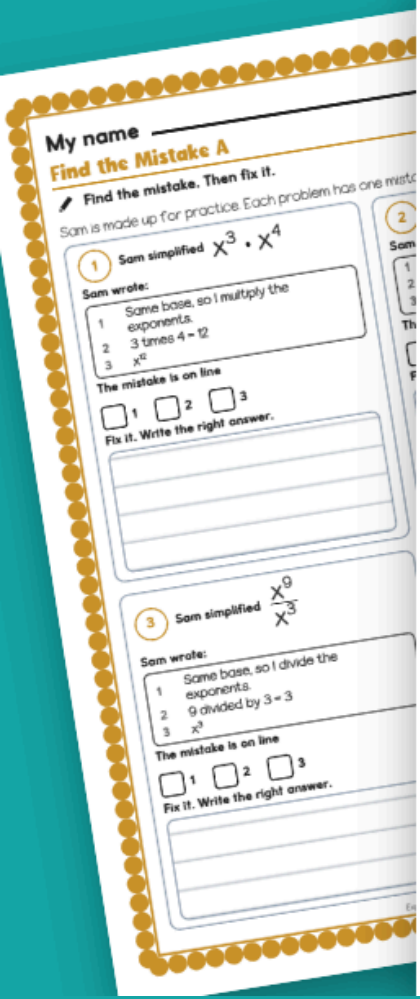
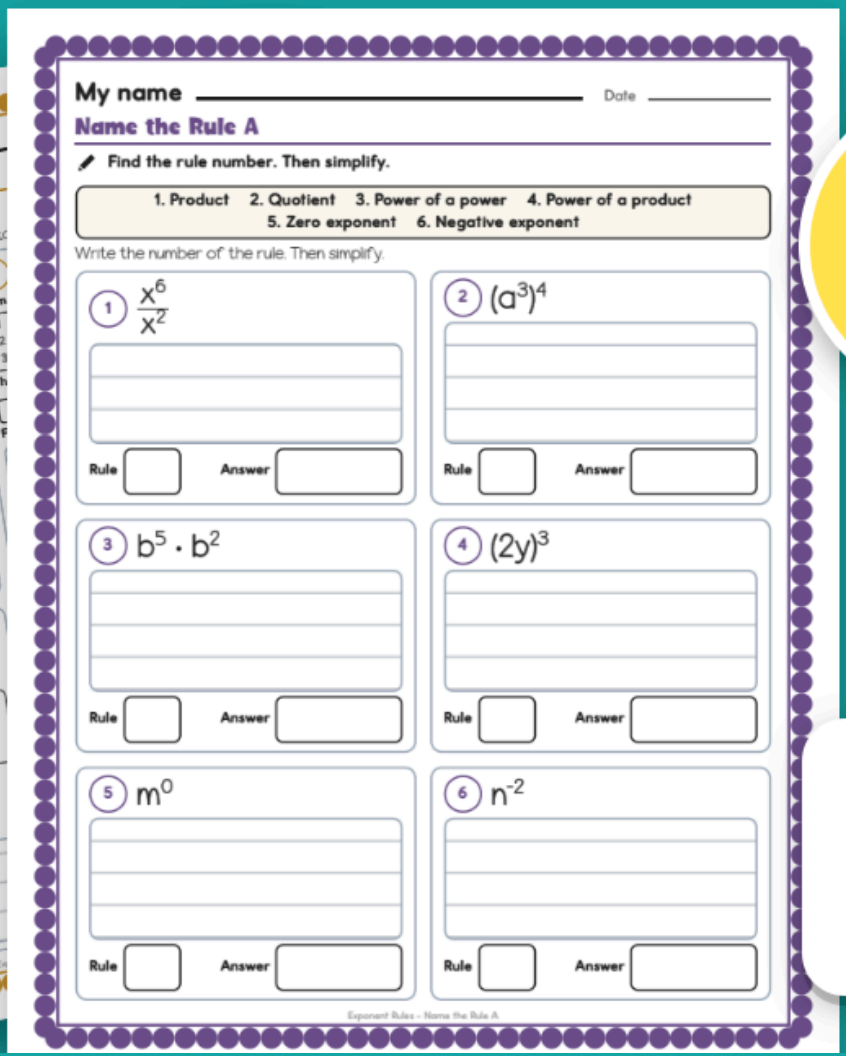
Bright Path Sped

