u>7</u>	8) $\left(-\frac{3}{8}\right)^4$ Base = <u><math>-\frac{3}{8}</math></u> Exponent = <u>4</u>	9) $\left(\frac{4}{7}\right)^3$ Base = <u><math>\frac{4}{7}</math></u> Exponent = <u>3</u>
10) $\left(-\frac{7}{4}\right)^2$ Base = <u><math>-\frac{7}{4}</math></u> Exponent = <u>2</u>	11) $-2^9$ Base = <u>2</u> Exponent = <u>9</u>	12) $\left(\frac{5}{4}\right)^6$ Base = <u><math>\frac{5}{4}</math></u> Exponent = <u>6</u>
13) $\left(\frac{4}{5}\right)^7$ Base = <u><math>\frac{4}{5}</math></u> Exponent = <u>7</u>	14) $\left(\frac{1}{8}\right)^5$ Base = <u><math>\frac{1}{8}</math></u> Exponent = <u>5</u>	15) $(-2)^7$ Base = <u>-2</u> Exponent = <u>7</u>
16) $-(-8)^{-3}$ Base = <u>-8</u> Exponent = <u>-3</u>	17) $\left(\frac{6}{7}\right)^{-5}$ Base = <u><math>\frac{6}{7}</math></u> Exponent = <u>-5</u>	18) $(-3)^8$ Base = <u>-3</u> Exponent = <u>8</u>

Name: \_\_\_\_\_

Exponents

(A) Rewrite in expanded form:

$$1) \left(\frac{4}{7}\right)^3$$
$$= \underline{\left(\frac{4}{7}\right)\left(\frac{4}{7}\right)\left(\frac{4}{7}\right)}$$

$$2) (6.3)^5$$
$$= \underline{(6.3)(6.3)(6.3)(6.3)(6.3)}$$

$$3) (0.9)^6$$
$$= \underline{0.9 \times 0.9 \times 0.9 \times 0.9 \times 0.9 \times 0.9}$$

$$3) -\left(-\frac{8}{5}\right)^4$$
$$= \underline{-\left(-\frac{8}{5}\right)\left(-\frac{8}{5}\right)\left(-\frac{8}{5}\right)\left(-\frac{8}{5}\right)}$$

(B) Rewrite in exponent form:

$$1) \frac{5}{9} \times \frac{5}{9} \times \frac{5}{9} \times \frac{5}{9} \times \frac{5}{9} \times \frac{5}{9} \times \frac{5}{9} \times \frac{5}{9} \times \frac{5}{9}$$
$$= \underline{\left(\frac{5}{9}\right)^9}$$

$$2) \cancel{(9.4 \times 9.4 \times 9.4 \times 9.4 \times 9.4 \times 9.4)}$$
$$= \underline{-9.4^6}$$

$$3) 4.3 \times 4.3 \times 4.3 \times 4.3 \times 4.3 \times 4.3 \times 4.3$$
$$= \underline{4.3^7}$$

$$4) \left(-\frac{2}{3}\right) \times \left(-\frac{2}{3}\right) \times \left(-\frac{2}{3}\right) \times \left(-\frac{2}{3}\right) \times \left(-\frac{2}{3}\right)$$
$$= \underline{\left(-\frac{2}{3}\right)^5}$$

(C) Rewrite standard form:

$$1) \left(\frac{1}{4}\right)^4$$
$$= \underline{\frac{1}{4^4} = \frac{1}{256}}$$

$$2) (0.5)^3$$
$$= \underline{0.125}$$

$$3) -(1.6)^2$$
$$= \underline{-2.56}$$

$$4) \left(\frac{9}{2}\right)^3$$
$$= \underline{\frac{9^3}{2^3} = \frac{729}{8}}$$

$$5) (3.8)^3$$
$$= \underline{54.872}$$

$$6) -\left(-\frac{8}{3}\right)^2$$
$$= \underline{-\frac{8^2}{3^2} = -\frac{64}{9}}$$

$$7) \left(-\frac{7}{5}\right)^3$$
$$= \underline{-\frac{7^3}{5^3} = -\frac{343}{125}}$$

$$8) (5.2)^4$$
$$= \underline{731.1616}$$

Name: \_\_\_\_\_

## Nested parentheses in PEMDAS

Solve.

