Numbers, Relations & Functions 10 Name________________________________

Mutilpying Polynomials Date____________

Find each product.

1) $5(6b+3)$

2) $8(6r+3)$

3) $2(8x+y)$

4) $5mn(3m+2n)$

5) $7(x-7y)$

6) $2mn(8m-2n)$

7) $(4x-2y)(6x+6y)$

8) $(6x+3y)(4x-7y)$

9) $(2x+5y)(7x-8y)$

10) $(3x+6y)(5x-8y)$

11) $(5x-4y)(5x^2-4xy+6y^2)$

12) $(8x-7y)(6x^2+8xy+3y^2)$

13) $(6a^2-2a-3)(8a+2)$

14) $(2k^2+8k-2)(7k+4)$

15) $(7a^2-2ab+2b^2)(a^2-2ab-8b^2)$

16) $(x^2-4xy+2y^2)(x^2-2xy-7y^2)$

Numbers, Relations & Functions 10 Name________________________

Mutilpying Polynomials Date__________

Find each product.

1) $5(6b+3)$

30b + 15

2) $8(6r+3)$

48r +24

3) $2(8x+y)$

16x + 2 y

4) $5mn(3m+2n)$

$15m^2n + 10mn^2$

5) $7(x-7y)$

$7x - 49y$

6) $2mn(8m-2n)$

$16m^2n - 4mn^2$

7) $(4x-2y)(6x+6y)$

$24x^2 + 12xy - 12y^2$

8) $(6x+3y)(4x-7y)$

$24x^2 - 30xy - 21y^2$

9) $(2x+5y)(7x-8y)$

$14x^2 + 19xy - 40y^2$

10) $(3x+6y)(5x-8y)$

$15x^2 + 6xy - 48y^2$

11) $(5x-4y)(5x^2-4xy+6y^2)$

$25x^3 - 40x^2y + 46xy^2 - 24y^3$

12) $(8x-7y)(6x^2+8xy+3y^2)$

$48x^3 + 22x^2y - 32xy^2 - 21y^3$

13) $(6a^2-2a-3)(8a+2)$

$48a^3 - 4a^2 - 28a - 6$

14) $(2k^2+8k-2)(7k+4)$

$14K^3 + 64K^2 + 18K - 8$

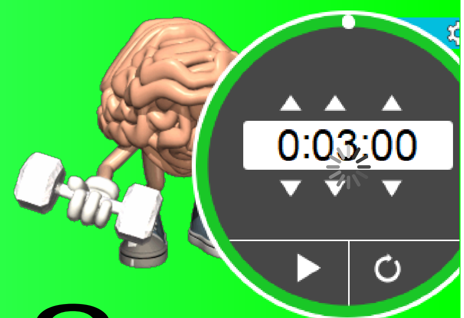
15) $(7a^2-2ab+2b^2)(a^2-2ab-8b^2)$

$7a^4 - 16a^3b - 50a^2b^2 + 12ab^3 - 16b^4$

16) $(x^2-4xy+2y^2)(x^2-2xy-7y^2)$

$x^4 - 6x^3y + 3x^2y^2 + 24xy^3 - 14y^4$

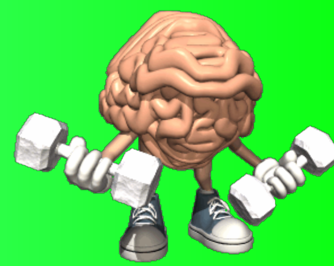
Warm Up



Expand and Simplify

$$(x-3)^2 - (x+2)^2$$

Warm Up



Expand and Simplify

$$(x-3)^2 - (x+2)^2$$

$$(x-3)(x-3) - (x+2)(x+2)$$

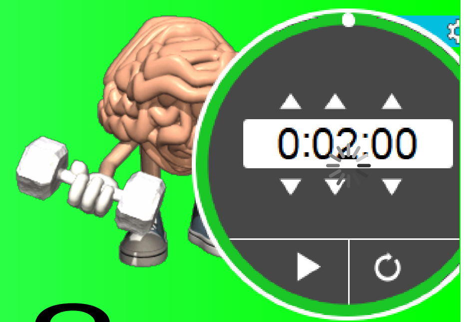
$$x^2 - 3x - 3x + 9 - (x^2 + 2x + 2x + 4)$$