EXPONENT RULES

WORKSHEETS + CUT AND PASTE SORTS





48 PAGES

$$x^3 \cdot x^4 = x^7$$

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This is a fillable PDF

- Open it in a PDF reader (Adobe Acrobat Reader, Preview, or your browser), click into a line or a box, type, and Save As.
- The name line, every answer box, every ruled work box and every check box on the student pages are type-in fields, and so are the tracker, class grid, team note and family page. You can also print any page and write by hand.
- It works offline. No account, no subscription, no internet connection needed after you download it.

Print at 100 percent

Turn off fit to page and shrink to fit so the ruled lines stay 0.34 inch apart. Every student page is black and white inside a colored border, so it still reads when copied in black and white.

Student work

A filled-in tracker, class grid or team note carries a real student's name. Keep it in the data folder, and use a first name only on any page that leaves your hands.

Need help?

If a field will not behave or a page will not print the way you expect, use Ask a Question on the product page before leaving a review. Every question is read, and a fix to the file ships as a free update: re-download it any time from My Purchases.

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PREVIEW

How To Read a Page

The parts of a student page, then the page types in the order they come.

The parts of a page

- **The answer box.** A bordered box for the simplified answer. Click it to type, or print and write in it.
- **The ruled work box.** Lines 0.34 inch apart for showing work. One step to a line.
- **The check box.** Which rule, how sure, yes or not yet: click or mark.
- **How the problems are written.** Exponents are raised, fractions are stacked, and a dot means times. Every answer uses positive exponents.
- **The cut line.** Six pieces in a 3 by 2 grid, each 2.4 by 1.25 inches, edge to edge: one cut across and two down.

Page type	What it looks like	What the student does
Rules and Worked Examples	5 pages	Six rules with a blank each, a look-for chart, three worked pages with guided copies.
Name the Rule	2 pages, 12 problems	Write the rule number that fits, then simplify.
One Rule at a Time	11 pages, 66 problems	Product, quotient, power of a power, power of a product, zero, negative.
Mixed Review	3 pages, 18 problems	Two rules in one problem, then more variables and negative exponents.
Find the Mistake	2 pages, 8 problems	An invented student's work has one mistake. Find it and fix it.
Quizzes, Exit Tickets, Sorts	12 + 6 items, 18 pieces	Two quizzes, two exit tickets sheets, three cut-and-paste sorts.

Untimed, unscored on the page

No student page has a timer or a score on it. The keys and the tracker are for you. The answer keys are on pages 37 to 41.

Checked by number

Every answer in the keys was simplified by program and then checked by putting numbers in for the letters in the problem and in the answer. Students can do the same to check their own work. Print at 100 percent.

Printing and the type-in fields

Every page prints clean in black and white. The name line, every answer box, every ruled box and every check box are type-in fields in any PDF reader: click one, type, then save. This is a fillable PDF, not a slideshow or a word-processor file.

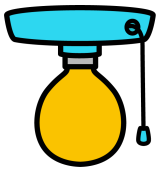
Room to work

Work boxes hold three lines of steps. If a student needs more room, hand over one page a day, or let students work on scrap paper and copy the answer into the box.

PREVIEW

Preview - Bright Path Sped

My name _____ Date _____



The Six Exponent Rules

Read each rule. Fill in the blanks.

a and b stand for any base (not 0). m and n stand for whole numbers. Keep this page next to you.

1. Product

Same base, multiplying: add the exponents.

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

Try it: $x^2 \cdot x^5 =$ _____

2. Quotient

Same base, dividing: subtract the exponents, top minus bottom.

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

Try it: $\frac{y^8}{y^3} =$ _____

3. Power of a power

A power to a power: multiply the exponents.

$$(a^m)^n = a^{m \cdot n}$$

Try it: $(m^3)^3 =$ _____

4. Power of a product

The exponent outside goes to every factor.

