**4.2 Working with Exponents**

**PART A: Review**



What is the power in the example above? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the base? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the exponent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3 Power Rules**

When multiplying powers with the same base, add exponents.

$$3^{4} ×3^{2} =\left( 3 ×3×3×3\right) ×(3×3)$$

 $=3^{6}=3^{4+2}$

**You try:** $4^{7}×4^{3}$

When dividing powers with the same base, subtract the exponents.

$$5^{4}÷5^{2}= \frac{5×5×5×5}{5×5}$$



$$=5×5$$

$$= 5^{2}=5^{4-2} $$

 **You try:** $3^{9}÷3^{6}$

To raise a power to a power, multiply exponents.

 $(6^{2})^{3}=\left(6×6\right)×\left(6×6\right)×\left(6×6\right)$

$$=6^{6}= 6^{2×3}$$

**You try:** $(5^{2})^{7}$

**PART B: Working with Negative and Zero Exponents**

Fill in the table below by continuing the pattern. DO NOT USE decimals, use FRACTIONS

|  |  |  |
| --- | --- | --- |
| Power | Power Evaluated | Pattern |
| 24  | 16 | 16 /2 = 8 |
| 23 | 8 | 8/2 = 4 |
| 22 | 4 |  |
| 21 | 2 |  |
| 20 |  |  |
| 2-1 |  |  |
| 2-2 |  |  |
| 2-3 |  |  |

|  |  |  |
| --- | --- | --- |
| Power | Power Evaluated | Pattern |
| 53 | 125 | 125/5 = 25 |
| 52 | 25 | 25/5 = 5 |
| 51 | 5 |  |
| 50 |  |  |
| 5-1 |  |  |
| 5-2 |  |  |
| 5-3 |  |  |

What do you notice about 20 and 50?

Use your calculator to evaluate 80 and 12460?

In general, any number raised to the power of zero is equal to \_\_\_\_\_\_\_\_.

How do 2-1 and 21 compare?

How do 5-1 and 51 compare?

How do 2-2 and 22 compare?

How do 5-2 and 52 compare?

Does having a negative exponent, make the answer negative?

**In general,** $b^{-n}= \frac{1}{b^{n}}$

**You try: If** $6^{5}=7776$**, then** $6^{-5}=$ **\_\_\_\_\_\_\_\_\_\_\_**

**Exercises:** Evaluate.

1. 5-3 =
2. (-4)-2 =
3. -3-4 =

(See page 219 to check your answers)

**PART C: Negative Exponents with FRACTIONAL bases.**

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

$$=\frac{1}{\left(\frac{64}{343}\right)}$$

$$=1×\frac{343}{64}$$

$$=\frac{343}{64} $$

There is a faster way! Just flip the fraction base (take the reciprocal) and make the exponent positive.

**You try:** $\left(\frac{2}{3}\right)^{-3}$

Check your answer on page 220.

**PART D: Multi-step Problems**

Evaluate $\frac{\left(5^{3}\right)^{-2}}{5^{-4}×5^{6}}= \frac{5^{3×-2}}{5^{-4+6}}$

$$=\frac{5^{-6}}{5^{2} } $$

$$=5^{-6-2 }$$

$$=5^{-8 }= \frac{1}{5^{8}}= \frac{1}{390625} $$

**You try:** $\frac{3^{5}×3^{-2}}{(3^{-3})^{2}}$**.**

Check your answer on page 220.

**Homework: 1c,d,e; 2a,c,f; 4b,d,e; 5b,d,e; 6b,d,e; 7a,b,c; 8d,e,f;9, 11b,d; 13**