$$(x^2 - 6x + 9) - (x^2 + 4x + 4)$$

$$\boxed{x^2}\ \boxed{-6x}\ \boxed{+9}\ \boxed{-x^2}\ \boxed{-4x}\ \boxed{-4}$$

$$\boxed{-10x + 5}$$

Warm Up



Expand and Simplify

$$(x-3)^2 - (x+2)^2$$

$$(x-3)(x-3) \quad - \quad (x+2)(x+2)$$

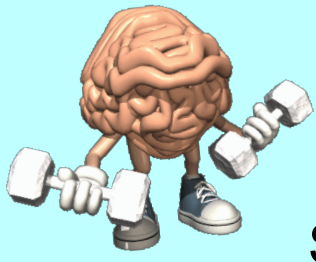
$$x^2 - 3x \underbrace{-3x}_{} + 9 \quad - \quad (x^2 + 2x + 2x + 4)$$

$$(x^2 - 6x + 9) \quad - \quad (x^2 + 4x + 4)$$

$$x^2 - 6x + 9 \qquad -x^2 - 4x - 4$$

$$x^2 - x^2 - 6x - 4x + 9 - 4$$

$$\boxed{-10x + 5}$$



Warm Up

Simplify THEN evaluate

1) $[(-2)^3 \times (-2)^2] - [(-3)^3 \div (-3)^2]$

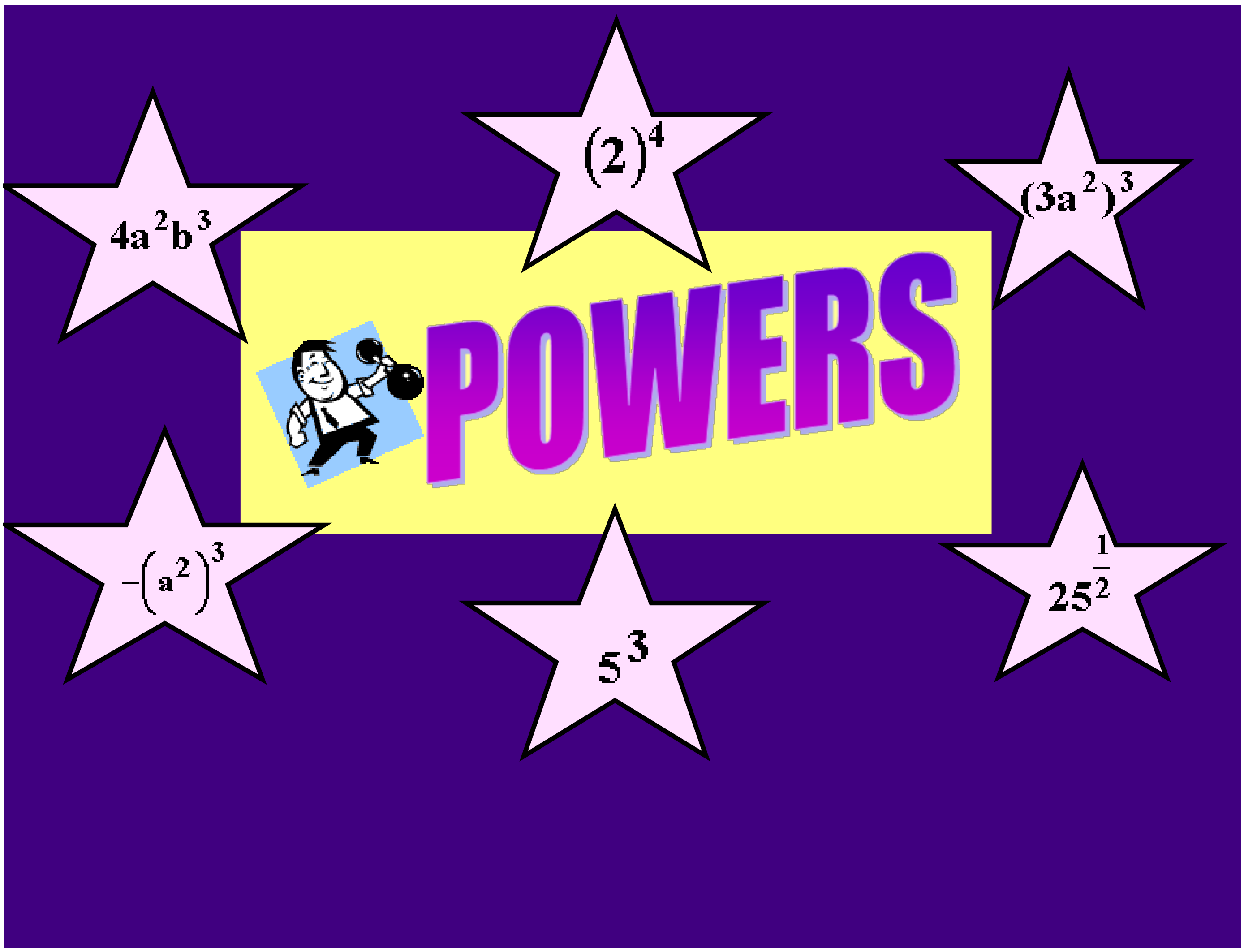
2) $$\frac{\left[(2 \times 2^2)^5 - (5^6 \div 5^4)^4\right]^0}{(3^3 \times 3)^2 - (3^6 \div 3^4)^2}$$