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

Try it: $(2n)^4 =$ _____

5. Zero exponent

Anything but 0, to the 0 power, is 1.

$$a^0 = 1$$

Try it: $b^0 =$ _____

6. Negative exponent

Flip it to the other side of the bar. The exponent turns positive.

$$a^{-n} = \frac{1}{a^n}$$

Try it: $a^{-2} =$ _____

PREVIEW

Preview - Bright Path Sped

My name _____ Date _____

Worked Examples: Power Rules

Read the example. Then fill in the blanks.

Example 1: power of a power: $(x^3)^4$

Step 1	3 times 4 A power to a power: multiply the exponents.
Step 2	12 3 times 4 = 12.
Step 3	x^{12} Write the base with the new exponent.

Example 2: power of a product: $(2x^3)^2$

Step 1	4 Give the exponent 2 to the number: 2 to the power 2 = 4.
Step 2	x^6 Give it to x too. Multiply the exponents: 3 times 2 = 6.
Step 3	$4x^6$ Put the number and the power together.

Now it is your turn.

Your turn 1: power of a power: $(y^5)^3$

Step 1	A power to a power: multiply the exponents.	
Step 2	5 times 3 =	
Step 3	Write the base with the new exponent.	

Your turn 2: power of a product: $(3a^2)^3$

Step 1	Give the exponent 3 to the number: 3 to the power 3 =	
Step 2	Give it to a too. Multiply the exponents: 2 times 3 =	
Step 3	Put the number and the power together.	

PREVIEW

Preview - Bright Ezee Shop

My name _____ Date _____

Name the Rule A

Find the rule number. Then simplify.

1. Product 2. Quotient 3. Power of a power 4. Power of a product
5. Zero exponent 6. Negative exponent

Write the number of the rule. Then simplify.

1. $\frac{x^6}{x^2}$

Rule ☐ Answer ☐

2. $(a^3)^4$

Rule ☐ Answer ☐

3. $b^5 \cdot b^2$

Rule ☐ Answer ☐

4. $(2y)^3$

Rule ☐ Answer ☐

5. m^0

Rule ☐ Answer ☐

6. n^{-2}

Rule ☐ Answer ☐

PREVIEW

Preview - Bright Path Shed

My name _____ Date _____

Product Rule B

Simplify each one. Show your work.

Same base, multiplying: add the exponents. Multiply the numbers in front.

1. $(3x^2)(4x^5)$

Answer

2. $(2a^3)(5a^4)$

Answer

3. $(6y^2)(2y^3)$

Answer

4. $(4b)(3b^6)$

Answer

5. $(2x^3y)(5x^2y^4)$

Answer

6. $(3m^2n^4)(3m^5n)$

Answer

PREVIEW

Preview - Bright Path Shed

My name _____ Date _____

Quotient Rule B

Simplify each one. Show your work.

Same base, dividing: subtract the exponents (top minus bottom). Divide the numbers in front.

1. $\frac{12x^8}{4x^3}$

Answer

2. $\frac{20a^6}{5a^2}$

Answer

3. $\frac{18y^7}{6y^5}$

Answer

4. $\frac{15b^9}{3b^4}$

Answer

5. $\frac{24x^5y^4}{6x^2y}$

Answer

6. $\frac{30m^7n^6}{10m^3n^2}$

Answer

PREVIEW

Preview - Bright Path Shed

My name _____ Date _____

Power of a Product A

Simplify each one. Show your work.

The exponent outside the parentheses goes to every factor, numbers too.

1. $(2x)^3$

Answer

2. $(3a)^2$

Answer

3. $(5y)^2$

Answer

4. $(4b)^3$

Answer

5. $(xy)^5$

Answer

6. $(ab)^4$

Answer

PREVIEW

Preview - Bright Path Shed

My name _____ Date _____

Zero Exponent

Simplify each one. Show your work.

Anything but 0, to the 0 power, is 1. Look at what the 0 is touching.

1. x^0

Answer

2. 7^0

Answer

3. $(5y)^0$

Answer

4. $5y^0$

Answer

5. $(ab)^0$

Answer

6. $12b^0$

Answer

PREVIEW

Preview - Bright Path Shop

My name _____ Date _____

Mixed Review A

Simplify. Use more than one rule.

Work one rule at a time. Check each step.

