Warm Up

Simplify:

$$\frac{\overset{3}{\cancel{15}}x^6 y^{-9}}{\underset{1}{\cancel{5}}x^1 y^{-11}} \Rightarrow 3x^{6-1} y^{-9--11}$$

$$3x^5 y^2$$

Be careful! ↓

$$= \frac{3x^5 y^{-9}}{y^{-11}}$$

$$= \frac{3x^5 y^{11}}{y^9}$$

$$= 3x^5 y^2$$

What Did ▢ ▢

Have You Ever Heard of the Planet Saturn?

Simplify each expression. Write the letter of the answer in the box containing the exercise number.

1 5^3

2 5^{-3}

3 3^{-5}

4 $(-5)^{-3}$

5 $(-12)^{-2}$

6 $-(2)^2$

7 $(-12)^0$

8 $(-4)^{-3}$

Answers 1-8:

T $\dfrac{1}{144}$ **M** $\dfrac{1}{125}$

P -1 **R** $-\dfrac{1}{64}$

I 125 **L** 144

U 1 **N** $\dfrac{1}{243}$

O $-\dfrac{1}{125}$ **F** -125

E $\dfrac{1}{64}$ **S** $-\dfrac{1}{144}$

9 -4^{-3}

$-1(4)^{-3}$

10 10^{-5}

11 $(-10)^{-5}$

12 10^0

13 75^{-1}

14 -75^{-1}

15 $(-2)^{-4}$

16 -2^{-4}

Answers 9-16:

O 16 **I** $\dfrac{1}{75}$

T $-\dfrac{1}{75}$ **E** $-\dfrac{1}{64}$

A $-\dfrac{1}{16}$ **N** $\dfrac{1}{1000}$

T 1 **R** -75

S -64 **H** $\dfrac{1}{16}$

B $\dfrac{1}{100,000}$

U $-\dfrac{1}{100,000}$

17 $7ab^0$

18 $7ab^{-4}$

19 $\dfrac{7}{ab^{-4}}$

20 $\dfrac{7^{-2}a}{b^{-1}}$

21 $2x^3y^{-8}$

22 $\dfrac{2x^{-3}}{y^{-8}}$

23 $\dfrac{2^{-1}x^{-3}}{u^8}$

Answers 17-23:

I $\dfrac{2y^8}{x^3}$ **A** $\dfrac{7a}{b^4}$

R $2x^3y^8$ **O** $7ab^4$

F $\dfrac{7b^4}{a}$ **L** $\dfrac{1}{2x^3y^8}$

S $7a$ **A** $\dfrac{ab}{49}$

M $\dfrac{2x^3}{y^8}$ **N** $\dfrac{b}{49a}$

24 $\dfrac{3n^2}{t^{-5}}$

25 $3^4n^{-2}t^5$

26 $\dfrac{3^{-4}t^{-5}}{n^{-2}}$

27 $\dfrac{8^2c^{-1}d^{-6}}{5}$

28 $\dfrac{(-8)^2c^0}{5^{-1}d^{-6}}$

29 $\dfrac{(-8)^{-2}d^{-6}}{5c^{-1}}$

30 $\dfrac{-8^{-2}}{5^{-1}cd^0}$

Answers 24-30:

T $\dfrac{64c}{5d^6}$ **G** $-\dfrac{5}{64c}$

I $3n^2t^5$ **I** $320d^6$

R $\dfrac{n^2}{81t^5}$ **A** $\dfrac{81t^5}{n^2}$

E $320cd^6$ **S** $81n^2t^5$

R $\dfrac{64}{5cd^6}$ **N** $\dfrac{c}{320d^6}$

1	2		3	4	5		6	7	8	9		10	11	12		13	14	

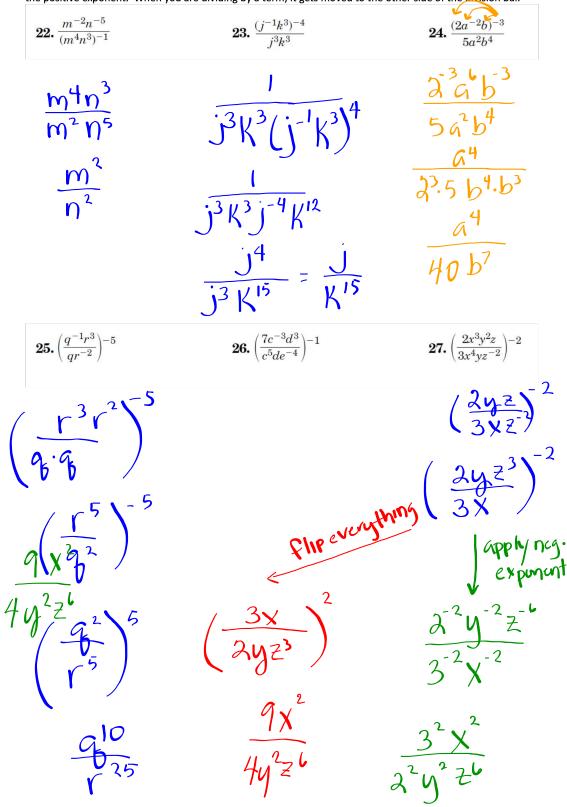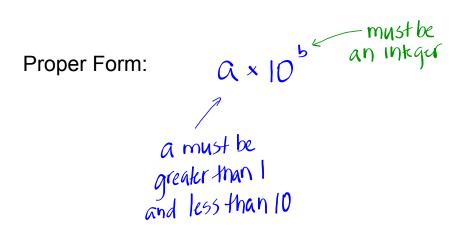| 15	16	17		18		19	20	21	22	23	24	25	26		27	28	29	30

Additional Practice

All work should be done in your notebook. Final answer should contain only positive exponents.
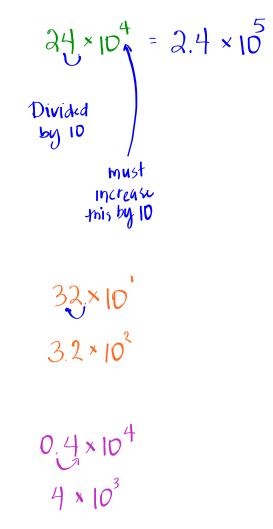
Remember: Whenever a term is raised to a negative exponent, that means you are dividing by that term to the positive exponent. When you are dividing by a term, it gets moved to the other side of the division bar.
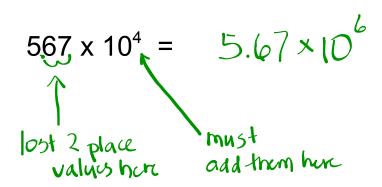
22. $\dfrac{m^{-2}n^{-5}}{(m^4n^3)^{-1}}$

23. $\dfrac{(j^{-1}k^3)^{-4}}{j^3k^3}$

24. $\dfrac{(2a^{-2}b)^{-3}}{5a^2b^4}$

$\dfrac{m^4n^3}{m^2n^5}$

$\dfrac{m^2}{n^2}$

$\dfrac{1}{j^3k^3(j^{-1}k^3)^4}$

$\dfrac{1}{j^3k^3j^{-4}k^{12}}$

$\dfrac{j^4}{j^3k^{15}} = \dfrac{j}{k^{15}}$

$\dfrac{2^{-3}a^6b^{-3}}{5a^2b^4}$

$\dfrac{a^4}{2^3\cdot5\,b^4\cdot b^3}$

$\dfrac{a^4}{40b^7}$

25. $\left(\dfrac{q^{-1}r^3}{qr^{-2}}\right)^{-5}$

26. $\left(\dfrac{7c^{-3}d^3}{c^5de^{-4}}\right)^{-1}$

27. $\left(\dfrac{2x^3y^2z}{3x^4yz^{-2}}\right)^{-2}$

$\left(\dfrac{r^3r^2}{q\cdot q}\right)^{-5}$

$\dfrac{q\left(\dfrac{r^5}{x^2q^2}\right)^{-5}}{4y^2z^6}$

$\left(\dfrac{q^2}{r^5}\right)^5$

$\dfrac{q^{10}}{r^{25}}$

$\left(\dfrac{2yz}{3xz^{-2}}\right)^{-2}$

$\left(\dfrac{2yz^3}{3x}\right)^{-2}$

flip everything

$\left(\dfrac{3x}{2yz^3}\right)^2$

$\dfrac{9x^2}{4y^2z^6}$

apply neg. exponent

$\dfrac{2^{-2}y^{-2}z^{-6}}{3^{-2}x^{-2}}$

$\dfrac{3^2x^2}{2^2y^2z^6}$

Scientific Notation Review

Proper Form:

$$a \times 10^b$$

must be an integer

a must be greater than 1 and less than 10

What if?

$$24 \times 10^4 = 2.4 \times 10^5$$

Divided by 10

must increase this by 10

$$32 \times 10^1$$

$$3.2 \times 10^2$$

$$0.4 \times 10^4$$

$$4 \times 10^3$$

Scientific Notation

$6000 = 6 \times 10^3$

$18{,}500 = 1.85 \times 10^4$

$0.004 = 4 \times 10^{-3}$

$0.0000721 = 7.21 \times 10^{-5}$

$567 \times 10^4 = 5.67 \times 10^6$

lost 2 place values here

must add them here

Scientific Notation

$6000 = 6 \times 10^3$

$18{,}500 = 1.85 \times 10^4$

$0.004 = 4 \times 10^{-3}$

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$567 \times 10^4 = 5.67 \times 10^6$

Write in Standard Form

$2.73 \times 10^4 =$ $2.7300, = 27,300$

need to
add 4 place values

$4 \times 10^6 =$

$= 4,000,000$

$4.000\,000,$

$2 \times 10^{-2} =$ $.02, = 0.02$

remove
2 place
values

$4.32 \times 10^{-4} =$ 0.000432

Write in Standard Form

$2.73 \times 10^4 =$ $2.7300, = 27,300$

↑ need to
add 4 place values

$4 \times 10^6 =$

$= 4,000,000$

$4.000000,$

$2 \times 10^{-2} =$ $.02, = 0.02$

↑ remove
2 place values

$4.32 \times 10^{-4} =$ 0.000432

Operations with Scientific Notation

$4.2 \times 10^2 + 1 \times 10^1 = 4.3 \times 10^2$

$420 + 10 = 430$

$4.2 \times 10^2 + .1 \times 10^2 = 4.3 \times 10^2$

✓

$6.3 \times 10^3 + 5.9 \times 10^{-1}$

$6300 + 0.59 = 6300.59 = 6.30059 \times 10^3$

$2.5 \times 10^7 + 1.3 \times 10^7 = 3.8 \times 10^7$

$6 \times 10^7 + 7 \times 10^7 = 13 \times 10^7 = 1.3 \times 10^8$

$2 \times 10^6 + 5 \times 10^5 =$

$2 \times 10^6 + 0.5 \times 10^6 = 2.5 \times 10^6$

Classwork

Addition and Subtraction With Scientific Notation

Date_____ Period_____

Simplify. Write each answer in scientific notation.

1) $3.1 \times 10^3 + 4.3 \times 10^3$

2) $3 \times 10^1 + 6.4 \times 10^2$

3) $2.4 \times 10^4 + 5.57 \times 10^3$

4) $5 \times 10^{-2} + 1.6 \times 10^{-3}$

5) $2.5 \times 10^1 + 6.14 \times 10^4$

6) $7 \times 10^{-1} + 6.4 \times 10^{-5}$

7) $5 \times 10^{-3} + 3.3 \times 10^{-6}$

8) $8 \times 10^{-1} + 6.9 \times 10^3$

9) $1.39 \times 10^5 - 4 \times 10^2$

10) $2.74 \times 10^{-1} - 6.53 \times 10^{-4}$

11) $8.14 \times 10^5 - 7.8 \times 10^2$

12) $6.36 \times 10^3 - 5.8 \times 10^{-1}$

13) $5.1 \times 10^{-1} + 0.38 \times 10^4$

14) $5.9 \times 10^{-2} - 0.078 \times 10^3$

Homework

Finish classwork