3)

Simplify the following using laws of exponents

a) $(3xy^2)^4$

b) $\dfrac{(12r^{12}t^3)}{(3r^{10}t^2)}$


$4a^2b^3$
$(2)^4$
$(3a^2)^3$
POWERS
$-(a^2)^3$
5^3
$25^{\frac{1}{2}}$


Power
8
3
exponent
base

Write each power as a product, then evaluate.

#1

a) 3^4

$(3)(3)(3)(3)$

81

b) 5^3

c) $\left(\frac{2}{3}\right)^3$

$\left(\frac{2}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right)$

$\frac{8}{27}$

d) $\left(\frac{4}{5}\right)^2$

Write each product as a power, then evaluate.

#2

a) $(4)(4)(4)$

$(4)^3$

$= 64$

b) $(-6)(-6)(-6)(-6)(-6)$

$(-6)^5$

$= -7776$

Can you see the difference?

$(-4)^2$

$(-4)(-4)$

16

-4^2

-4×4

-16

what is the base?

$(-4)^7 \rightarrow$ base -4

$-3^5 \rightarrow$ base 3

$(-1)^{10247} = -1$ $(-1)^{29584} = 1$

Evaluating powers when the base is negative...

If the exponent is ______ the answer will be ______.

If the exponent is ______ the answer will be ______.

$-\ (-)$

$-(-2)^3 = +$

$(-2)^4 = +$

$-2^5 = -$

$-\ (+)$

$-(-2)^6 = -$

Try These:

1. -4^2

Click here to check your answer.

2. $(-3)^2$

Click here to check your answer.

3. $(-2)^3$

Click here to check your answer.

Warm Up
Grade 9
October 1, 2010

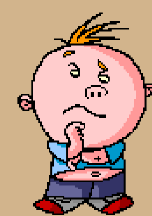
Write the following as a repeated multiple and evaluate

1) $(-5)^4$ 2) -2^5 3) $-(7)^3$

Write as a power then evaluate

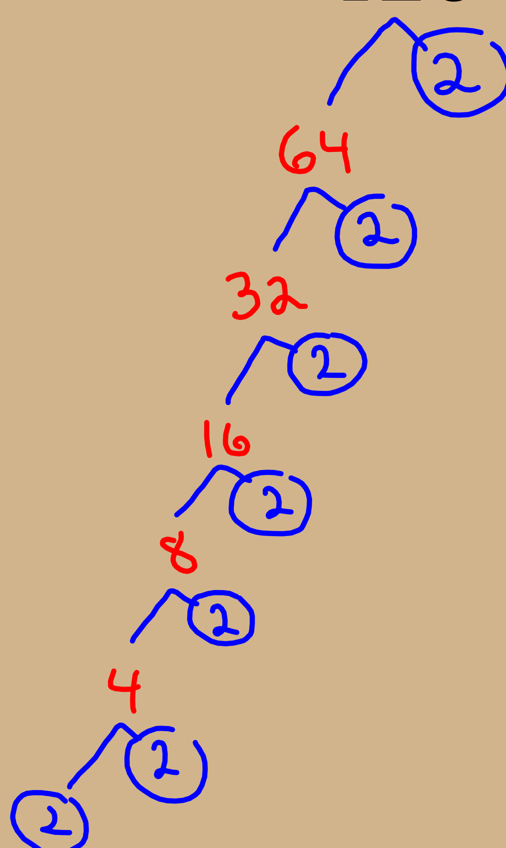
1) $-(-4)(-4)(-4)(-4)(-4)$ 2) $(6)(6)(6)(6)(6)$