1. $(x^2)^3 \cdot x^4$

Answer

2. $\frac{(a^2)^4}{a^2}$

Answer

3. $(2y^3)^2 \cdot y$

Answer

4. $\frac{(b^4)^2}{b^3}$

Answer

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

Answer

6. $(3n)^2 \cdot n^3$

Answer

PREVIEW

My name _____ Date _____

Find the Mistake A

Find the mistake. Then fix it.

Sam is made up for practice. Each problem has one mistake.

1 **Sam simplified** $x^3 \cdot x^4$

Sam wrote:

1. Same base, so I multiply the exponents.
2. 3 times 4 = 12
3. x^{12}

The mistake is on line

☐ 1 ☐ 2 ☐ 3

Fix it. Write the right answer.

2 **Sam simplified** $(3x^2)(4x^5)$

Sam wrote:

1. 3 + 4 = 7 for the numbers in front
2. 2 + 5 = 7 for the exponents
3. $7x^7$

The mistake is on line

☐ 1 ☐ 2 ☐ 3

Fix it. Write the right answer.

3 **Sam simplified** $\frac{x^9}{x^3}$

Sam wrote:

1. Same base, so I divide the exponents.
2. 9 divided by 3 = 3
3. x^3

The mistake is on line

☐ 1 ☐ 2 ☐ 3

Fix it. Write the right answer.

4 **Sam simplified** $\frac{20a^6}{5a^2}$

Sam wrote:

1. 20 divided by 5 = 4
2. 6 + 2 = 8 for the exponents
3. $4a^8$

The mistake is on line

☐ 1 ☐ 2 ☐ 3

Fix it. Write the right answer.

PREVIEW

My name _____ Date _____

Make Your Own

Make up your own exponent problems.

Tip: write the answer first. Then build a problem that gives that answer.

1. Write a product of two powers with the same base. Simplify it.

My problem

Answer:

2. Write a power to a power. Simplify it. Then try x = 2 in the problem and the answer. They should match.

My problem and my work

Answer: **Check with x = 2:** **=**

3. Write a problem with a negative exponent. Write the answer with a positive exponent.

My problem

With a positive exponent:

PREVIEW

My name _____ Date _____

Exit Tickets 1

Simplify. Tell how sure you are.

Exit ticket 1 $x^8 \cdot x$

Answer

How sure am I? ☐ sure ☐ kind of sure ☐ not sure

Exit ticket 2 $\frac{6a^7}{2a^4}$

Answer

How sure am I? ☐ sure ☐ kind of sure ☐ not sure

Exit ticket 3 $(2y^5)^3$

Answer

How sure am I? ☐ sure ☐ kind of sure ☐ not sure

PREVIEW

Preview - Bright Path Sped

My name _____ Date _____

Cut and Paste 1

Cut out the six pieces. Paste each one in the right box.

Look at each expression. Which rule would you use to simplify it?

Product	Quotient	Power of a power

PREVIEW

Cut on the dashed lines: six pieces, one cut across and two cuts down.

$x^4 \cdot x^3$	$(b^2)^6$	$\frac{a^9}{a^4}$
$(2y)(5y^2)$	$\frac{14n^8}{7n^2}$	$(m^5)^3$

Which rule was hardest to spot? Why?

My name _____ Date _____

Check My Own Work

Check your own work. Mark yes or not yet.

1	I can multiply powers with the same base by adding the exponents.	☐ yes	☐ not yet
2	I can divide powers with the same base by subtracting the exponents.	☐ yes	☐ not yet
3	I can raise a power to a power by multiplying the exponents.	☐ yes	☐ not yet
4	I give the outside exponent to every factor, the numbers too.	☐ yes	☐ not yet
5	I know anything but 0, to the 0 power, is 1.	☐ yes	☐ not yet
6	I can rewrite a negative exponent as a fraction.	☐ yes	☐ not yet
7	I check my answer by trying a number.	☐ yes	☐ not yet
8	I can explain my steps to a partner.	☐ yes	☐ not yet

The kind of exponent problem I can do now is...

The kind I still need help with is...

PREVIEW

Answer Key: Product, Quotient, Power of a Power

Pages 12 to 17. Item p13 #3 means the third problem on page 13. Every answer is written with positive exponents.