$$\begin{aligned} 1) & 2 - 3^2 \div (1 + (2 \times 4)) \\ & = 2 - 9 \div (1 + 8) \\ & = 2 - 9 \div 9 \\ & = 2 - 1 \end{aligned}$$

$$\text{Ans} = \boxed{1}$$

$$\begin{aligned} 2) & 5 - ((4 + 2^4) \times 8) \div 16 + 11 \\ & = 5 - ((4 + 16) \times 8) \div 16 + 11 \\ & = 5 - (20 \times 8) \div 16 + 11 \\ & = 5 - 160 \div 16 + 11 \\ & = 5 - 10 + 11 = -5 + 11 \end{aligned}$$

$$\text{Ans} = \boxed{6}$$

$$\begin{aligned} 3) & 14 \div 2 + ((6 \times 7) + 4^3) \div 2 \\ & = 7 + (42 + 64) \div 2 \\ & = 7 + 106 \div 2 \\ & = 7 + 53 \end{aligned}$$

$$\text{Ans} = \boxed{60}$$

$$\begin{aligned} 4) & ((7 \times 3) + 9) \div 10 - 5^2 \\ & = (21 + 9) \div 10 - 25 \\ & = 30 \div 10 - 25 \\ & = 3 - 25 \end{aligned}$$

$$\text{Ans} = \boxed{-22}$$

$$\begin{aligned} 5) & ((3 \times 6^2) + 5) - 9 \div 3 \\ & = ((3 \times 36) + 5) - 3 \\ & = (108 + 5) - 3 \\ & = 113 - 3 \end{aligned}$$

$$\text{Ans} = \boxed{110}$$

$$\begin{aligned} 6) & ((4 \times 2^5) \div 4) - 15 + 12 \\ & = ((4 \times 32) \div 4) - 15 + 12 \\ & = (128 \div 4) - 15 + 12 \\ & = 32 - 15 + 12 \\ & = 17 + 12 \end{aligned}$$

$$\text{Ans} = \boxed{29}$$

$$\begin{aligned} 7) & 72 + ((59 - 5) \div 3^3) \times 5 + 13 \\ & = 72 + (54 \div 27) \times 5 + 13 \\ & = 72 + 2 \times 5 + 13 \\ & = 72 + 10 + 13 \end{aligned}$$

$$\text{Ans} = \boxed{95}$$

$$\begin{aligned} 8) & 8 + ((3^2 \times 6) - 18) \div 9 \\ & = 8 + ((9 \times 6) - 18) \div 9 \\ & = 8 + (54 - 18) \div 9 \\ & = 8 + 36 \div 9 \\ & = 8 + 4 \end{aligned}$$

$$\text{Ans} = \boxed{12}$$

$$\begin{aligned} 9) & 81 + 45 \div ((4 + 1) \times 3) - 4^3 \\ & = 81 + 45 \div (5 \times 3) - 64 \\ & = 81 + 45 \div 15 - 64 \\ & = 81 + 3 - 64 \\ & = 84 - 64 \end{aligned}$$

$$\text{Ans} = \boxed{20}$$

$$\begin{aligned} 10) & 15 - ((11 + 4) \times 2^2) + 10 \\ & = 15 - (15 \times 4) + 10 \\ & = 15 - 60 + 10 \\ & = -45 + 10 \end{aligned}$$

$$\text{Ans} = \boxed{-35}$$

Name: \_\_\_\_\_

**Exponential Rules**

Use laws of exponents to rewrite each expression as single exponent:

<p>1) <math>\left(\frac{3^7 \times 3^3}{3^9}\right)^5</math>  <math>= (3^1)^5</math>  <math>= 3^5</math></p>	<p>2) <math>\left(\frac{10^9 \times 10^5}{10^6 \times 10^4}\right)^2</math>  <math>= \left(\frac{10^{14}}{10^{10}}\right)^2 = (10^4)^2</math>  <math>= 10^8</math></p>	<p>3) <math>\left(\left(\frac{13^7}{1} \times \frac{13^5}{13^3 \times 13^4}\right)^2\right)^6</math>  <math>= \left(\frac{13^{12}}{13^7}\right)^{12} = (13^5)^{12}</math>  <math>= 13^{60}</math></p>
<p>4) <math>\left(\left(\frac{11^9}{11^2 \times 11^3}\right)^{-2}\right)^4</math>  <math>= (11^4)^{-8}</math>  <math>= 11^{-32}</math></p>	<p>5) <math>12^5 \times \left(\frac{12^6 \times 12^3}{12^4}\right)^{-2}</math>  <math>= 12^5 \times (12^5)^{-2}</math>  <math>= 12^5 \times 12^{-10}</math>  <math>= 12^{-5}</math></p>	<p>6) <math>\left(\frac{19^3 \times 19^2}{19^4}\right)^{-5} \times (19^2)^5</math>  <math>= (19^1)^{-5} \times 19^{10}</math>  <math>= 19^5</math></p>
<p>7) <math>\left(\left(\frac{5^2}{5^6}\right)^{-3} \times \left(\frac{5^3}{5^4}\right)^{-2}\right)^{-2}</math>  <math>= (5^{12} \times 5^2)^{-2}</math>  <math>= (5^{14})^{-2} = 5^{-28}</math></p>	<p>8) <math>\left(\frac{(15^{-5} \times 15^3)^2}{15^{-6}}\right)^4</math>  <math>= \left(\frac{15^{-4}}{15^{-6}}\right)^4 = (15^2)^4</math>  <math>= 15^8</math></p>	<p>9) <math>\left(\left(\frac{2^{-7} \times 2^{-3}}{2^{-5}}\right)^4 \times 2^7\right)^2</math>  <math>= ((2^{-5})^4 \times 2^7)^2</math>  <math>= (2^{-13})^2 = 2^{-26}</math></p>
<p>10) <math>\left(\frac{7}{9}\right)^5 \times \left(\frac{\left(\frac{7}{9}\right)^3}{\left(\frac{7}{9}\right)^{-2} \times \left(\frac{7}{9}\right)^{-4}}\right)^2</math>  <math>= \left(\frac{7}{9}\right)^5 \times \left(\left(\frac{7}{9}\right)^9\right)^2</math>  <math>= \left(\frac{7}{9}\right)^{23}</math></p>	<p>11) <math>\left(\frac{\left(\frac{2}{3}\right)^{-4} \times \left(\frac{2}{3}\right)^3}{\left(\frac{2}{3}\right)^5}\right)^{-2}</math>  <math>= \left(\left(\frac{2}{3}\right)^{-6}\right)^{-2}</math>  <math>= \left(\frac{2}{3}\right)^{12}</math></p>	<p>12) <math>\left(\frac{(3^2)^{-5} \times (3^5)^{-2}}{(3^{-3})^4 \times (3^{-5})^3}\right)^7</math>  <math>= \left(\frac{3^{-20}}{3^{-27}}\right)^7 = (3^7)^7</math>  <math>= 3^{49}</math></p>
<p>13) <math>\left(\frac{\left(\frac{4}{7}\right)^5 \times \left(\frac{4}{7}\right)^4}{\left(\frac{4}{7}\right)^{-3} \times \left(\frac{4}{7}\right)^{-4}}\right)^2</math>  <math>= \left(\left(\frac{4}{7}\right)^{16}\right)^2</math>  <math>= \left(\frac{4}{7}\right)^{32}</math></p>	<p>14) <math>\left(\frac{\left(\frac{-5}{9}\right)^3 \times \left(\frac{-5}{9}\right)^4}{\left(\left(\frac{-5}{9}\right)^{-3}\right)^{-3}}\right)^{-2}</math>  <math>= \left(\left(\frac{-5}{9}\right)^{-2}\right)^{-2}</math>  <math>= \left(\frac{-5}{9}\right)^4</math></p>	<p>15) <math>\left(\frac{15}{17}\right)^2 \times \left(\frac{\left(\frac{15}{17}\right)^5}{\left(\frac{15}{17}\right)^{-4} \times \left(\frac{15}{17}\right)^{-3}}\right)^3</math>  <math>= \left(\frac{15}{17}\right)^2 \times \left(\left(\frac{15}{17}\right)^{12}\right)^3</math>  <math>= \left(\frac{15}{17}\right)^{38}</math></p>