Express as a power of 2.



$2^7 = 128$

$128 = 2^{\square}$



10^{21}

35^{0}

10^{3} 10^{5}

Section 2.2

10^{0} 700^{0}

Powers of Ten and the Zero Exponent

Avogadro's number = 6.0221415×10^{23}

The speed of light = $2.99\ 792\ 458 \times 10^{8}$ m / s

Temperature of the Sun's Core = 1.5×10^{7} °C

since 15000000 kelvin = 14999726.85 degree Celsius

Distance related to Powers of 10

http://vimeo.com/819138

Number in Words	Standard Form	Power
One billion	1 000 000 000	10^9
One hundred million	100 000 000	10^8
Ten million	10 000 000	10^7
One million	1 000 000	10^6
One hundred thousand	100 000	10^5
Ten thousand	10 000	10^4
One thousand	1 000	10^3
One hundred	100	10^2
Ten	10	10^1
One	1	10^0

*Image taken from "Math Makes Sense 9", page 59, copyright to pearson education Canada

Any number (except 0) with an exponent 0 will equal 1

$2^0 = 1$

$13^0 = 1$

$199^0 = 1$

$(-6)^0 = 1$

$$\frac{\cancel{(2^5 \times 3^4)^0}}{2^4}$$

$$= \frac{1}{2^4}$$

Why???

Zero Exponent LAW

A power with an interger base, not including 0, and an exponent of 0 is equal to 1

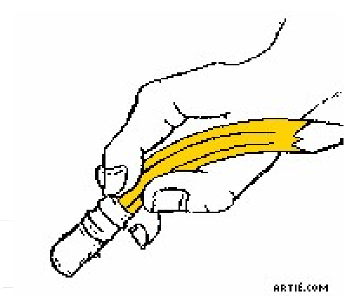
Writing Numbers Using Powers of Ten

A place value chart may help

Write 96 713 as a power of 10

Ten Thousands	Thousands	Hundreds	Tens	Ones

Erase to see solutions



96 713 =

= (9 x 1(

=

$$\overset{5}{3}\,\overset{4}{7}\,\overset{3}{8}\;\overset{2}{4}\,\overset{1}{2}\,\overset{0}{5}$$

Write in powers of ten:

$$(3 \times 10^5) + (7 \times 10^4) + (8 \times 10^3)$$
$$+ (4 \times 10^2) + (2 \times 10^1)$$
$$+ (5 \times 10^0)$$