Item	Problem	Answer
p12 #1	$x^3 \cdot x^4$	x^7
p12 #2	$a^5 \cdot a^2$	a^7
p12 #3	$y^6 \cdot y$	y^7
p12 #4	$b^2 \cdot b^8$	b^{10}
p12 #5	$m^4 \cdot m^4$	m^8
p12 #6	$n^7 \cdot n^3$	n^{10}
p13 #1	$(3x^2)(4x^5)$	$12x^7$
p13 #2	$(2a^3)(5a^4)$	$10a^7$
p13 #3	$(6y^2)(2y^3)$	$12y^5$
p13 #4	$(4b)(3b^6)$	$12b^7$
p13 #5	$(2x^3y)(5x^2y^4)$	$10x^5y^5$
p13 #6	$(3m^2n^4)(3m^5n)$	$9m^7n^5$
p14 #1	$\frac{x^9}{x^4}$	x^5
p14 #2	$\frac{a^8}{a^3}$	a^5
p14 #3	$\frac{y^7}{y}$	y^6
p14 #4	$\frac{b^{10}}{b^6}$	b^4
p14 #5	$\frac{m^9}{m^2}$	m^7
p14 #6	$\frac{n^{12}}{n^5}$	n^7

Item	Problem	Answer
p15 #1	$\frac{12x^8}{4x^3}$	$3x^5$
p15 #2	$\frac{20a^6}{5a^2}$	$4a^4$
p15 #3	$\frac{18y^7}{6y^5}$	$3y^2$
p15 #4	$\frac{15b^9}{3b^4}$	$5b^5$
p15 #5	$\frac{24x^5y^4}{6x^2y}$	$4x^3y^3$
p15 #6	$\frac{30m^7n^6}{10m^3n^2}$	$3m^4n^4$
p16 #1	$(x^3)^4$	x^{12}
p16 #2	$(a^2)^5$	a^{10}
p16 #3	$(y^4)^3$	y^{12}
p16 #4	$(b^5)^2$	b^{10}
p16 #5	$(m^7)^2$	m^{14}
p16 #6	$(n^3)^3$	n^9
p17 #1	$(a^4)^4$	a^{16}
p17 #2	$(x^5)^3$	x^{15}
p17 #3	$(y^2)^7$	y^{14}
p17 #4	$(b^6)^3$	b^{18}
p17 #5	$(m^8)^2$	m^{16}
p17 #6	$(n^3)^6$	n^{18}

PREVIEW

Answer Key: Mistakes and Sorts

The student in each Find the Mistake problem is invented. Line numbers count the first thing Sam wrote as line 1. Sort pieces are named by their row and column in the cutting grid, left to right and top to bottom.

Item	Problem	Mistake	What went wrong	Right answer
p26 #1	$x^3 \cdot x^4$	Line 1	Sam multiplied the exponents. For a product of the same base, add them: 3 + 4 = 7.	x^7
p26 #2	$(3x^2)(4x^5)$	Line 1	Sam added the numbers in front. Multiply them: 3 times 4 = 12. Only the exponents are added.	$12x^7$
p26 #3	$\frac{x^9}{x^3}$	Line 1	Sam divided the exponents. For a quotient of the same base, subtract them: 9 - 3 = 6.	x^6
p26 #4	$\frac{20a^6}{5a^2}$	Line 2	Sam added the exponents. For a quotient, subtract them: 6 - 2 = 4.	$4a^4$
p27 #1	$(x^3)^4$	Line 1	Sam added the exponents. For a power to a power, multiply them: 3 times 4 = 12.	x^{12}
p27 #2	$(2x^3)^2$	Line 2	Sam did not give the exponent to the 2. The exponent 2 goes to every factor: 2 squared is 4, so 4x to the 6.	$4x^6$
p27 #3	$(5y)^0$	Line 1	The 0 power goes to everything inside the parentheses, the 5 too. The answer is 1.	1
p27 #4	$3x^{-2}$	Line 2	Only x has the negative exponent, so only x moves. The 3 stays on top: 3 over x squared.	$\frac{3}{x^2}$

Cut and Paste 1 page 33

Piece	Expression	Box
r1 c1	$x^4 \cdot x^3$	Product
r1 c2	$(b^2)^6$	Power of a power
r1 c3	$\frac{a^9}{a^4}$	Quotient
r2 c1	$(2y)(5y^2)$	Product
r2 c2	$\frac{14n^8}{7n^2}$	Quotient
r2 c3	$(m^5)^3$	Power of a power