Name: \_\_\_\_\_

Exponent Rules

Use laws of exponents and simplify. Write your answers in \_\_\_\_\_ exponents.

1) $\left(\frac{x^7 y^3}{x^2 y}\right)^4 = (x^5 y^2)^4$ $= x^{20} y^8$	2) $(a^3 b)^4 (ab^6)^2$ $= (a^{12} b^4)(a^2 b^{12})$ $= a^{14} b^{16}$	3) $\left(\frac{8m^5 n^7}{2mn^5}\right)^3$ $= (4m^4 n^2)^3$ $= 64m^{12} n^6$
4) $(5p^3 q^2)(2p^4 q)^2$ $= (5p^3 q^2)(4p^8 q^2)$ $= 20p^{11} q^4$	5) $\frac{(8k^{-5})(2k^3)}{4k^{-6}}$ $= \frac{16k^{-2}}{4k^{-6}}$ $= 4k^4$	6) $(b^{-3} c^{-7})^{-2} (b^3 c^{-2})^{-3}$ $= (b^6 c^{14})(b^{-9} c^6)$ $= b^{-3} c^{20}$
7) $\left(\frac{6lm^2}{3l^3 m^6}\right)^2$ $= (2l^{-2} m^{-4})^2$ $= 4l^{-4} m^{-8}$	8) $\left(\frac{2r^{-5} s^6}{r^3 s^4}\right)(3r^9 s^{-4})$ $= (2r^{-8} s^2)(3r^9 s^{-4})$ $= 6rs^{-2}$	9) $(u^{-3} v^5)\left(\frac{9u^{-5} v^2}{3u^6 v^{-8}}\right)$ $= (u^{-3} v^5)(3u^{-11} v^{10})$ $= 3u^{-14} v^{15}$
10) $\frac{8v^5 w^{-6}}{(2v^{-3} w^2)(v^6 w)}$ $= \frac{8v^5 w^{-6}}{2v^{-3} w^3}$ $= 4v^8 w^{-9}$	11) $\left(\frac{3s^{-2} t^7}{6s^3 t^{-5}}\right)^4$ $= \left(\frac{1}{2} s^{-5} t^{12}\right)^4$ $= \frac{1}{16} s^{-20} t^{48}$	12) $(3l^{-2} m^3)(2m^{-5})^2 (lm^4)^{-3}$ $= (3l^{-2} m^3)(4m^{-10})(l^{-3} m^{-12})$ $= 12l^{-5} m^{-19}$
13) $(4u^2 v)^3 (u^{-5} v^6)^2 (u^{-8} w^{-9})$ $= (64u^6 v^3)(u^{-10} v^{12})(u^{-8} w^{-9})$ $= 64u^{-12} v^{15} w^{-9}$	14) $\left(\frac{6x^{-3} y^5}{2xy^2 z^6}\right)^5$ $= (3x^{-4} y^3 z^{-6})^5$ $= 243x^{-20} y^{15} z^{-30}$	15) $\frac{(2a^{-3} b)(6b^5 c^{-7})}{4c^{-9}}$ $= \frac{12a^{-3} b^6 c^{-7}}{4c^{-9}}$ $= 3a^{-3} b^6 c^2$

Name: \_\_\_\_\_

Exponent Rules

Use laws of exponents and simplify. Write your answers in \_\_\_\_\_ exponents.