$$(5\times10^{2}) + (8\times10^{7}) + (3\times10^{5}) + (1\times10^{0})$$

7 6 5 4 3 2 1 0

8 0 3 0 0 5 0 1

Law of exponents

1. $x^0 = 1$

2. $(x^2)(x^3) = x^5$

3. $\frac{x^7}{x^4} = x^3$

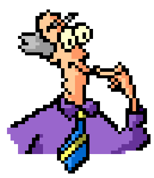
4. $(x^4)^5 = x^{20}$

5. $(x^3 y^4)^7 = x^{21} y^{28}$

6. $\left(\frac{x^3}{y^5}\right)^2 = \frac{x^6}{y^{10}}$

Try this

Evaluate each expression

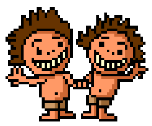


a) 5^0 b) $-(5)^0$ c) $(-5)^0$ d) -5^0

1 -1 1 -1


Section 2.3
Order
of
Operations

II



BEDMAS

$$[3 + (-3)^2 - 5(3 - 7)^2] + 1$$

$$[3 + (-3)^2 - 5(-4)^2] + 1$$

$$[3 + 9 - 5(16)] + 1$$

$$[3 + 9 - 80] + 1$$

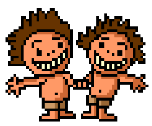
$$[12 - 80] + 1$$

$$-68 + 1$$

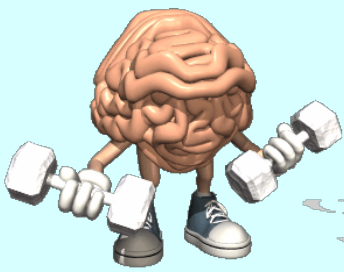
$$-67$$

$$\frac{-15+3-11}{3\times 2-7}$$

B E D M A S



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



Grade 9 Warm Up

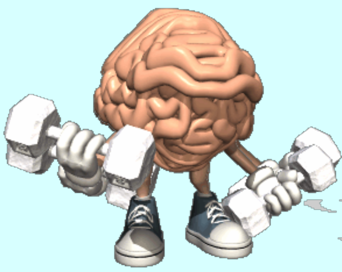
Get those brain muscles pumping!!!

Without your calculators evaluate the following expressions:

1) $$\frac{3^2(5^0 + 2 + 2^2)}{2(5 + 4^2)}$$

2) $$\frac{4^2(3^4 \div 2^0)}{2^4(3^4 - 2^0)}$$

3) $$\frac{2^4(4^3 \div 2^2) - 4^0}{3(3^4 + 2^2)}$$

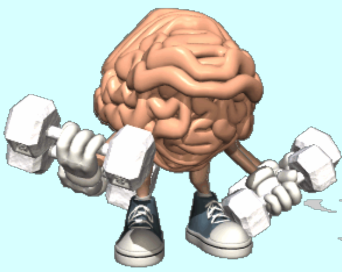


Grade 9 Warm Up

Get those brain muscles pumping!!!

Without your calculators evaluate the following expressions:

1) $$\frac{3^2(5^0 + 2 + 2^2)}{2(5 + 4^2)}$$

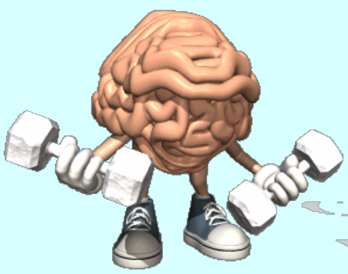


Grade 9 Warm Up

Get those brain muscles pumping!!!

Without your calculators evaluate the following expressions:

2) $$\frac{4^2(3^4 \div 2^0)}{2^4(3^4 - 2^0)}$$



Grade 9 Warm Up

Get those brain muscles pumping!!!

Without your calculators evaluate the following expressions:

3) $$\frac{2^4(4^3 \div 2^2) - 4^0}{3(3^4 + 2^2)}$$

Class/Homework

Complete the following review questions:

Page 87-89

1(a, c, d)
3(a, c)
#7(a)
#8(a, c, e)
#9(a, b, c)

#12 (a, b)
#13 (b, d)
#14 (a, b, c, d)
#17
18

#20
#24
#26
#27

&

Work Sheet: All Questions

Extended Laws of Exponents (No Negative)

Date____

Simplify. Your answer should contain only positive exponents.

1) $4a^2 \cdot 5a^4$

2) $3b \cdot 8b^3$

3) $7x^3 \cdot x^2$

4) $5x^5 \cdot 8x^3$

5) $\frac{6a^4}{3a^3}$

6) $\frac{5n^{20}}{8n^4}$

7) $\frac{12n^4}{8n}$

8) $\frac{7r}{6r}$

9) $(8n)^4$

10) $(7k)^3$

11) $(6k)^2$

12) $(5x^2)^4$

13) $4b^8 \cdot 2b^3$

14) $4m \cdot 3m$

15) $6x^3 \cdot 3x^3$

16) $7v \cdot 8v^2$

17) $\frac{6n^3}{2n^3}$

18) $\frac{12x^{21}}{2x^{13}}$

19) $\frac{15x^{13}}{3x^4}$

20) $\frac{40b^{44}}{4b^{21}}$

(No Negative)