Cut and Paste 2 page 34

Piece	Expression	Box
r1 c1	x^{-5}	Negative exponent
r1 c2	$(3x)^2$	Power of a product
r1 c3	9^0	Zero exponent
r2 c1	6^{-2}	Negative exponent
r2 c2	$(ab^2)^3$	Power of a product
r2 c3	$(4y)^0$	Zero exponent

Cut and Paste 3 page 35

Piece	Expression	Box
r1 c1	$x^5 \cdot x^3$	x^8
r1 c2	x^{-3}	$\frac{1}{x^3}$
r1 c3	$(x^2)^3$	x^6
r2 c1	$x^4 \cdot x^{-7}$	$\frac{1}{x^3}$
r2 c2	$\frac{x^{10}}{x^4}$	x^6
r2 c3	$(x^4)^2$	x^8

Make Your Own (page 28): what to look for

- Product: the exponents add. A sample is $(3x^2)(2x^4) = 6x^6$.
- Power to a power: the exponents multiply. With x = 2, the problem and the answer give the same number.
- Negative exponent: the answer has the base in the bottom of a fraction, with a positive exponent.

PREVIEW

Class Progress Grid

Every student on one grid: items right by page type.

Class or group _____ Month _____

Student	Rules and worked (of 12)	Name the rule (of 12)	Product and quotient (of 24)	Power rules (of 24)	Zero and negative (of 18)	Mixed review (of 18)	Mistakes (of 8)	Quizzes and exit (of 18)	Sorts (of 18)

PREVIEW

How to fill this in

For each column, add up how many items that student has right with no prompt (the tracker rows). One glance across a row shows which skill is easiest and which is next.

Grouping for small-group time

Students low in Name the rule need the rules and worked pages (pages 5 to 9). Students low in the power rules need the worked power page (page 8) first. Students near full marks can move to the mistakes and the quizzes (pages 26 to 30).

Maya's Tracker (Invented Student)

Maya R. is invented; nothing on this page describes a real student. The blank tracker is on page 42.

Student	Teacher	Month
Maya R. (an invented student)	Mr. Okafor (invented)	October

Page	Page type and set	Items	Right	Date	Notes
5	The Six Exponent Rules	6	5	10/6	Wrote 5 for the zero-power card
7	Worked Examples: Product and Quotient	2	2	10/7	-
8	Worked Examples: Power Rules	2	-	-	-
9	Worked Examples: Zero and Negative	2	-	-	-
10	Name the Rule A	6	3	10/8	Called a power of a product a product
11	Name the Rule B	6	-	-	-
12	Product Rule A	6	6	10/9	-
13	Product Rule B	6	5	10/10	Added the numbers in front
14	Quotient Rule A	6	6	10/13	-
15	Quotient Rule B	6	4	10/14	Divided the exponents on two
16	Power of a Power A	6	6	10/15	-
17	Power of a Power B	6	-	-	-
18	Power of a Product A	6	3	10/17	Left the number unchanged
19	Power of a Product B	6	-	-	-
20	Zero Exponent	6	-	-	-
21	Negative Exponents A	6	4	10/20	Wrote 2 to the -3 as -8
22	Negative Exponents B	6	-	-	-
23	Mixed Review A	6	-	-	-
24	Mixed Review B	6	-	-	-
25	Mixed Review C	6	-	-	-
26	Find the Mistake A	4	3	10/22	One fix not finished
27	Find the Mistake B	4	-	-	-
29	Quiz A	6	-	-	-
30	Quiz B	6	-	-	-
31	Exit Tickets 1	3	-	-	-
32	Exit Tickets 2	3	-	-	-
33	Cut and Paste 1	6	-	-	-
34	Cut and Paste 2	6	-	-	-
35	Cut and Paste 3	6	-	-	-

PREVIEW

How to read it

Maya R. has done **11 of 29** scored pages and got **47 of 60** items right with no prompt. **4** pages were all right and **7** carry a note. Every number comes from the table.

What the table points to

The lowest page is Name the Rule A (3 of 6) and Power of a Product A (3 of 6). That is where the next practice goes. The 18 pages left blank are not tried yet, never wrong.