<p>1) <math>\left(\frac{p^{-7}q^2}{p^2q^{-8}}\right)^2</math>  <math>= (p^{-9}q^{10})^2</math>  <math>= p^{-18}q^{20}</math></p>	<p>2) <math>(a^{-2}b)^{-3}(ab^{-7})</math>  <math>= (a^6b^{-3})(ab^{-7})</math>  <math>= a^7b^{-10}</math></p>	<p>3) <math>\left(\frac{-6u^{-5}v^2}{-2u^4n^3}\right)^2</math>  <math>= (3u^{-9}v^2n^{-3})^2</math>  <math>= 9u^{-18}v^4n^{-6}</math></p>
<p>4) <math>(-8m^{-3}n^2)(2m^5n)^3</math>  <math>= (-8m^{-3}n^2)(8m^{15}n^3)</math>  <math>= -64m^{12}n^5</math></p>	<p>5) <math>\frac{(5r^{-2})(2r^{-6})}{7r^5}</math>  <math>= \frac{10r^{-8}}{7r^5}</math>  <math>= \frac{10}{7}r^{-13}</math></p>	<p>6) <math>\left(\frac{-3x^2y^3}{x^{-4}y^2}\right)(-2x^{-8}y^{-2})</math>  <math>= (-3x^6y)(-2x^{-8}y^{-2})</math>  <math>= 6x^{-2}y^{-1}</math></p>
<p>7) <math>\left(\frac{-9mn^{-3}}{3m^4n^{-5}}\right)^2</math>  <math>= (-3m^{-3}n^2)^2</math>  <math>= 9m^{-6}n^4</math></p>	<p>8) <math>(s^4t^2)^3(s^{-5}t^3)^2</math>  <math>= (s^{12}t^6)(s^{-10}t^6)</math>  <math>= s^2t^{12}</math></p>	<p>9) <math>(-8r^3s^{-5})\left(\frac{r^7s^{-5}}{2r^{-4}s^7}\right)</math>  <math>= (-8r^3s^{-5})\left(\frac{1}{2}r^{11}s^{-12}\right)</math>  <math>= -4r^{14}s^{-17}</math></p>
<p>10) <math>\frac{6l^7m^{-3}}{(l^5m^{-2})(2lm^3)}</math>  <math>= \frac{6l^7m^{-3}}{2l^6m^1}</math>  <math>= 3lm^{-4}</math></p>	<p>11) <math>\left(\frac{-4b^{-2}c^3}{-8b^4c^{-7}}\right)^3</math>  <math>= \left(\frac{1}{2}b^{-6}c^{10}\right)^3</math>  <math>= \frac{1}{8}b^{-18}c^{30}</math></p>	<p>12) <math>(-5a^2b^4)(2bc^{-3})^2(-3c^4)^3</math>  <math>= (-5a^2b^4)(4b^2c^{-6})(-27c^{12})</math>  <math>= 540a^2b^6c^6</math></p>
<p>13) <math>\frac{(4l^3m^{-2})(2m^{-3}n^5)}{8n^7}</math>  <math>= \frac{8l^3m^{-5}n^5}{8n^7}</math>  <math>= l^3m^{-5}n^{-2}</math></p>	<p>14) <math>\left(\frac{9p^2q^{-3}}{27pq^3r^{-2}}\right)^2</math>  <math>= \left(\frac{1}{3}pq^{-6}r^2\right)^2</math>  <math>= \frac{1}{9}p^2q^{-12}r^4</math></p>	<p>15) <math>(-8x^2y)(y^3z^{-2})^{-2}(2x^{-3}y^2)^3</math>  <math>= (-8x^2y)(y^{-6}z^4)(8x^{-9}y^6)</math>  <math>= -64x^{-7}y^1z^4</math></p>