21) $(2m^2)^4$

22) $(4x^2)^3$

23) $(8n^4)^4$

24) $(6x^4)^3$

25) $\dfrac{8r^3 \bullet 12r^3}{(2r)^{4}}$

26) $\dfrac{(9v^8)^2}{(3vv^3)^3}$

27) $\dfrac{8x^{12} \bullet 3x^4}{(2x^4)^3}$

28) $\dfrac{(3n^4)^3 \bullet (3n^4)^4}{(3n)^4}$

29) $\dfrac{(3n^3)^3 \cdot n^3}{(3n^2)^2}$

30) $\left(\dfrac{2v^2 \cdot 4v^5}{2v^2}\right)^2$

31) $\left(\dfrac{3p^3 \cdot p^2}{3p^3}\right)^{0}$

32) $\dfrac{3a^7 \cdot 4a^2}{a^4}$

33) $\dfrac{(2n^3)^5}{4n^3 \cdot (n^4)^2}$

34) $\dfrac{10p^8 \cdot p^3 \cdot 2p^{12}}{4p^4}$

35) $\dfrac{(x^2)^5}{x^2 x^2}$

36) $\dfrac{(3n^4)^2}{3n^2 \cdot 3n^2}$

37) $\left(\dfrac{3n^5}{3n^2 \cdot n}\right)^4$

38) $\dfrac{(6x^2)\ (2x^5)^4}{(2x^3 \cdot x^4)^3\ (x^0)}$

Notes on Laws of Exponent

Exponent Law for a Product of Powers


To multiply powers with the same base, add the exponents.

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

must be the same base

The variable "a" is any interger, except 0.

The variable "m" and "n" are any whole numbers.


Exponent Law for a Quotient of Powers


To divide powers with the same base, subtract the exponents.

$$a^{m} \div a^{n} = a^{m-n}$$ Where $m \geq n$

must be the same base

The variable "a" is any interger, except 0.

The variable "m" and "n" are any whole numbers.


Exponent Law for a Power of a Power

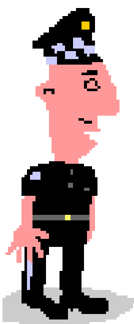
To raise a power to a power, multiply the exponents.

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

The variable "a" is any integer, except 0.

The variable "m" and "n" are any whole numbers.

Exponent Law for a Power of a Product



$$(ab)^m = a^m b^m$$

The variables "a" and "b" are any integer, except 0.

The variable "m" is any whole numbers.

Exponent Law for a Power of a Quotient

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

BUT $b \neq 0$

The variables "a" and "b" are any integer, except 0.

The variable "m" is any whole numbers.

Extra Material

Write each expression as a product and then evaluate the following:

1) $3^2 \times 3^2$

2) $2^2 \times 2^5$

Do you notice anything???

3) $(-5)^2 \times (-5)^4$

Write each of the following as a single power and then evaluate.

1) $7^2 \times 7^4$

2) $(-2)^5 \times (-2)^3$

3) $4^5 \times 4$

What happens when we divide powers with the same base?

1) $\frac{2^6}{2^2}$

2) $\frac{7^9}{7^4}$

Do you notice anything???

3) $\frac{(-5)^7}{(-5)^3}$

Remember to always use BEDMAS when evaluating

*Simplify first (using exponent law I) THEN Evaluate each of the following:

1) $3^{10} \div 3^{6} + 3^{2}$

2) $-2^{3}(2^{9} \div 2^{7}) - 2^{1}$

3) $\dfrac{10^{1003}}{10^{1000}} - 1$

Grade 9 Warm Up

October 12, 2012

Express each as a single power and then evaluate

1) $2^{20} \times 2^{3} \div 2^{7}$

2) $-(-5)^{7} \times (-5)^{2}$

3) $\dfrac{8^{121}}{8^{118}}$

Evaluate:

Simplify then Evaluate

4) $15(15^{12} \div 15^{9}) \div 5 + 1$

Write the following number with powers of ten

5) 21 045

Write the following number in standard form

6) $(7 \times 10^{1}) + (8 \times 10^{6}) + (3 \times 10^{0}) + (7 \times 10^{5}) + (1 \times 10^{2})$

Master 2.20 **Extra Practice 4**

Lesson 2.4: Exponent Laws 1

1. Write each product as a single power.
   a) $4^3 \times 4^2$ b) $5^0 \times 5^0$ c) $(-2)^2 \times (-2)^4$
   d) $-6^3 \times 6^1$ e) $(-7)^0 \times (-7)^2$ f) $(-9)^6 \times (-9)^3$

2. Write each quotient as a single power.
   a) $8^7 \div 8^5$ b) $10^4 \div 10^0$ c) $(-1)^6 \div (-1)^3$
   d) $\dfrac{-3^4}{3^4}$ e) $\dfrac{(-9)^{10}}{(-9)^5}$ f) $\dfrac{11^9}{11^6}$

3. Express as a single power.
   a) $2^3 \times 2^6 \div 2^9$ b) $(-5)^8 \div (-5)^4 \times (-5)^3$ c) $\dfrac{6^3 \times 6^5}{6^2 \times 6^4}$

4. Simplify, then evaluate.
   a) $2^2 - 2^0 \times 2 + 2^3$ b) $(-2)^6 \div (-2)^5 - (-2)^5 \div (-2)^3$ c) $-2^2(2^3 \div 2^1) - 2^3$

5. Simplify, then evaluate.
   a) $4^3 \div 4^2 + 2^4 \times 3^2$ b) $3^2 + 4^2 \times 4^1 \div 2^3$ c) $\dfrac{3^4}{3^3} + \dfrac{4^2 \times 4^0}{2^4}$

6. Write each relationship as a product of powers or a quotient of powers.
   a) One million is 1000 times as great as one thousand.
   b) One billion is 1000 times as great as one million.
   c) One hundred is one-tenth of one thousand.
   d) One is one-millionth of one million.
   e) One trillion is 1000 times as great as one thousand million.

7. Identify, then correct any errors in these answers.
   Explain how you think the errors occurred.
   a) $5^3 \times 5^2 = 5^6$ b) $2^3 \times 4^2 = 8^5$ c) $(-3)^8 \div (-3)^4 = (-3)^4$
   d) $1^2 \times 1^4 - 1^3 = 1^3$ e) $\dfrac{4^2 \times 4^4}{4^2 \times 4^1} = 4^2$

Section 2.5 Exponent Laws II

Fill in the following chart

Power	As Repeated Multiplication	As a Product of Factors	As a power
$(3^2)^5$			
$(4^2)^3$			
$[(-2)^4]^3$			

Try this

Express the following as a single power

1) $(5^7)^8$ 2) $(10^2)^3$ 3) $[(-2)^4]^3$

Evaluate

1) $(2^3)^2$ 2) $(5^2)^3$ 3) $[(-3)^2]^4$

Try this

Write as a power

1) $[(-5)^3]^7$

2) $-(3^5)^4$

3) $(4^8)^2$

4)

What about a power of a quotient?

$$\left(\frac{4}{5}\right)^3$$

Let's Investigate

Step 1) Write the above as a repeated multiplication.

Step 2) Look at the numerators can you express that as a single power

Step 3) Look at the denominators can you express that as a single power

What did you discover?

Evaluating Powers of Product and Quotients

$$[(-6) \times 4]^2$$

Method 1

Use the exponent law for a power of a product

$[(-6) \times 4]^2$

= Erase To see

=

=

Method 2

Use the order of operations

$[(-6) \times 4]^2$

= Erase To see

=

You Decide

Try some more (use which ever method you want)

2) $-(5 \times 2)^3$

3) $\left(\frac{21}{-3}\right)^3$

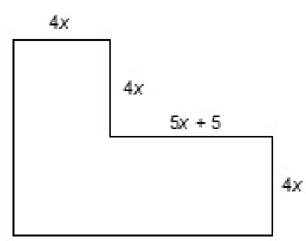
Applying Exponent Laws and Order of Opertations

$$(5 \text{ x } 2)^3 + (2^8 \div 2^5)^4$$

$$[(-4-(-3))^2]^2-(-5^3+2)^3$$

6. Answer the questions below using the shape to the right:

a) Determine a polynomial for the area of the shape. SHOW ALL WORK **(4)**



c) Determine the area of the shape when x = 5 cm. SHOW ALL WORK **(2)**